THE
ENCYCLOPÆDIA BRITANNICA

ELEVENTH EDITION

FIRST edition, published in three volumes, 1768—1771.
SECOND " " ten " 1777—1784.
THIRD " " eighteen " 1788—1797.
FOURTH " " twenty " 1801—1810.
FIFTH " " twenty " 1815—1817.
SIXTH " " twenty " 1823—1824.
SEVENTH " " twenty-one " 1830—1842.
EIGHTH " " twenty-two " 1853—1860.
NINTH " " twenty-five " 1875—1889.
TENTH " ninth edition and eleven supplementary volumes, 1902—1903.
ELEVENTH " published in twenty-nine volumes, 1910—1911.
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<td>INITIALS AND HEADINGS OF ARTICLES</td>
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<td><strong>R. G.</strong> Richard Garnett, LL.D.</td>
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<td><strong>T.</strong> Teniers (in part).</td>
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<td><strong>T.</strong> Sweden Geology.</td>
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<td><strong>T.</strong> Swift, Jonathan (in part).</td>
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<td><strong>T.</strong> Taxation.</td>
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<td><strong>T.</strong> Testaments of the Three Patriarchs; Testaments of the Twelve Patriarchs.</td>
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<td><strong>T.</strong> Tarantula; Tardigrada; Ticks.</td>
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INITIALS AND HEADINGS OF ARTICLES

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W. Y. S. William Young Sellar, LL.D. See the biographical article: Sellar, William Young.

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PRINCIPAL UNSIGNED ARTICLES

Succession Duty. Surrey. Tampa.
Suez Canal. Sussex. Tarragona.
Suffolk, Earls and Dukes of. Sutherland, Earls and Tenby.
Sumatra. Syllogism. Tennis.
Sunstroke. Table. Texas.
Surat. Tahiti. Thallium.

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Thames. Teraphim (in part).
Theocritus. Thoreau, Henry David.
Thesaurus. Tallis, Thomas.
Thuringia. Toledo, Councils of.
Tibbu. Terence (in part).
Tierra del Fuego. Thigbath-Pileser.
Tin. Timor.
Tipperary. Tin.
Tintoretto. Titan.
Tobago. Togoland.
SUBMARINE MINES. A submarine mine is a weapon of war used in the attack and defence of harbours and anchorages. It may be defined as “A charge of explosives, moored at or beneath the surface of the water, intended by its explosion to put out of action without delay a hostile vessel of the class it is intended to act against.” It differs from the torpedo (q.v.) in being incapable of movement (except in the special form of drifting mines, which are not moored, but move with the tide or current). But this subdivision into two distinct classes was not made till 1876. Prior to that date the term “torpedo” was used for all explosive charges fired in the water.

Submarine mines may be divided into two main classes, controllable and uncontrollable, or, as they are often classified, “electrical” or “mechanical.” In the first class the method of firing is by electricity, the source of the electric power whether by battery or dynamo being contained in a firing station on shore and connected to the mines by insulated cables. By simply switching off the electricity in the firing station, such mines are rendered inert and entirely harmless. In the second class, the means of firing are contained in the mine itself, the source of power being a small electric battery, or being obtained from a pistol, spring or suspended weight. In all mines of this class the impulse which actuates the firing gear is given by a ship or other floating object bumping against the mine. When mechanical mines have once been set for firing they are thus dangerous to friend and foe alike. Safety arrangements are employed to prevent the firing apparatus working while the mine is being laid, and clockwork is sometimes added to render the mine inactive after a certain definite time or in case the mine breaks away from its mooring. Their principal advantages, as compared with the electrically controlled mines, are cheapness and rapidity of laying. “Controllable” mines are absolutely under the control of the operator on shore, their condition is always accurately known, and if any break adrift not only is the fact at once known but the mines themselves are harmless. Another advantage is that when fired by “observation” as described below, they are placed at depths which will be well below the bottom of any vessels passing through the mine field. They can thus be used in channels which have to be kept open for traffic during hostilities.

Electrical mines take rather longer to prepare and lay out than the other class, as the electrical cables have to be laid and jointed, and they require rather more skill and training in the operators employed to lay and fire the mines. Such mines represent the highest development of this form of warfare, and the details given below refer mainly to this class of mine.

Electrical mines are arranged on two systems according to the method of ascertaining the proper moment to apply the firing current to the mine cables. These methods are by “observation” or by “circuit closer.”

The “observation” system depends on two careful observations made by an operator on shore, one of the exact position in which the mines are laid, the other of the track of hostile ships passing over the mine field. The position of the mines when laid is marked on a special chart, on which the track of ships crossing the mine field can also be plotted. When the track is seen to be crossing the position of a mine, a switch is closed on shore and the mine is fired. To allow for errors in observation such mines are fitted with large charges of explosive and are usually arranged in lines of two, three or four mines placed across the channel, all the mines in a line being fired together. Observation mines are placed either resting on the bottom or moored at depths which are well below the bottom of any friendly vessels and (except that anchoring in the mine field must be forbidden for fear of injury to cables) such mines offer no obstruction to friendly traffic.

In the “circuit closer” or “C.C.” system, each mine contains a small piece of apparatus which is set in action by the blow of a vessel or other object against the mine. When set in action, this apparatus completes an electrical circuit in the mine, through which the mine can be fired, if the main switch on shore is closed. If it is not wished to fire, the C.C. is restored to its ordinary condition either automatically by a spring in the mine, or by an electrical device operated from the shore.

Such mines are necessarily placed near the surface, and are to this extent an interference with friendly traffic. A vessel passing by mistake through a mine field of this class would run no risk of an explosion while the mines are inactive, but might do some damage to the mines.

This class of mine is used in side channels which it is intended to close entirely, or to reduce the width of navigable channels where too wide to be defended by observation mines. Their principal advantage is that if the firing switch is closed they are effective in fog or mist, when observation mines could not be worked, and when the guns of the defence would be equally out of action. As they are fired only when close against the side of a ship, the charge can be comparatively small and the mines themselves are handy and easy to lay.

Compared with observation mines they use much less cable, as the action of the C.C. is such that only the mine which is struck can be fired. Several mines of this class can therefore share one cable from the shore, though in practice details of mooring and arrangement limit the number connected to one cable to four. A set of mines on one cable is referred to as a “group.”

The arrangements for firing the mines are contained in a firing station on shore, in which is the battery or other source of
electrical power for firing, and the necessary apparatus for testing the system of mines, which is usually done daily. To let the operator in the firing station know when the C.C. of a mine has been struck and the mine is ready to fire, a small electrical apparatus is provided in the firing station for each group of mines. This arrangement strikes a bell when the C.C. is worked and also closes a break in the firing circuit. The operator can then close the main switch and fire the mine, or if acting on the order to "fire all mines that signal" he has already closed his main switch, the signalling apparatus, in the act of striking the bell, completes the firing circuit. A similar piece of apparatus is connected to each observing instrument, the completion of the circuit of any line at the observing station then gives a signal in the firing station and the firing circuit is completed.

The firing station can be on a vessel moored near the mine field, but is more usually on shore, where it can be made absolutely secure against any form of attack. But the observing stations must be on shore to give stability to the observing instruments, they cannot be entirely protected as they must have a small opening facing the mine field, but can be made very inconspicuous.

Any explosive can be used in submarine mines, provided adequate means are taken to explode the charge, but the explosive which is easiest to handle and is in most general use is wet gun-cotton with a small dry primer and detonator to start ignition. The detonators for electrical mines are on the "low tension" system, that is, firing is effected by the heating of a small length of wire called a "bridge," round which is placed a priming which ignites and detonates a small charge of fulminate of mercury.

The charge is contained in a steel mine-case, which has an "apparatus" inside to contain the electrical arrangements and the C.C. when used. Cases for observation mines are usually cylindrical in shape for mines to rest on the bottom and spherical for buoyant mines. The weight of charge is about 500 lb and the size of a buoyant case for this charge would be four feet in diameter. Cases for contact mines are spherical, about 39 in. in diameter, and can hold 100 lb of gun-cotton. They are always buoyant. Buoyancy is provided for by an air-space inside the case. Buoyant cases are moored to a heavy weight or "sinker," the connexion being by a steel wire rope, or in electrical mines, the cable itself. The cable is carefully insulated and protected with a layer of steel wires. An earth return is used for the electrical circuit.

The employment of mines in any defence must depend entirely on the general character of the defence adopted, which will itself depend on the size and importance of the harbour to be defended and other details (see COAST DEFENCE). The rôle of mines in a defence is to act as an obstacle to detain ships under fire and compel them to engage the artillery of the defence. Thus mines find their greatest usefulness in the defence of harbours with long channels of approach. Mine fields can be destroyed by "creeping" for and cutting the electric cables, by "sweeping" for the mines themselves with long loops of chain or rope or by destroying the mines with "countermines." To guard against any of these, the mine field should be protected by gun fire and lit at night by electric lights. As vessels sunk by mines may obstruct the channel, mines should not be used in very narrow channels.

Although the scientific development of submarine mining is the work of the last fifty years, attempts to use drifting charges against ships and bridges are recorded as early as the 16th century. Mines were used by the Americans in 1777, and in 1780 Robert Fulton produced an explosive machine which he called a "torpedo," and which was experimented with, not very successfully, up to 1815. In 1834 the Russians used mechanical mines in the Baltic, but without any marked success. The first application of electricity to the explosion of submerged charges was made by Sir Charles Pasley in the destruction of wrecks in the Thames and of the wreck of the "Royal George" at Spithead in 1839 and subsequent years. The first military use of electrically-fired mines was made in the American Civil War of 1861-65 when several vessels were sunk or damaged by mines or torpedoes. From this date onwards the American nations experimented with mines, and they were actually used in the Franco-German War of 1870, the Russo-Turkish War of 1878 and the Spanish-American War of 1898. But the most interesting example of mine warfare was in the attack and defence of Port Arthur during the Russo-Japanese War (95-96). Both sides used the mechanical mines only, and bombs.

SUBSIDY (through Fr. from Lat. subsidium, reserve troops, aid, assistance, from subdivere, literally "to sit or remain behind"), aid, subvention, assistance granted especially in money. The word has a particular use in economic history and practice. In English history it is the general term for a tax granted to the king by parliament, and so distinguished from those duties, such as the customs duties, which were raised by the royal prerogative; of these subsidies there were many varieties; such was the subsidy in excess of the customs on wool, leather, wine or cloth exported or imported by aliens, later extended to other articles and to native exporters and importers (see Tonnage and Poundage); there was also the subsidy which in the 14th century took the shape of a glass or term subsidy. Apart from this application the term, in modern times, is particularly applied to the pecuniary assistance by means of bounties, &c., given by the state to industrial undertakings (see Bounty). Subsidies granted by the state to literary, dramatic or other artistic institutions, societies, &c., are generally styled "subventions" (Lat. subvenire, to come to the aid of).

SUCCESSION (Lat. successio, from succedere, to follow after) the act of succeeding or following, as of events, objects, places in a series, &c., but particularly, in law, the transmission or passing of rights from one to another.

In every system of law provision has to be made for a readjustment of things or goods on the death of the human beings who owned and enjoyed them. Succession to rights may be considered from two points of view: in some ways they depend on the personality of those who are concerned with them: if you hire a servant, you acquire a claim against a certain person and your claim will disappear on his death. But personal relations are commonly implicated in the arrangement of property: if a person borrows money, the creditor expects to be paid even should the debtor die, and the actual payment will depend to a great extent on the rules as to inheritance. Succession, in the sense of the partition or redistribution of the property of a former owner is, in modern systems of law, the subject of many rules. Such rules may be based on the will of a deceased person. They will be found in such articles as Administration; Assets; Executors and Administrators; Inheritance; Intestacy; Legacy; Will; &c. There are cases, however, in which a will cannot be expressed; this eventuality is discussed in the present article, and there can be no doubt that it is the most characteristic one from the point of view of social conditions. It represents the normal course of succession, and is to what ought to be the normal course of succession in the readjustment of property after the death of a citizen. We shall dwell chiefly on the customs of succession among the nations of Aryan stock. Other customs are noticed in the articles on Village Communities; Mahomedan Law; &c.

We have to start from a distinction between personal goods and the property forming the economic basis of existence for the family which is strongly expressed in early law. War booty, proceeds of hunting, clothes and ornaments, implements fashioned by personal skill, are taken to belong to a man in a more personal way than the land on which he dwells or the cattle of a herd.
The character of this kind of property has a decisive influence on the modes of succession to it. This part of the inheritance is widely considered in early law as still in the power of the dead even after demise. We find that many savage tribes simply destroy the personal belongings of the dead: this is done by several Australian and Negro tribes (Post, Grundriss der ethnologischen Jurisprudenz, pp. 174–5). Sometimes this rule is modified in the sense that the goods remaining after deceased persons have to be taken away by strangers, which leads to curious customs of looting the house of the deceased. Such customs were prevalent, for example, among the North American Indians of the Delaware and Iroquois tribes. Evidently the nearer relations dare not take over such things on account of a tabu rule, while strangers may appropriate them, as it were, by right of conquest.

The continuance of the relation of the deceased to his own things gives rise in most cases to provisions made for the dead out of his personal succession. The habit of putting arms, victuals, clothes and ornaments in the grave seems almost universal, and there can be no doubt that the idea underlying such usages consists in the wish to provide the deceased with all matters necessary to his existence after death. A very characteristic illustration of this conception may be given from the customs of the ancient Russians, as described about 921 by the Arabian traveller Ibn Fadlan. The whole of the personal property was divided into three parts: one-third went to the family, the second third was used for making clothes and other ornaments for the dead, while the third was spent in carousing on the day when the corpse was cremated. The ceremony itself consisted in the following: the corpse was put into a boat and was dressed up in the most gorgeous attire. Intoxicating drinks, fruit, bread and meat were put by his side; a dog was cut into two parts, which were thrown into the boat. Then, all the weapons of the dead man were brought in, as well as the flesh of two horses, a cock and a chicken. The concubine of the deceased was also sacrificed, and ultimately all these objects were burned in a huge pile, and a mound thrown up over the ashes. This description is the more interesting because it starts from a logical point of view, that is, even in the case of the dead, some of them being affected, as it were, to his personal usage. This rule continues to be observed in Germanic law in later times and became the starting point of the doctrine of succession to personal property in English law. According to Glanville (vii. 5, 4), the chattels of the deceased have to be divided into three equal parts, of which one goes to his heir, one to his wife and one is reserved to the deceased himself. The same reservation of the third to the deceased himself is observed in Magna Charta (c. 26) and in Bracton's statement of Common Law (fol. 60), but in Christian surroundings the reservation of the dead man's part was taken to apply to the property which had to be spent for his soul and of which, accordingly, the Church had to take care. This lies at the root of the common law doctrine observed until the passing of the Court of Probate Act 1857. On the strength of this doctrine the bishop was the natural administrator of this part of the personality of the deceased.

The succession to real property, if we may use the English legal expression, is not governed by such considerations or the needs of the dead. Roughly speaking, three different views may be taken as to the proper readjustment in such cases. Taking the principal types in a logical sequence, which differs from the historical one, we may say that the aggregate of things and claims relinquished by a deceased person may: (1) pass to relatives or other persons who stood near him in a way determined by law. Should several persons of the kind stand equally near in the eye of the law the consequence would be a division of the inheritance. The personal aspect of succession rules in such systems of inheritance. (2) The deceased may be considered as a subordinate member of a higher organism—a kindred, a village, a state, &c. In such a case there can be no succession proper as there has been no individual property to begin with. The cases of succession will be a relapse of certain goods used by the member of a community to that community and a consequent rearrangement of rights of usage. The law of succession will again be constructed on a personal basis, but this basis will be supplied not by the single individual whose death has had to be recorded but by some community or union to which this individual belonged. (3) The aggregate of goods and claims constituting what is commonly called an inheritance may be considered as a unit having an existence and an object of its own. The consequence of the death of an individual owner will, as in case 2, be treated as an accidental fact. The unity of the inheritance and the social part played by it will constitute the ruling considerations in the arrangement of succession. The personal factor will be subordinated to the real one.

In practice pure forms corresponding to these main conceptions occur seldom, and the actual systems of succession mostly appear as combinations of these various views. We shall try to give briefly an account of the following arrangements: (1) the joint family in so far as it bears on succession; (2) voluntary associations among co-heirs; (3) division of inheritance; (4) united succession in the shape of primogeniture and of junior right.

The large mass of Hindu juridical texts representing customs and doctrines ranging over nearly 5000 years contains many indications as to the existence of a joint family which was considered as the corporate owner of property and therefore did not admit in principle of the opening of succession through the death of any of its members. The father or head of such a joint family was in truth only the manager of its property during lifetime, and though on his demise this power and right of management had to be regulated anew, the property itself could not be said to pass by succession: it remained as formerly in the joint family itself. In stating this abstract doctrine we have to add that our evidence shows us in practice only characteristic consequences and fragments of it, but that we have not the means of observing it directly in a consistent and complete shape during the comparatively recent epochs which are reflected in the evidence. It is even a question whether such a doctrine was ever absolutely enforced in regard to the whole body of personal property. Under the influence of personal apparel and objects acquired by personal will and strength fell to a great extent under the conception of separate property. Gains of science, art and craft are mentioned in early instances as subject to special ownership and corresponding rules of personal succession are framed in regard to them (Jolly, Tagore lectures on Partition, Inheritance and Adoption, 94). But on the other hand there are certain categories of movable goods which even in later law are considered as belonging to the family community and incapable of partition, e.g. water, prepared food, roads, vehicles, female slaves, property destined for pious uses and sacrifices, books. When law became rationalized these things had to be sold in order that the proceeds of the sale should be divided, but originally they seem to have been regarded as owned by the joint family though used by its single members. And as to immovables—land and houses—they were demonstrably excluded in ancient customary law from partition among co-heirs.

In Greek law the most drastic expression of the joint family system is to be found in the arrangements of Spartan households, where brothers clustered round the eldest or "keeper of the hearth" (ερημαδώος), and not only the management of property but their marriages were dependent on the unity of the shares and on the necessity of keeping down the offspring of the younger brothers. With the Romans there are hardly any traces of a primitive family community excluding succession, but the Celtic tribal system was to a great extent based on this fundamental conception (Seebohm, Tribal System in Wales).

*The term illustrates the intimate connexion between inheritance and household religion in ancient Aryan custom.*
During three generations the offspring of father, grandfather and great-grandfather held together in regard to land. The consequence was that, although separate plots and houses were commonly reserved for the uses of the smaller families included within the larger unit, the death of the principal brought about an equalization of shares first per stirpes and ultimately per capita until the final break-up of the community when it reached the stage of the great-grandsons of the original founder. But the most elaborate system of family ownership is to be observed in the history of the latest comers among the Aryan races—the Slavs. In the backward mountain regions which they occupied in the Balkan Peninsula and in the wilderness of the forests and moors of Eastern Europe they developed many characteristic tribal institutions and, among these, the joint family, the Zadruga, inokoshtina. The huge family communities of the southern Slavs have been described at length by recent observers, and there can be no doubt that their roots go back to a distant past (see Village Communities). There is no room in them for succession proper: what has to be provided for is the continuity of business management by elders and the repartition of rights of usage and maintenance, a repartition largely dependent on varying customs and on the policy of the above-mentioned elders. In Russia the so-called large family appears as a much less extensive application of the same idea. It extends rarely over more than three generations, but even as a cluster of members gathering around a grandfather or a great-uncle it presents an arrangement which hampers greatly private enterprise and staves off succession until the moment when the great household breaks up between the descendants of a great-grandfather.

In Germanic law we catch a glimpse of a state of things in which side relations were not admitted to succession at all. The Frankish Edict of Chilperic (a.d. 571) tells us that if somebody died without leaving sons or daughters, his brother was to succeed him and not his neighbours (non vicini). This has to be construed as a modification of the older rule according to which the neighbours succeeded and not the brother. Under "neighbours" we cannot understand merely people connected with a person by proximity of settlement, but rather his kinsmen in their usual capacity of neighbours. The fact that kinsmen forming a settlement have precedence of such near relations as the brothers is characteristic enough, especially, as even the succession of sons and daughters is mentioned in a way which shows that there was still some doubt whether neighbouring kinsmen should not take inheritance instead of the latter. These are systems of a very archaic arrangement based on a close tribal community between the members of a kindred. Such a community is not apparent in later legal custom, but there are many signs of a close union between members of the same family. The law of Scania, a province of his own, shows us a group settled around a grandfather. His sons even when married held part of the property under him and it is with some difficulty that they and their wives succeed in separating some of the goods acquired by personal work or brought in by marriage from the rest of the household property (Scanian Law, Danish Text i. 5). The same arrangement appears in Lombard law as regards brothers who remain settled in a common house (Edict of Rothari c. 167). Of course, in all such cases, there could be no real inheritance and succession, but merely the stepping in of the next generation into the rights and duties of the representative of an older generation on the latter's demise. In legal terminology it is a case of accretion and not of succession.

The next stage in the development of succession is presented by an arrangement which was common in Germany, viz. by the management of property under the rule of so-called Ganerbshaft. Ganerben is the same as the Latin coheredes, comparitices, consories. A capitulare of 816 mentions such communities of heirs holding in common (cf. Boretius Capitularia, i. 282). Within the community the shareholders could dispose of any part of the property by his single will. Legally and economically all transactions had to proceed from common consent and common resolve. This did not preclude the possibility of any one among the shareholders claiming his own portion, in which case part of the property had to be meted out to him according to fair computation (swascara). There was no legal constraint over the shareholders to remain in common: division could be brought about either by common consent or by claims of individuals, and yet the constant occurrence of these settlements of co-heirs shows that as a matter of fact the necessity of keeping together and not to break up the unit of property by division. The customary union of co-heirs appears in this way as a corrective of the strict legal principle of equal rights between heirs of the same degree. In English practice the joint management of co-heirs is not so fully described, but there can be no doubt that under the older Saxon rule admitting heirs of the same degree to equal rights in succession the interests of economic efficiency were commonly preserved by the carrying on of common husbandry without any realization of the concurrent claims which would have broken up the course of succession. This accounts for the fact that notwithstanding the prevalence among the early English of the rule admitting all the sons or heirs in the same position to equal shares in the inheritance, the organic units of hides, yardlands, &c. are kept up in the course of centuries. In the management of so-called gevallkind succession in Kent partition was legally possible and came sometimes to be effected, but there was the customary reaction against it in the shape of keeping up the "yokes" and "sulungs." A trace of the same kind of union between co-heirs appears in the so-called parage communities so often mentioned in Domesday Books.

In all these cases of co-heirs and joint management is kept up by purely economic means and considerations. The legal possibility of partition is admitted by the side of it. It is interesting to watch two divergent lines of further development springing from this common source; on the one side we see the full realization of individual right resulting in frequent divisions; on the other side we watch the rise of legal restraints on subdivision resulting in the establishment, in respect of certain categories of property, of rules excluding the plurality of heirs for the sake of preserving the unity of the household. The first system, of course, most easily carried out in countries where individualistic types of husbandry prevail. In Europe it is especially prevalent in the south with its intense cultivation of the arable and its habits of wine and olive growing. We shall not wonder, therefore, that the unrestricted subdivision among heirs is represented most completely by Roman law. Not to speak of the fact that already in the XIT. Tables the principal mode of inheritance was considered to be inheritance by will while intestate succession came in as a subsidiary expedient, we have to notice that there is no check on the disposition of property among heirs of the same degree. The only survival of a régime of family community may be found in the distinction between heredes sui (heirs of their own) and heredes extranei (outside heirs of the deceased). The first entered by their own right and took possession of property which had belonged to them potentially even during their ancestor's life. The latter drew their claims from their relationship to the deceased and this did not give them a direct hold on the property in question. Apart from that the civil law of ancient Rome favoured complete division and the same principle is represented in all European legislation derived from Roman law or strongly influenced by it. Sometimes, as in the French Code Civil, even the wish of the owner cannot alter the customary subdivision as no person can make a will depriving any of his children of their legal share. In full contrast with this mode of succession prevailing in romanized countries we find the nations proceeding from Germanic stock and strongly influenced by feudalism developing two different kinds of restraints on subdivision. In Scandinavian law this point of view is expressed by the Norwegian customs as to Odal. The principal estates of the country, which, according to the law of the Gulating have descended through five generations in the same family, cannot be dispersed and
alienated at pleasure. They are considered as rightly belonging to the kindred with which a historical connexion has been established. In order to keep these estates within the kindred they are to descend chiefly to men; women are admitted to property in them only in exceptional cases. Originally it is only the daughter of a man who has left no sons and the sister of one who has left no children and no brothers that are admitted to take Odal as if they were men. Nieces and first-cousins are admitted in the sense that they have to pass the property to their nearest male heir. They may, in certain eventualities, be bought out by the nearest male relative. A second peculiarity of Odal consists in the right of relations descending from one of the common ancestors to prevent strangers from acquiring Odal estate. Any holder of such an estate who wants to sell it in its entirety or in portion has first to apply to his relatives and they may acquire the estate at the price proposed by a stranger less one-fifth. Even if no relative has taken advantage of this privilege an Odal estate sold to a stranger may be bought back into the family by compulsory redemption if the relatives subsequently find the means and have the wish to resort to such redemption. Odal right does not curtail the claims of the younger sons or of any heirs in a similar position. As a matter of fact, however, customary succession in Norwegian peasant families sets great price on holding the property of the household well together. It is keenly felt that agaard (farm) ought not to be parcelled up into smaller holdings, and in the common case of several heirs succeeding to the farm, they generally make up among themselves who is to remain in charge of the ancestral household: the rest are compensated in money or helped to start on some other estate or perhaps in a cottage by the side of the principal house. In medieval England, France and Germany the same considerations of economic efficiency are felt as regards the keeping up of united holdings, and it may be said that the lower we get in the scale of property the stronger these considerations become. If it is possible, though not perhaps profitable, to divide the property of a large farm, it becomes almost impossible to break-up the smaller units—so-called yardlands and ooxgans. Through being parcelled up into small plots, land loses in value, and, as to cattle, it is impossible to divide one ox or one horse in specie without selling them. No wonder that we find practices and customs of united succession arising in direct contradiction with the ancient rule that all heirs of the same degree should be admitted to equal shares. Glanville mentions expressly that the socagers of his time held partly by undivided succession and partly by divided inheritance. The relations of feudalism and serfdom contributed strongly towards creating such individual tenancies. It was certainly in the interest of the lord that his men, whether holding a military fief or an agricultural farm, should not weaken the value of their tenancies by dispersing the one or the other among heirs. But apart from these interests of over-lords there was the evident self-interest of the tenants themselves and therefore the point of view of unification of holdings is by no means confined to servile tenements or to military fiefs. The question whether the successor should be the eldest son or the youngest son is a secondary one. The latter practice was very prevalent all through Europe and produced in England what is termed the Borough English rule. The quaint name has been derived from the contrast in point of succession between the two parts of the borough of Nottingham. The French burgesses transmitted their tenements by primogeniture, while in the cases of the English tenure who has left no children or brothers usual explanation of this passage of the holdings to the youngest is found in the fact that the youngest son remains longest in his father's house, while the elder brothers have opportunities of going out into the world at a time when the father is still alive and able to take care of his land. This is well in keeping with the view that customs of united succession arise in connexion with compensation provided for co-heirs waiving their claims in regard to settlement in the original household. The succession of the youngest appears also very characteristic in so far as it illustrates the break up into small tenancies, as the youngest in the family is certainly not a fit representative of hierarchy and authority and could not have been meant to rule anything but his own restricted household.

One more feature of the ancient law of succession has to be noticed in conclusion, viz. the exclusion of women from inheritance in law. There can be no doubt that in regards movable goods women held property and transmitted it to their males with right from the earliest time. According to German conception personal ornaments and articles of household furniture are specially effected to their use and follow a distinct line of succession from woman to woman (Gerade). Norse law puts women and men on the same footing as to all forms of property equated to movable goods (Loisée); but as to land there is a prevalent idea that men should be privileged. Women are admitted to a certain extent, but always placed behind men of equal degree. Frankish law originally excluded women from inheritance in land, and this exclusion seems as ancient as the patriarchal system itself, whatever we may think about the position of affairs in prehistoric times when rules of matriarchy were prevalent. A common-sense explanation of one side of this doctrine is tendered by the law of the Thuringians (Lex Anglorum et Wernironum, c. 6). It is stated there that inheritance in land goes with the duty of taking revenge for the homicide of relatives and with the power of bearing arms. One of the most potent adversaries of this system of exclusion proved to be the Church. It favoured all through the view that land should be transmitted in the same way as money or chattels. A Frankish formula (Marcellus) shows us a father who takes the prudent step to endow his daughter with a piece of land according to natural affection in spite of the strict law of his tribe. Such instruments were strongly backed by the Church, and the view that women should be admitted to hold land on certain occasions had made its way in England as early as Anglo-Saxon times.

any other person in possession or expectancy." The property which is liable to pay the duty is in reality or leasehold estate in the United Kingdom and part of the value subject to the duty, will be the value of the estate, as claimed by virtue of English, Scottish or Irish law. Personality in England bestowed abroaD by a person domiciled abroad is not subject to succession duty. Successions of a husband or a wife, successions where the principal value is under £500, and individual successions under £20, are exempt from duty. Leasehold property and personally directed to be converted into real estate are liable to succession, not to legacy duty. Special provision is made for the collection of duty in the cases of joint tenants and where the successor is also the predecessor. The duty is payable on the chargeable amount, the actual charge paid before the duty is paid to the liability of the successor is transferred to the alienor. It is, therefore, usual in requisitions on title before conveyance, to demand for the payment of the purchaser the production of receipts for succession duty, as such receipts are an effectual protection notwithstanding any suppression or misstatement in the account on the footing of which the duty was assessed or any insufficiency of such assessment. The duty is by this act directed to be assessed as follows: on personal property, if the successor takes a limited estate, the duty is payable on the annuity or year's income estimated according to the period during which he is entitled to receive the annuity or yearly income, and the duty is payable in four yearly installments free from interest. If the successor takes absolutely he pays in a lump sum duty on the principal value. On real property the duty is payable in eight half-yearly installments without interest on the capital value of an annuity equal to the annual value of the property. Various minor changes were made. By the Customs and Inland Revenue Act 1881, personal estates under £500 were exempted. By the Customs and Inland Revenue Act 1888 a duty of 1% is charged on successions already paying a 5% and an additional 1% on successions paying more than 5%. By the Customs and Inland Revenue Act 1889 an additional duty of 1% called estate duty was payable on successions over £10,000.

The Finance Acts 1894 and 1900 effected large changes in the duties payable on death (for which see Estate Duty; Legacy). As regards the succession duties they enacted that payment of the estate duties thereby created should include payment of the additional duties mentioned above unless the value of the estate or property (in the case of deceased person child of deceased) are exempted from payment of any succession duties. The succession duty payable under the Succession Duty Act 1853 was in all cases to be calculated according to the principal value of the property, i.e. its selling value, and though still payable by instalments at 3% is chargeable. The additional succession duties are still payable in cases where the estate duty is not charged, but such cases are of small importance and in practice are not as a rule charged.

United States.—The United States imposed a succession duty by the War Revenue Act of 1895 on all legacies or distributive shares of personal property exceeding $10,000. It is a tax on the privilege of succession. Devises or distributions of land are not affected by it. The rate of duty runs from 75 cents on the $100 to $5 on the $100, if the legacy or share in question does not exceed $25,000. On those over that value the rate is 1 ½ times those up to $100,000, twofold on those from $100,000 to $500,000, 2½ times on those from $500,000 to a million, and threefold for those exceeding a million. This statute has been supported as constitutional by the Supreme Court. Many of the states also impose succession duties, or transfer taxes; generally, however, on collateral and remote successions; sometimes progressive, according to the amount of the legacy or share. The real estate succession duties are as important as those personal to real estate successions as well as those to personal property. If a citizen of state A owns registered bonds of a corporation chartered by state B, which he has put for safe keeping in a deposit vault in state C, his estate may thus have to pay four succession taxes, one to state A, to which he belongs and which, by legal fiction, is the seat of all his personal property; one to state B, for permitting the transfer of the bonds to the legatees on the books of the corporation; one to state C, for allowing them to be removed from the deposit vault for that purpose; and one to the United States.

**Succinic Acid**

Succinic acid, C₂H₄(CO₂H)₂. Two acids corresponding to this empirical formula are known—namely ethylene succinic acid, H₂O·C₂H₄·CH₂·C₂O₂H and ethyldiene succinic acid CH₂=C(CH₂·CO₂H)

Ethylene succinic acid occurs in amber, in various resins and lignites, in fossilized wood, in many members of the natural orders of Papaveraceae and Compositae, in unripe grapes, urine and blood. It is also found in the thymus gland of calves and in the spleen of cattle. It may be prepared by the oxidation of fats and of fatty acids by nitric acid, and is also a product of the fermentation of malic and tartaric acids. It is usually obtained by the distillation of the mother-liquors from the fermentation of calcium malate or ammonium tartrate. Syntheticly, it may be obtained by reducing malic or tartaric acids with hydrides of acrid (R. Schmitt, Ann., 1860, 114, p. 106; V. Dessaingues, ibid., 1860, 115, p. 120; by reducing fumaric and maleic acids with sodium amalgam; by heating bretmamic acid with silver to 130° C.; in small quantity by the oxidation of acetic acid with potassium persulphate (C. Moritz and R. Wolfenstein, Ber., 1890, 32, p. 2534). By the hydrolysis of succinonitriile (from ethylene dibromide) C₂H₂(C=O)Br₂—C₂H₄(CN)₂—C₂H₂(CO₂H)₂; by the hydrolysis of β-cyanacetone (from acetic ester with monochloracetic ester and hydrolysis of the resulting ethane tricarboxylic ester (RO₂C₂CH₂CH₂CO₂R; this method is applicable to the preparation of substituted succinic acids. It is also produced by the electrolysis of a concentrated solution of potassium ethyl malonate.

It crystallizes in prisms or plates which melt at 185° C. and boil at 235° C. with partial conversion into the anhydride. It is readily soluble in water. Aqueous solutions of the acid are decomposed in sunlight by uranium salts, with evolution of carbon dioxide and the formation of propionic acid. Potassium succinic acid, in concentrated sulphuric acid, forms a white crystalline precipitate, and in water. The sodium salt on distillation with phosphorus trichloride gives thiophene. The esters of the acid condense readily with aromatic aldehydes and ketones to form γ-substituted itaconic acids and γ-alkyl pyrotaurinic acids (H. Stobbe, Ann., 1899, 308, p. 71). γ-Oxycacid are formed when aldehydes are heated with sodium succinate and sodium acetate. Numerous salts of the acid are known, the basic ferric salt being occasionally used in quantitative analysis for the separation of iron from aluminium.

Succinyl chloride, obtained by the action of phosphorus pentachloride on succinic acid, is a colourless liquid which boils at 190° C. In many respects it behaves as though it were dichlorobutyrolactone, C₆H₄(CCl₂)₂CO₂H on reduction it yields butyro-lactone, and when condensed with benzene in the presence of aluminium chloride it yields hexamethylpyridine. Succinic anhydride, CH₂=C(CH₂·CO₂H)₂ is obtained by heating the acid or its sodium salt with acetic anhydride; by the action of acetyl chloride on the barium salt; by distilling a mixture of succinic acid and succinyl chloride, or by heating succinyl chloride with anhydrous oxalic acid. It crystallizes in plates which melt at 120° C., and distils without decomposition. It is slowly dissolved by water with the formation of the acid. It can be distilled readily by heating with baryta water it yields succinamic acid, HO·C₂H₂·CH₂·CONH₂, and with alcoholic ammonia at 100° C. it gives succinamide.

The imino hydrogen atom is easily replaced by metals. Distillation with zinc dust gives pyrrol (gln.). By the action of bromine in alkaline solution it is converted into β-bromopropionic acid. Succinimide, CH₂(CONH₂)₂, best obtained by the action of ammonia to the sodium succinate and ethyl carbonate at 243° C., and is soluble in hot water. Succinimide, CH₂(CN)₂, is obtained by the action of potassium cyanide on ethylene dibromide or by the electrolysis of a solution of potassium cyanide and succinic acid. It is insoluble in water, and by the reduction with sodium in alcoholic solution it yields tetraethylenediamine (putrescine) and pyrrolidine.

Methyl succinic acid (pyrotaurinic acid), HO·C₂H₂·CH₂·C₂H₂·CO₂H, is formed by the dry distillation of succinic acid; by heating pyruvic acid with concentrated hydrochloric acid to 180° C.; by the reduction of citraconic and mesaconic acids with sodium amalgam; and by
the hydrolysis of α-cyano-butyric acid. It crystallizes in small prisms which melt at 112° C. and are soluble in water. It forms an anhydride when heated. The sodium salt on heating with the action of malonic acid and the alkali metal gives succinic acid.

Ethyldene succinic acid or succinic acid, CH₂COOH₂, is produced by the hydrolysis of α-cyano-butyric acid and by the action of methyl iodide on sodio-malonic ester. It crystalizes in prisms of melting point at 120° C. (T. Salzer, Journ. Prakt. Chem., 1856, l. 57, p. 497), and dissolve in water. It does not yield an anhydride, but when heated loses carbon dioxide and leaves a residue of propionic acid. It may be distinguished from the isomeric ethylene succinic acid by the fact that its sodium salt does not give a precipitate with ferric chloride.

SUCHER, ROSA (1840- ), German opera singer, née Hasselbeck, was the wife of Josef Sucher (1844-1906), a well-known conductor and composer. They were married in 1876, when she had already had various engagements as a singer and he was conductor at the Leipzig city theatre. Frau Sucher soon became famous for her performances in Wagner's operas, her seasons in London in 1882 and 1892 proving her great capacity both as singer and actress; in 1886 and 1888 she sang at Bayreuth, and in later years she was principally associated with the opera stage in Berlin, retiring in 1903. Her magnificent rendering of the part of Isolde in Wagner's opera is especially remembered.

SUCHET, LOUIS GABRIEL, Duc D'ALBUFERA DE VALENCIA (1797-1826), marshall of France, one of the most brilliant of Napoleon's generals, was the son of a silk manufacturer at Lyons, where he was born on the 2nd of March 1799. He originally intended to follow his father's business; but having in 1792 served as volunteer in the cavalry of the national guard at Lyons, he manifested military abilities which secured his rapid promotion. As chef de bataillon he was present at the siege of Toulon in 1793, where he took General O'Hara prisoner. During the Italian campaign of 1796 he was severely wounded at Genoa and on the 11th of October. In October 1797 he was appointed to the command of a demi-brigade, and his services, under Joubert in the Tirol in that year, and in Switzerland under Brune in 1797-98, were recognized by his promotion to the rank of general of brigade. He took no part in the Egyptian campaign, but in August was made chief of the staff to Brune, and restored the efficiency and discipline of the army in Italy. In July 1799 he was made general of division and chief of staff to Joubert in Italy, and was in 1800 named by Masséna his second in command. His dexterous resistance to the superior forces of the Austrians with the left wing of Marshal Ney's army, when the right and centre were shut up in Genoa, not only prevented the invasion of France from this direction but contributed to the success of Napoleon's crossing the Alps, which culminated in the battle of Marengo on the 14th of June. He took a prominent part in the Italian campaign till the armistice of Treviso. In the campaigns of 1805 and 1806 he greatly increased his reputation at Austerlitz, Saalfeld, Jena, Pultusk and Ostrolenka. He obtained the title of count on the 10th of March 1808, married Mlle de Saint Joseph, a niece of Joseph Bonaparte's wife, and soon afterwards was ordered to Spain. Here, after taking part in the siege of Saragossa, he was made commander of the army assembled at 16. He governor of the province, which, by wise and (unlike that of most of the French generals) disinterested administration no less than by his brilliant valour, he in two years brought into complete submission. He annihilated the army of Blake at Maria on the 14th of June 1809, and on the 22nd of April 1810 defeated O'Donnell at Lerida. After being made marshal of France (July 8, 1811) he in 1812 achieved the conquest of Valencia, for which he was rewarded with the title of Duc d'Albufera da Valencia (1812). When the tide set against the French Suchet defended his conquests step by step till compelled to retire into France, after which he took part in Soult's defensive campaign. By Louis XVIII. he was on the 4th of June made a peer of France, but, having during the Hundred Days commanded one of Napoleon's armies on the Alpine frontier, he was deprived of his peerage on the 24th of July 1815. He died near Marseilles on the 3rd of January 1826. Suchet wrote Mémoires dealing with the Peninsular War, which were left by the marshal in an unfinished condition, and the two volumes and atlas appeared in 1829-334 under the editorship of his former chief staff officer, Baron St Cyr-Nogués.

See C. H. Barrault-Rouillon, Le Maréchal Suchet (Paris, 1854); Choumara, Considérations militaires sur les mémoires du Maréchal Suchet (Paris, 1840), and the Peninsular War, inspired, it is supposed, by Soult; and Lieutenant-General Lamarque's obituary notice in the Spectateur militaire (1826). See also bibliography in article Peninsular War.

SU-CHOW. There are in China three cities of this name which deserve mention.

1. Su-chow-Fu, in the province of Kiang-su, formerly one of the largest cities in the world, and in 1907 credited still with a population of 500,000, on the Grand Canal, 55 m. W.N.W. of Shanghai, with which it is connected by railway. The site is practically a cluster of islands to the east of Lake Tai-hu. The walls are about 10 m. in circumference and there are four large suburbs. Its silk manufactures are represented by a greater variety of goods than are produced anywhere else in the empire; and the publication of cheap editions of the Chinese classics is carried to great perfection. There is a Chinese proverb to the effect that to be perfectly happy a man ought to be born in Su-chow, live in Canton and die in Eee-chow. The nine-storied pagoda of the northern temple is one of the finest in the country. In 1866 Su-chow was captured by the T’ai-pings, and when in 1863 it was recovered by General Gordon the city was almost a heap of ruins. It has since largely recovered its prosperity, and besides 7000 silk looms has cotton mills and an important trade in rice. Of the original splendour of the place some idea may be gathered from the beautiful plan on a slab of marble preserved since 1247 in the temple of Confucius and reproduced in Yule’s Marco Polo, vol. i. Su-chow was founded in 434 by Ho-lu-Wang, whose grave is covered by the artificial hill of the Tiger, in the vicinity of the town. The literary and poetic designation of Su-chow is Ku-su, from the great tower of Ku-su-tai, built by Ho-lu-Wang. Su-chow was opened to foreign trade by the Japanese treaty of 1895. A Chinese and European school was opened in 1908.

2. Su-chow, formerly Tsiu-tsan-tsian, a free city in the province of Kan-suh, in 30° 48’ N., just within the extreme north-west angle of the Great Wall, near the gate of jade. It is the great centre of the rubarb trade. Completely destroyed in the great Mahommedan or Dungan insurrection (1865-72), it was recovered by the Chinese in 1873 and has been rebuilt.

3. Su-chow, a commercial town situated in the province of Sze-ch’u-en at the junction of the Min River with the Yang-tse-Kiang, in 28° 46’ 50’ N. Population (1907) about 50,000.

SUCKLING, SIR JOHN (1609-1664), English poet, was born at Whitton, in the parish of Twickenham, Middlesex, and baptized there on the 10th of February 1609. His father, Sir John Suckling (1560-1627), had been knighted by James I. and was successively master of requests, comptroller of the household and secretary of state. He sat in the first and second parliaments of Charles I’s reign, and was made a privy councilor. During his career he amassed a considerable fortune, of which the chief was his marriage at the age of eighteen. He was elected to Trinity College, Cambridge, in 1633, and was entered at Gray’s Inn in 1637. He was intimate with Thomas Carew, Richard Lovelace, Thomas Nabbes and especially with John Hales and Sir William Davenant, who furnished John Aubrey with information about his friend. In 1628 he left London to travel in France and Italy, returning, however, before the autumn of 1630, when he was knighted. In 1631 he volunteered for the force raised by the marquess of Hamilton to serve under Gustavus Adolphus in Germany. He was back at Whitehall in May 1632; but during his short service he had been present at the battle of Breitenfeld and in many sieges. He was hand- rich and generous; his happy gift in verse was only one of many accomplishments, but it commended him especially to Charles I. and his queen. He says of himself ("A Sessions of the Poets") that he "prized black eyes or a lucky hit at bowls above all the trophies of wit." He was the best card-player and the best bowler at court. Aubrey says that he
invented the game of cribbage, and relates that his sisters came weeping to the bowling green at Piccadilly to dissuade him from play, fearing that he would lose their positions. In 1634 great scandal was caused in his old circle by a beating he received at the hands of Sir John Digby, a rival suitor for the hand of the daughter of Sir John Willoughby; and it has been suggested that this incident, which is narrated at length in a letter (Nov. 10, 1634) from George Garrard to Strafford, had something to do with his beginning to seek more serious society. In 1635 he retired to his country estates in obedience to the proclamation of the 20th of June 1632 enforced by the Star Chamber against absentee land-holders and other noblemen. His collection of "Sessions of the Poets" was circulated in MS., and about the same time he wrote a tract on Socionism entitled An Account of Religion by Reason (pr. 1646).

As a dramatist Suckling is noteworthy as having applied to regular drama the accessories already used in the production of masques. His Aeglaura (pr. 1638) was produced at his own expense with elaborate scenery. Even the lace on the actors' coats was of real gold and silver. The play, in spite of its felicity of diction, lack of dramatic unity, and the criticism of Hogarth (Short Discourse of the English Stage), that it seemed "full of flowers, but rather stuck in than growing there," is not altogether unjustified. The Goblins (1638, pr. 1646) has some reminiscences of The Tempest; Brennoral, or the Discontented Colonel (1639, pr. 1646) is a satire on the Scots, who are the Lithuanian rebels of the play; a fourth play, The Sad One, was left unfinished owing to the outbreak of the Civil War. Suckling raised a troop of a hundred horse, at a cost of £12,000, and accompanied Charles on the Scottish expedition of 1639. He shared in the earl of Holland's retreat before Duns, and was ridiculed in an amusing ballad (pr. 1650), in Musarum deliciae, "on Sir John Suckling's most war-like preparations for the Scottish war."

He was elected as member for Bramber for the opening session (1640) of the Long Parliament; and in that winter he drew up a letter addressed to Henry Jermyn, afterwards earl of St Albans, advising the king to discountest the opposition leaders by making more concessions than they asked for. In May of the following year he was implicated in an attempt to rescue Strafford from the Tower and to bring in French troops to the king's aid. The plot was exposed by the evidence of Colonel George Godley, and Suckling fled beyond the seas. The circumstances of his short exile are obscure. He was certainly in Paris in the summer of 1641. One pamphlet related a story of his elopement with a lady to Spain, where he fell into the hands of the Inquisition. The manner of his death is uncertain, but Aubrey's statement that he put an end to his life by poison in May or June 1642 in fear of poverty is generally accepted.

Suckling's reputation as a poet depends on his minor pieces. They have wit and fancy, and at times exquisitely felicity of expression. "Easy, natural Suckling," Millamant's comment in Congreve's Way of the World (Act iv., sc. i.) is a just tribute to their spontaneous quality. Among the best known of them are the "Ballade upon a Wedding," on the occasion of the marriage of Roger Boyle, afterwards earl of Orrery, and Lady Margaret Howard, "I prithee, send me back my heart," "Out upon it, I have loved three whole days together," and "Why so pale and wan, fond lover?" from Aeglaura. "A Sessions of the Poets," describing a meeting of the contemporary versifiers under the presidency of Apollo to decide who should wear the laurel wreath, is the prototype of many later satires.

A collection of Suckling's poems was first published in 1646 as Fragments aurea, the so-called Selections (1638) published by the

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1 Strafford's Letters and Despatches (1739), i. 336.
2 For an account of the proceedings see Historical Collections, ed. by Rushworth (1868), 2nd pt., pp. 288-293.
4 Approved by Aubrey to Sir John Mennis (1659-1671). See also a song printed in the tract, Vox borealis (Harl. Misc. iii. 235).
The Sudan has an ethnological rather than a physical unity, and politically it is divided into a large number of states, all now under the control of European powers. These countries being separately described, brief notice only is required of the Sudan as a whole.

Within the limits assigned it has a length of about 4000 m. extending southwards at some points 1500 m., with a total area of over 2,000,000 sq. m., and a population, approximately, of 40,000,000. Between the arid and sandy northern wastes and the well-watered and arable Sudanese lands there is a transitional zone of level grassy steppes (partly covered with mimosas and acacias) with a mean breadth of about 60 m. The zone lies between 17° and 13° N., but towards the centre reaches as far south as 15° N. Excluding this transitional zone, the Sudan may be described as a moderately elevated region, with extensive open or rolling plains, level plateaus, and abutting at its eastern and western ends on mountainous country. Crystalline rocks, granites, gneisses and schists, of the Central African type, occupy the greater part of the country. Towards the south-east, slates, quartzites and iron-bearing schists occur, but their age is not known. The Congo sandstones do not appear to extend as far north. The Nubian sandstone borders the Libyan desert on the south and south-west, but it is doubtful if this sandstone is of Cretaceous or earlier date.

The Sudan contains the basin of the Senegal and parts of three other hydrographic systems, namely: the Niger, draining southwards to the Atlantic; the central depression of Lake Chad; and the Nile, flowing northwards to the Mediterranean. Lying within the tropics and with an average elevation of not more than 1500 to 2000 ft. above the sea, the climate of the Sudan is hot and in the river valleys very unhealthy. Few parts are suitable for the cultivation of European crops although the grazing is good, but from North Africa by the Saharan desert, the inhabitants, who belong in the main to the negro family proper, are thought to have received their earliest civilization from the East. Arab influence and the Moslem religion began to be felt in the western Sudan as early as the 9th century and had taken deep root by the end of the 11th. The existence of native Christian states in Nubia hindered for some centuries the spread of Islam in the eastern Sudan, and throughout the country some tribes have remained pagan. It was not until the last quarter of the 19th century that the European nations became the ruling force.

The terms western, central and eastern Sudan are indicative of geographical position merely. The various states are politically divisible into four groups: (1) those west of the Niger; (2) those between the Niger and Lake Chad; (3) those between Lake Chad and the basin of the Nile; (4) those in the upper Nile valley.

The first group includes the native states of Bondu, Futa Jallon, Masina, Mossi and all the tribes within the great bend of the Niger. In the last quarter of the 19th century they fell under the control of France, the region being styled officially the French Sudan. In 1900 this title was abandoned. The greater part of what was the French Sudan is now known as the Upper Senegal and Niger Colony (see SENEGAL, FRENCH WEST AFRICA, &c.).

The second group of Sudanese states is almost entirely within the British protectorate of Northern Nigeria. It includes the sultanate of Sokoto and its dependent emirates of Kano, Bida, Zaria, &c., and the ancient sultanate of Bornu, which, with Adamawa, is partly within the German colony of Cameroon (see NIGERIA and CAMEROON). The third or central group of Sudanese states is formed of the sultanates of Bagirmi (q.v.) with Kanem and Wadai (q.v.). Wadai was the last state of the Sudan to come under European influence, its conquest being effected in 1909. This third group is included in French Congo (q.v.).

The fourth group consists of the states conquered during the 19th century by the Egyptians and now under the joint control of Great Britain and Egypt. These countries are known collectively as the Anglo-Egyptian Sudan (see below).

For the regions west of Lake Chad the standard historical work is the Travels of Dr. Heinrich Barth (5 vols., London, 1857–1858). Consult also P. C. Meyer, Derforschungsgeschichte und Staatenbildungen der Westsudan (Gotha, 1897), an admirable summary with bibliography and maps; Karl Kummer, The Sudan (London, 1907); Lady
SUDAN

Lugard, A Tropical Dependency (London, 1905); and the bibliographies given under the various countries named. For sources and references under the unit of State or Department, the important work is that of Gustav Nachtigal, Sahara und Sudan (3 vols., Berlin 1879–1880). See also Boyd Alexander, From the Niger to the Nile (2 vols., London, 1907); Karl Kumm, Paulitschke’s Die Sudanländer (Freiburg, 1885).

The Anglo-Egyptian Sudan

The region which before the revolt of the Arabized tribes under the Mahdi Mahomed Ahmed in 1881–83 was known as the Egyptian Sudan has, since its reconquest by Bondaries and Area. the Anglo-Egyptian expedition of 1856–58, been under the joint sovereignty of Great Britain and Egypt. The limits of this condominium differ slightly from those of the Egyptian Sudan of the pre-Mahdi period. It is bounded N. by Egypt, the 2nd parallel of N. latitude being the dividing line), E. by the Red Sea, Eritrea and Abyssinia, S. by the Uganda Protectorate and Belgian Congo, W. by French Congo. North of Darfur is the Libyan Desert, in which the western and northern frontiers meet. Here the boundary is undefined.1

As thus constituted the Anglo-Egyptian Sudan forms a compact territory which, being joined southwards by the Uganda Protectorate, brings the whole of the Nile valley from the equatorial lakes to the Mediterranean under the control of Great Britain. The Anglo-Egyptian Sudan extends north to south beyond the limits of the Nile. The Sudan is a distinctly marked intermediate zone of steppes. In the southern district, between 5° and 10° N., huge swamps extend on either side of the Nile and along the Bahr-el-Ghazal.

From north to south the Sudan is traversed by the Nile (q.n.), and all the great tributaries of that river are either partly or entirely within its borders. The most elevated district is a range of mountains running parallel to the Red Sea. These mountains, which to the south of the Abyssinian highlands, present their steepest face eastward, attaining heights within the Sudan of 4000 to over 7000 ft. Jebel Erba, 7430 ft., and Jebel Soturba, 6880 ft. (both between 21° and 22° N.), are the highest peaks in the Sudan. Westward the mountains slope gradually to the Nile valley, which occupies the greater part of the country and has a general level of from 600 to 1600 ft. In places, as between Suakin and Berbera, the land is level. The Nile, the mountainous approach close to the river. Beyond the Nile westward extend vast plains, which in Kordofan and Dar Nuba (between 10° and 11° N.) are broken by hills reaching 3000 ft. Farther west, in Darfur, the country is more elevated, the Jebel Mufarab (between 5° and 10° N. 5000 to 6000 ft. high. In the south-west, beyond the valley of the Bahr-el-Ghazal, the country gradually rises to a ridge of hills, perhaps 2000 ft. high, which running south-east and north-west form the water-parting between the Nile and the Congo.

Apart from the Nile system, fully described elsewhere, the Sudan has two other rivers, the Gash and the Baraka. These are intermediate and not unlike the eastward-flowing White Nile, and flow in a general northerly direction. The Gash enters the Sudan near Kassala and north of that town turns west towards the Nile, while the Baraka, which rises in the same part of the country, flows north-west and then south-west towards the Red Sea. The Gash nevertheless fertilizes a considerable tract of country. The Khor Baraka lies east of the Gash. It flows towards the Red Sea in the neighbourhood of Trinkitat (some 50° m. south of Suakin), but about 30 m. from the coast forms an inland delta. Except in seasons of great rain its waters do not reach the sea.

The Coast Region.—The coast extends along the Red Sea north to south from 22° N. to 18° N., a distance following the indentations of the Red Sea. These indentations are numerous but not deep, the general trend of the coast being S.S.E. The most prominent headland is Ras Rawaya (21° N.) which forms the northern shore of Dokhana Bay. There are a few good harbours, Port Sudan and Suakin being the chief ports. South of Suakin is the shallow bay of Trinkitat. A large number of islands, or shoals off the coast, and low scrub stretches for ten to twenty miles, and is traversed by khors (generally dry) with ill-defined shifting channels. Beyond this plain rise the mountainous region, the seaward slopes often bear a considerable amount of vegetation.

The Desert Zone.—The greater part of the region between the coast and the Nile is the Nubian Desert. It is a rugged, rocky, barren desert, scored with khors, wadis, along which is scanty vegetation. The desert character of the country increases as the river is neared, but along either bank of the Nile is a narrow strip of cultivable land. Westwards of the Nile the climate is hot and dry, the scrublands of the oasis country, even in the point of the Arabian influence. The country enclosed by the Nile, the Athara and the Blue Nile, the so-called Island of Meroë, consists of very fertile soil, and along the eastern frontier, by the upper courses of the White Nile, there are extensive grasslands. This is mainly open, steppe-like country with extensive tracts of cultivable land and a central mountain massif, the Jebel Marra (see SENNAR KORDOFAN, DARFUR).

Climate.—The country lies generally within the tropics, and as the greater part of it is far removed from the ocean and less than 1500 ft. above the sea it is extremely hot. The heat is greatest in the central regions, least in the desert zone, where the difference between summer and winter is marked. Even in winter, however, the temperatures are high. Of this region the Arabs say "the soil is like fire and the wind like a flame." Nevertheless, the dryness of the air renders the climate healthy. The steppe countries, Kordofan, Darfur, are also healthful after the autumn rains. Between Khartum, centrally situated, the minimum temperature is about 40° F., the maximum 113°, the mean annual temperature being 80°, January is the coldest and June the hottest month. Violent sand-storms occur in places. The rainy season, from August to January, is usually divided into two parts, the "great rainy season" is from mid-June to September, there are some 10 in. of rain during the year. The number of days on which rain falls rarely exceeds, however, fifteen. The rainfall increases to about 20 in. per annum in the eastern and southern regions. In the swamp district and throughout the Bahr-el-Ghazal heavy rains (40 in. or more a year) are experienced. The period of the heaviest rain begins from April to September. In the maritime district there are occasional rains from August to December and January. In the soud region thunderstorms are frequent. Here the temperature averages about 85° F., the air is always dry; in the river is especially low.

Flora.—In the deserts north of Khartum vegetation is almost confined to stunted mimosa, and in the less arid districts, scanty herbage. Between the desert and the cultivated Nile lands is an open growth of samar, hashab (Acacia terek) and other acacia trees. Between Khartum and 12° N. forest belts line the banks of the rivers and khors, in which the most noteworthy tree is the sant or sant (Acacia arbores). Farther from the rivers are open woods of Balantides nepetoides, hashab, 8c, and dense thickets of losh (Linceta rubra) and kitte (Acacia mellifera). These open woods cover a considerable part of Kordofan, the hashab and tahl trees being the chief producers of gum arabic. South of 12° N. the forest landscape is lost, and the chief feature of the grasslands is the characteristic to that described. On the Blue Nile the forest trees alter, the most abundant being the babanuss (Sudan ebony) and the Erythrina crista galli. While gigantic baobabs, called tebelidi in the Sudan, and tarfi (Sterculia divaricata) are numerous. In southern Kordofan and in the higher parts of the Bahr-el-Ghazal the slag and ebony are also common, as well as African mahogany (Khayal) and the Acacia senegal. The Bahr-el-Ghazal province also are many rubber-producing lianas, among them the Lantolophia ovarteris. There are also forest regions in the Bahr-el-Jbel, in the Mongola mudra, and along the Abyssinian-Egyptian border. The regions of the Blue Nile are vaste prairies covered with tall coarse grass. Cotton is indigenous in the valley of the Blue Nile, and in some localities the jatropha is very plentiful. The castor-oil plant grows in almost every province, (see also Vegetable of the swamp region, NILE.)

Fauna.—Wild animals and birds are numerous. Elephants are abundant in the Bahr-el-Ghazal and Bahr-el-Jbel forests, and are found in fewer numbers in the upper valley of the Blue Nile.
The hippopotamus and crocodile abound in the swamp regions, which also shelter many kinds of water-fowl. The lion, leopard, giraffe and various kinds of antelope are found in the plain and in the open woods. In the forests are numerous bright-plumed birds and many species of monkeys. The ground, mosses and the trees being too prickly for climbing. Snakes are also plentiful, many poisonous kinds being found. In the steppe regions of Kordofan, Darfur, &c., and in the Nubian Desert ostriches are fairly plentiful. Insect life is very abundant, especially south of 12° N. The Nile valley north of Khartum the inhabitants are of very mixed origin. This applies particularly to the so-called Nubians who inhabit the Dongola muduria (see Nubia). Elsewhere the inhabitants north of 12° N. are of mixed Arab descent. In the Nubian Desert the chief tribes are the Ababda and Bisharit, the last named grazing their camels in the mountainous districts towards the Red Sea. In the region south of Berber and Susakin is the Hadendoa. The Jaalil, Hassania and Shukria inhabit the country between the Atbara and Blue Nile; the Hassania and Hadendoa are to be found in the Gash, and the Shukria in the Gash. The Kabbalish occupy the desert country north of Kordofan, which is the home of the Baggara tribes. In Darfur the inhabitants are of mixed Arab and negro blood.

Of negro Nilotic tribes there are three or four main divisions. The Shilluks occupy the country along the west side of the Nile northward from about Lake Abou. The country east of the Nile is divided between the Bari, Nuer and Dinka tribes. The Dinkas are also widely spread over the Bah尔-el-Ghazal province. South of Kordofan and west of the Shilluk territory are the Nubas, apparently the original stock of the Nubians. In the south of Kordofan the Bah尔-el-Ghazal are the Dongola. Some other tribes, and along the Nile-Congo water-parting are the A-Zande or Niam-Niam, a comparatively light-coloured race. All the tribes mentioned are separately noticed.

Social Conditions.—In contrast with the Egyptians, a most industrious race, the Sudanese tribes, both Arab and negro, are as a general rule indolent. Where wants are few and simple, where houses need not be built nor clothes worn to keep out the cold, there is little stimulus to exertion. Many Arabs "clothed in rags, with only a mat for a house, prefer to lead the life of the free-born sons of the desert, no matter how large their herds or how numerous their followings." (Egypt, No. 1 [1904], p. 147.) Following the establishment of British control slave-raiding and the slave trade were stopped, but domestic slavery continues. A genuine desire for education is manifest among the Arabic-speaking peoples and slow but distinct moral improvement is visible among them. Among the riverain "Arabs" some were found to supply labour for public works, and with the money thus obtained cattle were bought and farms started. The Dongolese are the keener traders in the country. The Arab tribes are all Mahomedans, credulous and singularly liable to fits of religious excitement. Most of the negro regions are pagan, but some of them who live in the northern regions have embraced Islam.

**Divisions and Chief Towns.**—Darfur is under native rule. The rest of the Sudan is divided into mudurias (provinces) and these are subdivided into mandurias. The mudurias are Harfa, Reda, Dongola and Berber in the north (these include practically all the region of the Blue Nile), Kordofan, Heshim, Gezira (or Suakin), of which Kassala and Sennar in the east; Kordofan in the west; and Bah�-el-Ghazal, Upper Nile (formerly Fashoda) and Mongalla in the south. The mudurias vary considerably in size.

In the west, Kordofan, Khartoum, the capital, has a population of about 70,000, is built in the broad fork formed by the junction of the White and Blue Niles. Opposite Khartoum, on the west bank of the White Nile, is its rival, Omdurman (q.v.). (Louis), capital of the Sudan during the Mahdist War. On the Nile north of Khartoum are several ports of Berber, Abu Hamed, Merawi (Morowe), Dongola and Wadi Halfa. On the Red Sea are Port Sudan and Suakin. Kassala and El-Fasher are the chief ports of the Cash (these towns are separately noticed.) On the Blue Nile are Kamlin, Sennar, Wad Medani (q.v.), pop. about 20,000, a thriving business centre and capital of the Blue Nile muduria, and Rosseires, which marks the point of navigation by steamers of the river. At South is a town in the Kassala muduria close to the Abyssinian frontier, and Gedaref lies between the Blue Nile and Atbara a little north of 1° N. El Obeid, the chief town of Kordofan, is 250 m. south and west by south of Khartum. Duiem, capital of the White Nile muduria, is the river port for Khartoum. El Fasher, the capital of Darfur, is 500 m. W.S.W. of Khartoum. All the towns named, with the exception of El Fasher, are port cities. In the south of the Sudan there are no towns properly so called. The native villages are composed of straw or palm huts; the places inhabited by Europeans or Egyptians are merely posts, where the agents of the European or British business companies (Fashoda, now renamed Kodok, is the headquarters of the Upper Nile muduria.

**Communications.**—North of Khartoum the chief means of communication is by railway; south of that city by steamer. There are two railways, a railway on the Wadi Halfa line to the Red Sea, and another affording access to the Red Sea. The first line runs from the Nile at Wadi Halfa across the desert in a direct line to Abu Hamed, and from there goes by the old British road and follow the left bank of the Nile to Khartum. At Khartoum the Blue Nile is bridged and the railway is continued south through the Gezira to Sennar. Thence it turns west, crosses the White Nile near Abba Island, and runs to El Obeid for a distance of 121 m., then to El Obeid Junction for 27 m., then to Khartum is 575 m.; from Khartoum to Obeid is 350 m. The railway from the Nile to the Red Sea starts from the Halfa-Khartoum line at Atbara Junction, a mile north of the Atbara confluence. It runs south on the west of the line of the railway, and to Atbara for 278 m. from Atbara Junction, the line divides, one branch going north to Port Sudan, the other south to Suakin. The total distance from Port Sudan to Khartum is 138 m. The line to Suakin being 4 m. longer. Besides these main lines a railway, 138 m. long, runs from Abu Hamed on the right bank of the Nile to Kairema (opposite Merawi) in the Dongola muduria below the Fourth Cataract. (The line is independent of the Nile.) At the junction of this line at Kairema the Nile to Kerma, 201 m. from Halfa, was abandoned in 1903.) The railways are owned and worked by the state.

In connexion with the Khartoum-Halfa railway steamers ply on the route between Port Sudan and Halfa, and the railway from Alexandria ends. The distance by rail and steamer between Khartoum and Alexandria is about 1490 m. Steamers run on the Nile between Kerenia and Kairema, and above Khartoum the government launches ply from Khartoum to the Protectorate. The Rabbani steamer to Port Sudan runs from February 1st to the end of September, and the Kordofan steamer to Suakin runs from March 1st to the end of September. During flood season there is also a steamer service on the Blue Nile. Powerful dredgers and cutting machines are used to keep open communications in the upper Nile and Bah尔-el-Ghazal.

The ancient caravan routes Korosko-Abu Hamed and Berber-Suakin are still used by the nomads, and the main routes between Khartoum and the towns and the Nile. On some of these roads a motor car service is maintained.

From Port Sudan and Suakin there is a regular steamer service to Alexandria via the Suez Canal. There are also services to Alexandria, the Red Sea ports of Arabia, Aden and India.

There is an extensive telegraphic system. Khartoum is connected by direct line with El Obeid, and lines of this first order also exist to the following places: Northern Desert (2500 m.); Khartoum other lines go to Kassala and the Red Sea ports. In some places the telegraph wires are placed 16 ft. in. above the native wire to protect them from the effects of bad weather. Three telegraphic connexion between Alexandria and Mombasa (2500 m.). From Khartoum other lines go to Kassala and the Red Sea ports. In some places the telegraph wires are placed 16 ft. in. above the ground wire and protected by iron pipes.

**Agriculture and other Industries.**—North of Khartoum agricultural land is confined to a narrow strip on either side of the Nile and to the few areas in the Libyan Desert. In the Gezira and in the Bah尔-el-Ghazal provinces, and in the Gedaref and Kordofan regions, there are wide areas of arable land, as also in the neighbourhood of Kassala along the banks of the Cash. In Kordofan and Darfur cultivation is confined to the Khors or valleys. The chief grain crop is durra, the cultivation of sugarcane is also very extensive in several districts. On lands near the rivers the durra is sown after the flood has gone down and also at the beginning of the rainy season. Considerable quantities of wheat and barley are also
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Each of the mudirates into which the country is divided is presided over by a mudir (governor) responsible to the central government at Khartoum. The governor-general, the chief of the various departments of state and the mudirs are all Europeans, the majority being British military officers. The minor officials are nearly all Egyptians or Sudanese. Revenue is derived as above, about 60% from the customs and revenue-earning departments (i.e., steamers, railways, posts and telegraphs), and 40% to the rest from taxes on land, date-trees and animals, from royalties on gum, ivory and ostrich feathers, from licences to sell spirits, carry arms, &c., and from fees paid for the shooting of game. Expenditure is largely on public works, education, justice and the army. Financial affairs are managed from Khartoum, but control over expenditure is exercised by the Egyptian financial department. The revenue, which in 1898 was £35,000, for the first time exceeded a million in 1909, when the amount realized was £60,000. The expenditure in 1899 was £1,153,000. Financially the government had been, up to 1910, largely dependent upon Egypt. In the years 1901-1909 £43,000,000 was advanced from Cairo for public works in the Sudan; in the same period a further sum of about £27,000,000 had been found by Egypt to meet annual deficits in the Sudan budgets (see Egypt, No. 1 [1910], pp. 5-6).

Justice.—The Sudan judicial codes, based in part on those of India and in part on the principles of English law and of Egyptian commercial law, provide for the recognition of "customary law," so far as applicable and "not repugnant to good conscience." In civil cases, all elements are tried by a court, consisting of the mudir (or a judge) and two magistrates, which has general competence. The magistrates are members of the administrative staff, who try minor cases without the help of the mudir (or judge). The governor-general possesses revising powers in all cases. Civil cases of importance are heard by a judge (or where no judge is available by the mudir or his representative); minor civil cases are tried by magistrates. From the decision of the judges an appeal lies to the legal secretary of the government, in his capacity of judicial commissioner. Jurisdiction in all legal matters, as regards personal status of Mahomedans is administered by a grand kadi and a staff of subordinate cadis. The police force of each mudiria is independently organized under the control of the mudirs.

Education.—Education is in charge of the department of public instruction. Elementary education, the medium of instruction being Arabic, is given in kuttab or village schools. There are primary schools in the chief towns where English, Arabic, mathematics, and in some cases land-measuring is taught. There are also government industrial workshops, and technical schools for girls. The Gordon College at Khartoum trains teachers and judges to complete their technical courses and has annexed to it a secondary school. The college also contains the Wellcome laboratories for scientific research. Among the pagan negro tribes Protestant and Roman Catholic missions are established. These missions carry on educational work, special attention being given to industrial training.

Defence.—The defence of the country is entrusted to the Egyptian army, of which several regiments are stationed in the Sudan. The governor-general is sirdar (commander-in-chief) of the army. A small force of British troops is also stationed in the town—chiefly at Khartoum. They are under the command of the governor-general in virtue of an arrangement made in 1905, having previously been part of the Egyptian command.

For topography, &c., see The Anglo-Egyptian Sudan, a compendium prepared by officers of the Sudan government and edited by Count Gleichen (2 vols., London, 1905); for administration, finance and trade, see Official Reports [by the British agent at Cairo] on Egypt and the Sudan, since 1884 (2 vols., London, 1884); no. 2, 1885); by Colonel D. H. Stewart. Consult also J. Petherick, Travels in Central Africa (2 vols., London, 1862); W. Junker, Travels in Africa, 1873-1879 (3 vols., London, 1880); S. G. Schweinfurth, Der Sudan und seine Verbindungen mit dem Arabischen und Ostafrika, der Sudan und das Scengebiet (Gotth., 1890); F. D. Schoenfeld, Ethnografie und der ägyptische Sudan (Berlin, 1901); C. E. Muriel, Report on the Forests of the Sudan (Cairo, 1901); H. W. Hetherly, Bird Hunting on the White Nile (London, 1902). For ethnology.

grown. Other foodstuffs raised are lentils, beans, onions and melons. The date-palm is cultivated along the Nile valley below Khartoum, and in the west banks of the Dongola and Beni-Suef districts in the neighbouring oases. Dates are also a staple product in Darfur and Kordofan. Ground-nuts and sesame are grown in large quantities for the oil they yield, and cotton of quality equal to that found in India is produced. The Sudan was indeed the original home of Egyptian cotton.

For watering the land by the river banks (water-wheels) are used, oxen being employed to turn them. There are few irrigation systems; and in most of the native plantations, about 1,500,000 acres were under cultivation. In 1910 a system of basic irrigation was begun in Dongola mudiria.

Trade. The chief export products. The gum is obtained from the Kordofan and in the forests modern of the Nile Valley of the red sand, the best gum coming from Kordofan. It is of two kinds, kaasab (white) and laab (red), the white being the more valuable. An oil is obtained from the Batariels, where there are Para and Ceara rubber plantations—and in the l'obat district. The wood of the sun tree is largely used for boat-building and for fuel, and the mahogany tree yields excellent timber. Fibre is made from several trees and plants. Elephants are hunted for the sake of their ivory. The wealth of the Arab tribes consists largely in their herds of camels, horses and cattle. They also keep ostrich farms, the feathers being of good quality. The Dongola breed of horses is noted for its strength and hardiness. The camels are bred in the desert north of Berber, between the Nile and Red Sea, in southern Dongola, in the Hadendua country and in northern Kordofan. The bigher camel is considered first rate and is richer than the camel of Egypt. The camel, horse and ostrich are not found south of Kordofan and Sennar. The negro tribes live mostly in the southern and central parts of the country, and the camel and the cattle are generally small and the sheep yield little wool. The Arabs use the camel as draught-animals as well as for their milk and flesh; the negro tribes as a rule do not eat their oxen. Poultry are plentiful, but of poor quality. Donkeys are much used in the central regions; they make excellent transport animals.

Mineral Wealth.—In ancient times Nubia, i.e., the region between the Red Sea and the Nile south of Egypt and north of the Sudal, Berber line, was worked for gold. Reins of an extensive gold-mine exist near Jebel Erba at a short distance from the sea. In 1905 gold mining recommenced in Nubia, in the district of Um Nabardy. The mineral is rich desert. The railway line from Haifa and Abu Hamid. A light railway, 30 m. long, opened in June 1905, connects Um Nabardy with the government railway system. The producing stage was reached in 1908, and between September 1908 and August 1909 the mines yielded 4,000 oz. of gold. Small quantities of gold-dust are obtained from Kordofan, and gold is found in the Beni-Shangul country south-west of Sennar, but this region is within the Abyssinian frontier (agreement of the 15th of May 1902). There is lignite in the Dongola mudiria and iron ore is found in Darfur, southern Kordofan and in the Bahl-el-Ghazal. In the last-named mudiria iron is worked by the natives. In the district of the Hafet-el-Ghazal, the country is rich in copper, the mines having been worked intermittently from remote times.

The chief products of the Sudan for export are gum, ivory, ostrich feathers, dates and rubber. Cotton, cottonseed, and grain (durra, wheat, barley) sesame, livestock, hides and skins, beeswax, mother-of-pearl, senna and gold are also exported. Before there was little trade with Britain, the customs have been liberalized in order to trade with Egypt via the Nile, and the great cost of carriage hindered its development. Since the completion of the railway named goods can be put on the world's markets at a much cheaper rate. Besides the Egyptian and Red Sea routes there is considerable trade between the eastern mudirates and Abyssinia and Eritrean, and some trade south and west with Uganda and the Congo countries. The Red Sea ports trade largely with Arabia and engage in pearl fishery. The principal imports are cotton goods, food-stuffs (flour, rice, sugar, provisions), timber, tobacco, spirits (in large quantities), iron and machinery, candles, cement and perfumery. The value of trade with the Mahomedan countries in 1898–99 was £670,000, and in 1908 only, had increased in 1905 to over £1,500,000. In 1908 the exports of Sudan produce were valued at £651,000; the total imports at £6,929,000.

Government. The administration is based on the provisions of the Convention signed on the 19th of January 1859 between the British and Egyptian governments. The executive and governmental powers are represented by a governor-general appointed by Egypt on the recommendation of Great Britain. In 1910 a council consisting of four ex officio members and from two to four non-official nominated members was created to advise the governor-general in the exercise of his executive and legislative functions. Subject to the power of veto retained by the governor-general all questions are decided by a majority of the council.

1 A £ (pound Egyptian) is equal to £1, os. 6d. British currency.
For dating the earliest example of such a fusion to the exact period of the Egyptian Old Empire. It is certain in any case that the process was commonly repeated at different dates and in different parts of the country from Aswan to Axum, and to the stimulation which resulted from it must be ascribed the principal political and intellectual movements of the Sudanese nations. Thus the Ethiopians who usurped the crown of the Pharaohs from 740–660 B.C. were of a mixed stock akin to the modern Barabra; the northern Nubians who successfully defied the Roman emperors were under the lordship of the Blemmyes (Blemmyes), an East African tribe, and the empire of the Candace dynasty, no less than the Christian kingdoms which succeeded it, included many heterogeneous racial elements. The ethnological history of the Sudan will therefore be concerned with the evolution of what may be called East African or East Central African civilizations.

Up to the present, however, this aspect has been obscured, for until 1907 scholars had little opportunity of studying ancient Ethiopia except as a colonial extension of Egypt. From the purely Egyptological standpoint there is much of value to be learned from the Sudan. The Egyptian penetration of the country began, according to the evidence of inscriptions, as early as the Old Empire. Under the XIIth Dynasty colonies were established in the Memphite territory, and the fortresses of the empire, including that at Nimrod near the site of the modern city, were founded.

During the XVIIIth Dynasty the political subjugation was completed and the newly won territories were studded with cities and temples as far south as the Fourth Cataract. Some two hundred years later the priests of Amen (Ammon), flying from Thebes, founded a quasi-Egyptian capital at Napata. But after this date Egypt played no part in the evolution of Ethiopia. Politically moribund, it succumbed to the attacks of its virile southern neighbours, who, having emerged from foreign tutelage, developed according to the natural laws of their own genius and environment. The history of Ethiopia therefore as an independent civilization may be said to date from the 6th century B.C., though archaeological research may be able to carry its infant origins to a remoter past.

Of the thousand years or more of effective Egyptian occupation many monuments exist, but on a broad general view it must be pronounced that they owe their fame more to the accident of survival than to any special intrinsic value. For excepting Philae, which belongs as much to Egypt as to Ethiopia, Abu Simbel is the only temple which can be ranked among first rate products of Egyptian genius. The other temples, attractive as they are, possess rather a local than a universal interest. Similarly while the exploration of the Egyptian colonies south of the First Cataract has added many details to our knowledge of political history, of local cults and provincial organization, yet with one exception it has not affected the known outlines of the history of civilization. This exception is the discovery made by Dr G. A. Reisner that the archaic culture first detected at Nagada and Abydos and then at many points as far north as Giza extended southwards into Nubia at least as far as Gerf Husain. This was wholly unexpected, and if, as seems probable, the evidence stands the test of criticism, it is a new historical fact of great importance. The government expedition found traces between Aswan and Korosko of the principal periods and that this early date down to the Christian era. The specimens obtained are kept in a separate room of the Cairo Museum, where they form a collection of great value.

The work of the Pennsylvanian expedition, however, while adding only a few details to the archaeology of the Egyptian periods, has opened a new chapter in the history of the African races. No records indeed were discovered of the founders of the first great Ethiopian kingdom from FIankhi to Tigrhak, nor has any fresh light been thrown upon the relations which that remarkable king Ergameues maintained with the Egyptian Ptolemyes. But the exploration of sites in the southern half of Lower Nubia has revealed the existence of a wholly unsuspected civilization which grew up during the first six centuries after Christ. The history of the succeeding periods, moreover, has been partially recovered and the study...
of architecture enriched by the excavation of numerous churches dating from the time of Justinian, when Nubia was first Christianized, down to the late medieval period when Christianity was extirpated by Mahomedanism.

The civilization of the first six centuries A.D. may be called "the Indo-Nubian period" in which not only the site and period where it is situated but the name of the people living on the borders of the Roman Empire who inhabited much of the Hellenistic tradition in minor arts but combined it with a remarkable power of independent origination. The sites on which it has been observed range from Dakhla to Halfa, that is to say within the precise limits which late Latin and Greek writers assign to the Blemmyes, and there is good reason to identify the people that evolved it with this hitherto almost unknown barbarian nation. Apart from this, however, the greatest value of the new discoveries will consist in the fact that they may lay the foundations for a new documentary record of past ages. For the graves yielded not only new types of statues, bronzes, ivory carvings and painted pottery—all of the highest artistic value—but also a large number of stone stelae inscribed with funerary formulae in the Meroitic script.

In the course of sixty years the small collection of Meroitic inscriptions made by Lepsius had not been enlarged and no progress had been made towards decipherment. But the treasures of Shabul and Karanog alone yielded 170 inscriptions on stone, besides some inscribed ostraka. This mass of material brought the task of decipherment within the range of possibility, and even without any bilingual record to assist him, Mr. F. L. Griffith rapidly succeeded in the first stages of translation. As further explorations bring more inscriptions to light the records of Ethiopia will gradually be placed on a firm documentary basis and the names and achievements of its greatest monarchs will take their place on the roll of history.


Ancient Monuments south of Halfa.—Ruins of pyramids, temples, churches and other monuments are found along both banks of the Nile almost as far south as the Fourth Cataract, and again in the "Island of Merowe." In the following list the ruins are named as met with on the journey south from Wadi Halfa (Opposite town that on the east bank are the remains of Shabul, where was found the stela, now at Florence, com- memorating the conquest of the region by Senwosret (Usetertes) I. of Egypt (c. 2750 B.C.). Forty-three miles farther south are the ruins of the twin fortresses of Kumba and Semna. Here the Nile narrows and passes the Semna cataract, and graven on the rocks are ancient records of "high Nile." At Amara, some 50 m. above Semna, are the ruins of a temple with Meroitic hieroglyphics. At Sai Island, 130 m. above Halfa, are remains of a Christian church. Thirteen miles south of Sai at Sobel are the ruins of a temple commemorating Amenophis (Amenhotep) III. (c. 1414 B.C.) to whose Taha was dedicated a temple at Sedeninga, a few miles to the north. At Sesebi, 40 m. higher up the Nile, is a temple of the hecateic king Akhenaton re-worked by Seti I. (c. 1372 B.C.). Opposite Hanek at the Third Cataract on Tombol Island are extensive ancient granite quarries, in one of which lies an unfinished colossus. On the east side of the river near Kerma are the remains of an Egyptian city. Argo Island, a short distance higher up, abounds in ruins, and those at Old Dongola, 320 m. from Halfa, afford evidence of the town having been of considerable size during the time of the Christian kingdom of Dongola. From Old Dongola to Merowe (a distance of 100 m. by the river) are numerous ruins of monasteries, churches and fortresses of the Christian era in Nubia—notably at Jebel Deka and Magal. In the immediate neighbourhood of Jebel Barkal (the "holy mountain" of the ancient Egyptians), a flat-topped hill which rises abruptly from the desert on the right bank of the Nile a mile or two above the existing village of Merawi (Merowe), are many pyramids and six temples, the pyramids having a height of from 35 to 60 ft. Pyramids are also found at Zuma and Kurrk on the right bank, and at Tangasi on the left bank of the river, these places being about 20 m. below "Merawi." That village is identified by some archaeologists with the ancient Napata, which is known to have been situated near the "holy mountain." On the left bank of the Nile opposite Merawi are the pyramids of Nut, and a few miles distant in the Wadi Ghazal are the ruins of a great Christian monastery, where were found gravestones with inscriptions in Greek and Coptic. Ruins of various ages extend from Merawi to the Fourth Cataract.

Leaving the Nile at this point and striking direct across the Bayuda Desert, the river is regained at a point above the Athbara confluence. Thirty miles north of the town of Shendi are the remains of two Meroitic shrines (Meroë and Merawi) in three distinct groups. Nearly one of these pyramids was taken "the treasure of Queen Candace" now in the Berlin Museum. Many of the pyramids have a small shrine on the eastern side inscribed with debased Egyptian or Meroite hieroglyphics. These pyramids are on the right bank of the Nile, that is in the "Island of Merowe." Portions (including a harbour) of the site of the city of Merowe, at Begerawia, not far from the pyramids named, were excavated in 1909-1910 (see Merowe). In this region, and distant from the river, are the remains of several cities, notably Naga, where are ruins of a church, one of the Classic style. On the east bank of the Blue Nile, about 13 m. above Khartum at Soha, Merawi, the site of some monasteries, is named "the village of a Christian basilica. Farther south still, at Cetena on the White Nile (in 1904), and at Wad el-Hadid, some miles north of Sennar, on the Blue Nile (in 1908), Christian remains have been observed.

Between the Nile at Wadi Halfa and the Red Sea are the remains of towns inhabited by the ancient miners who worked the district. The most striking of these towns is Deraheib (Castle Beautiful), so named from the picturesque situation of the castle, a large square building with pointed arches. The walls of some buildings have been considerably extant in the Nile valley between Egypt and Abyssinia—did not embrace Christianity until the 6th century, considerably later than their Abyssinian neighbours. The Arab invasion of North Africa in the 7th century, which turned Egypt into a Mahomedan country, had not the same effect in Nubia, the Moslems, though they frequently raided the country, being unable to hold it. On the ruins of the ancient Ethiopian states arose the Christian kingdoms of Dongola and Alas, with capitals at Dongola and Soba, respectively. These kingdoms continued to exist until the middle of the 14th century or later (see Dongola; Mudiaria). Meanwhile Arabs of the Beui Omayyia tribe, under pressure from the Beni Abbas, had begun to cross the Red Sea

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A. From the Earliest Time to the Egyptian Conquest.—The southern regions of the Anglo-Egyptian Sudan are without recorded history until the era of the Egyptian conquest in the 18th century. In the northern regions, known as Ethiopia or Nubia, Egyptian influence made itself felt as early as the 3rd millennium B.C., and in process of time powerful states grew up with capitals at Napata and Meroë (see Meroë, vol. iii, § 4 Archaeology and ETHIOPIA and EGYPT). The Nubians, that is the dwellers in the Nile valley between Egypt and Abyssinia—did not embrace Christianity until the 6th century, considerably later than their Abyssinian neighbours. The Arab invasion of North Africa in the 7th century, which turned Egypt into a Mahomedan country, had not the same effect in Nubia, the Moslems, though they frequently raided the country, being unable to hold it. On the ruins of the ancient Ethiopian states arose the Christian kingdoms of Dongola and Alas, with capitals at Dongola and Soba, respectively. These kingdoms continued to exist until the middle of the 14th century or later (see Dongola: Mudiaria). Meanwhile Arabs of the Beui Omayyia tribe, under pressure from the Beni Abbas, had begun to cross the Red Sea

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as early as the 8th century and to settle in the district around Sennar on the Blue Nile, a region which probably marked the southern limits of the kingdom of Aloa. The Omayya, who during the following centuries were reinforced by further immigrants from Arabia, intermarried with the negroid races, and gradually Arab influence became predominant and Islam the nominal faith of all the inhabitants of Sennar. In this way a barrier was erected between the Christians of Nubia and those of Abyssinia. By the 15th century the Arabized negro race of the Blue Nile had grown into a powerful nation known as the Funj (q.v.), and during that century they extended their conquests north to the borders of Egypt. The kingdom of Dongola had already been reduced to a condition of anarchy by Moslem invasions from the north. Christianity was still professed by some of the Nubians as late as the 16th century, but the whole Sudan north of the lands of the pagan negroes (roughly 12° N.) was then under Moslem sway. At that time the sultans of Darfur (q.v.) in the west and the sultans or kings of Sennar (the Funj rulers) in the east were the most powerful of the Mahomedan potentates.

The first of the Funj monarchs acknowledged king of the whole of the allied tribes, of which the Hameg were next in importance to the Funj, was Amara Dunkas, who reigned c. 1484–1526.1 During the reign of Adlan, c. 1500–1603, the fame of Sennar attracted learned men to his court from such distant places as Cairo and Bagdad. Adlan's great-grandson Badi Abu Daku attacked the Shilluk negroes and RAIDed Kordofan. This monarch built the great mosque at Sennar, almost the only building in the town to survive the ravages of the dervishes in the 19th century. In the early part of the 18th century there was war between the Sennar and the Abyssinians, in which the last named were defeated with great slaughter. It is said that the cause of quarrel was the seizure by the king of Sennar of presents sent by the king of France to the Negus. The victory over the "infidel" Abyssinians became celebrated throughout the Mahomedan world, and Sennar was visited by many learned and celebrated men from Egypt, Arabia and India. Towards the end of the 18th century the Hameg wrested power from the Funj and the kingdom fell into decay, many of the tributary princes refusing to acknowledge the king of Sennar. These disorders continued up to the time of the conquest of the country by the Egyptians.

B. From the Egyptian Conquest to the Rise of the Mahdi.—The conquest of Nubia was undertaken in 1820 by order of Mehmet Ali, the pasha of Egypt, and was accomplished in the two years following. In its consequences this proved one of the most important events in the history of Africa. Mehmet Ali never stated the reasons which led him to order the occupation of the country, but his leading motive was, probably, the desire to obtain possession of the mines of gold and precious stones which he believed the Sudan contained. He also saw that the revenue of Egypt was falling through the diversion, since about 1800, of the caravan routes from the Nile to the Red Sea ports, and may have wished to recapture the trade, as well as to secure a country whence thousands of slaves could be brought annually. Mehmet Ali also wished to crush the remnant of the Mamelukes who in 1812 had established themselves at Dongola, and at the same time to find employment for the numerous Albanians and Turks in his army, of whose fidelity he was doubtful. Mehmet Ali gave the command of the army sent to Nubia to his son Ismail, who at the head of some 4000 men left Wadi Halfa on October 15th. Following the Nile route he occupied Dongola without opposition, the Mamelukes fleeing before him. (Some of them went to Darfur and Wadai, others made their way to the Red Sea. This was the final dispersal of the Mamelukes.) With the nomad Shagia, who dominated the district,
Kassaia founded. In 1837 the pasha himself visited the Sudan, going as far as Fazokl, where he inspected the goldfields.

In 1849 Abd-el-Latif Pasha became governor-general and attempted to remedy some of the evils which disfigured the administration. He remained in office, however, little more than a year, too short a period to effect reforms. The Sudan was costing Egypt more money than its revenue yielded, though it must not be forgotten that large sums found their way illicily into the hands of the pashas. The successors of Mehemet Ali, in an endeavour to make the country more profitable, extended their conquests to the south, and in 1853 and subsequent years trading posts were established on the Upper Nile, the pioneer European merchant being John Petherick, who rendered great service in opening up the country for trade. The French established a station at Atbara for ivory only, but those who followed him soon found that slave-raiding was more profitable than elephant hunting. The viceroy Said, who made a rapid tour through the Sudan in 1857, found it in a deplorable condition. The viceroy ordered many reforms to be executed and proclaimed the abolition of slavery. The reforms were mainly inoperative and slavery continued. The project which Said also conceived of linking the Sudan to Egypt by railway remained unfulfilled. The Sudan at this time (c. 1863) is described by Sir Samuel Baker as follows: ‘The country is a barren one, with little or no water; it consists of sandstone hills, which are covered with scrub and thorny bushes; the inhabitants are scattered and wandershackled as they are, for want of water, for their cattle.’

In 1857 Bahr-el-Ghazal was annexed, and the viceroy continued his efforts to suppress slave raids. A large force was sent under Colonel Lupton, engaged in 1859 against some of the slave-raiders, and in the following year was again sent under Baker. At this period Zobeir’s dominions were approximately those of the present province of Darfur, and he was a great slave-raider. In 1862 Zobeir’s brother, Obeid, succeeded him as chief. In 1864 a large expedition went up the Nile, under an officer named De Graff, who was a very remarkable man. He captured Obeid and returned to the capital with a large number of slaves. The next year another expedition was sent up the Nile by Said’s orders, and a great number of slaves was captured. In 1866 another expedition was sent up the Nile, under Major Gordon, who, having succeeded Lupton in the command, was ordered to continue the war against the slave-raiders. He captured Obeid and a great number of slaves was taken, and a large number of Europeans was rescued. The expedition returned to the capital in 1867, having captured a large number of slaves and having destroyed many of the slave-raiders’ strongholds.

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SUDAN

execution (assuming that the Egyptian authorities were sincere in proposing reforms).

C. The Rise and Power of Mahdism.—The Mahdist movement, which was utterly to overthrow Egyptian rule, derived its strength from two different causes: the oppression under which the people suffered, and the measures taken to prevent the Baggara (cattle-owning Arabs) from slave trading. Venality and the extortion of the tax-gatherer flourished anew after the departure of Gordon, while the fearlessness of his successors inspired in the Baggara a contempt for the authority which prohibited them pursuing their most lucrative traffic. When Mahommed Ahmed (q.v.), a Dongolese, proclaimed himself the long-looked-for Mahdi (guide) of Islam, he found most of his original followers among the grossly superstitious villagers of Kordofan, where the government and local equality and a community of goods, while denouncing the Turks as unworthy Moslems on whom God would execute judgment. The Baggara perceived in this Mahdi one who could be used to shake off Egyptian rule, and their adhesion to him first gave importance to his "mission." Mahommed Ahmed became at once the leader and the agent of the Baggara. He married the daughters of their sheikhs and found in Abdullah, a member of the Taasha section of the tribe, his chief supporter. The first armed conflict between the Egyptian troops and the Mahdi's followers occurred in August 1881. In June 1882 the Mahdi's forces occupied Kordofan and captured Omdurman. The capture of El Obeid on the 17th of January 1883 and the annihilation in the November following of an army of over 10,000 men commanded by Hicks Pasha (Colonel William Hicks [q.v.] formerly of the Bombay army) made the Mahdi undisputed master of Kordofan and Sennar. The next month, December 1883, saw the surrender of Slatin in Darfur, whilst in February 1884 Osman Digna, his amir in the Red Sea regions, inflicted a crushing defeat on some 4,000 Egyptians at El Teb near Suakin. In April following Lupton Bey, governor of Bahr-el-Ghazal, whose troops and officials had embraced the Mahdist cause, surrendered and was sent captive to Omdurman, where he died on the 8th of May 1884.

On learning of the disaster to Hicks Pasha's army, the British government (Great Britain having been since 1852 in military occupation of Egypt) insisted that the Egyptian government should evacuate such parts of the Sudan as they still held, and General Gordon was despatched, with Lieut.-Colonel Donald H. Stewart, to Khartoum to arrange the withdrawal of the Egyptian civil and military population. Gordon's instructions, based largely on his own suggestions, were not wholly consistent; they contemplated vaguely the establishment of some form of autonomous government on the surrender of Egyptian authority, and among the documents with which he was furnished was a firman creating him governor-general of the Sudan. Gordon reached Khartoum on the 18th of February 1884 and at first his mission, which had aroused great enthusiasm in England, promised success. To smooth the way for the retreat of the Egyptian garrisons and civilians he issued proclamations announcing that the suppression of the slave trade was abandoned, that the Mahdi was sultan of Kordofan, and that the Sudan was independent of Egypt. He enabled some thousands of refugees to make their escape to Assuan and collected at Khartoum troops from some of the outlying stations. By this time the situation had altered for the worse and Mahdism was gaining strength among tribes in the Nile valley at first hostile to its propaganda. As the only means of preserving authority at Khartoum (and thus securing the peaceful withdrawal of the garrison) Gordon repeatedly telegraphed to Cairo asking that Zobeir Pasha might be sent to him, his intention being to hand over to Zobeir the government of the country. Zobeir (q.v.), a Sudanese Arab, was probably the one man who could have withstood successfully the Mahdi. Owing to Zobeir's notoriety as a slave-raider Gordon's request was refused. All hope of a peaceful retreat of the Egyptians was thus rendered impossible. The Mahdist movement now swept northward and on the 20th of May Berber was captured by the Mahdists and Khartoum invested. For this time the energies of Gordon were devoted to the defence of that town. After months of delay due to the vacillation of the British government a relief expedition was sent up the Nile under the command of Lord Wolseley. It started too late to achieve its object, and on the 25th of January 1885 Khartoum was captured by the Mahdi and Gordon killed. Colonel Stewart, Frank Power (British consul at Khartoum) and M. Herbin (French consul), who (accompanied by nineteen Greeks) had been sent down the Nile by Gordon in the previous September to give news to the relief force, had been decoyed ashore and murdered (Sept. 18, 1884). The fall of Khartoum was followed by the end of the British expedition, Dongola being evacuated in June 1885. In the same month Kassala capitulated, but just as the Mahdi had practically completed the destruction of the Egyptian power he died, in this same month of June 1885. He was at once succeeded by the khaliifa Abdullah, whose rule continued until the 2nd of September 1898, when his army was completely overthrown by an Anglo-Egyptian force under Sir H. (afterwards Lord) Kitchener. The military operations are described elsewhere (see Egypt: Military Operations), and here it is only necessary to consider the internal situation and the character of the khaliifa's government. The Mahdi had been regarded by his adherents as the only true commander of the faithful, endowed with divine power to conquer the whole world. He had at first styled his followers dervishes (i.e. religious mendicants) and given them the jibba as their characteristic garment or uniform. Later on he commanded the faithful to call themselves ansar (helpers), a reference to the part they were to play in his career of conquest, and at the time of his death he was planning an invasion of Egypt. He had liberated the Sudanese from the extortions of the Egyptians, but the people soon found that the Mahdi's rule was even more oppressive than that of their former masters. And after the Mahdi's death the situation of the peasantry in particular grew rapidly worse, neither life nor property being safe. Abdullah set himself steadfastly to crush all opposition to his own power. Mahommed Ahmed had, in accordance with the traditions which required the Mahdi to have four khaliifas (lieutenants), nominated, besides Abdullah, Ali wed Helu, a sheikh of the Degheim and Kenana Arabs, and Mahommed esh Sherif, his son-in-law, as khaliifas. The (other khaliifaship was vacant having been declined by the sheikh es Sennusi [q.v.]). Wad Helu and Sherif were stripped of their power and gradually all chiefs and amirs not of the Baggara tribe were got rid of except Osman Digna, whose sphere of operations was on the Red Sea coast. Abdullah's rule was a pure military despotism which brought the country to a state of almost complete agricultural and commercial ruin. He was also almost constantly in conflict either with the Shilluks, Nuers and other negro tribes of the south; with the peoples of Darfur, where at one time an anti-Mahdi gained a great following; with the Abyssinians; with the Kabbabish and other Arab tribes who

*Writing from Darfur in April 1879 Gordon said: "The government of the Egyptians in these far-off countries is nothing but one of brigandage of the worst description. It is so bad that all hope of ameliorating it is hopeless."

1 The Sudanese spoke of all foreigners as "Turks." This arose from the fact that most of the higher Egyptian officials were of Turkish nationality and that the army was officered mainly by Turks, Albanians, Circassians, &c., and included in the ranks many Bashish-Bazucks (irregulars drawn from the Sudan).

2 He had been sent to Khartoum in 1882 on a mission of inquiry, and he drew up a valuable report, Egypt, No. 11 (1885).

3 It is unnecessary here to enter upon a discussion of the precise nature of the table of government on the surrender of Egyptian power, or the measures in which he carried them out. The material for forming a judgment will be found in Gordon's Journals (1885), Morley's Life of Gladstone (1903), Fitzmaurice's Life of Granville (1905), and Cromer's Modern Egypt (1906). (See also Gordon, Charles George.)
had never embraced Mahdism, or with the Italians, Egyptians and British. Notwithstanding all this opposition the khilfa found in his own tribesmen and in his black troops devoted adherents and successfully maintained his position. The attempt to conquer Egypt ended in the total defeat of the dervish army at Toski (Aug. 3, 1898). The attack upon the Egyptian forces were but partly successful. Emin Pasha, to whose relief M. Stanley had gone, evacuated Wadelai in April 1890. The greater part of the region and also most of the Bahr-el-Ghazal relapsed into a state of complete savagery.

In the country under his dominion the khilifa’s government was carried on after the manner of other Mahomedean states, but pilgrimages to the Mahdi’s tomb at Omdurman were substituted for pilgrimages to Mecca. The arsenal and dockyard and the printing-press at Khartum were kept busy (the workmen being Egyptians who had escaped massacre). Otherwise Khartum was deserted, the khilfa making Omdurman his capital and compelling disaffected tribes to dwell in it so as to be under better control. While Omdurman grew to a huge size the population of the country generally dwindled enormously from constant warfare and the ravages of disease, small-pox being endemic. The Europeans in the country were kept prisoners at Omdurman. Besides ex-officials like Slatin and Lupton, they included several Roman Catholic priests and sisters, and numbers of Greek merchants established at Khartum. Although several were killed, the Khartum garrison was loaded with chains and repeatedly flogged, it is a noteworthy fact that none was put to death. From time to time a prisoner made his escape, and from the accounts of these ex-prisoners knowledge of the character of Dervish rule is derived in large measure. The fanaticism with which the Mahdi had inspired his followers remained almost unbroken to the end. The khilfa after the fatal day of Omdurman fled to Kordofan where he was killed in battle in November 1899. In January 1900 Osman Digna, a wandering fugitive faktah of Khartum’s days, was captured in Tanganyika. His amir of importance surrendered to the sultan of Darfur. Mahdism as a vital force in the old Egyptian Sudan ceased, however, with the Anglo-Egyptian victory at Omdurman.1

D. The Anglo-Egyptian Condominium.—Of the causes which led to the reconquest of the Sudan—the natural desire of the Egyptian government to recover lost territory, the equally natural desire in Great Britain to “avenge” the death of Gordon were among them—the most weighty was the necessity of securing for Egypt the control of the Upper Nile, Egypt being wholly dependent on the waters of the river for its prosperity. That control would have been lost had a European power other than Great Britain obtained possession of any part of the Nile valley; and at the time the Sudan was reconquered (1896-98) France was endeavouring to establish her authority on the river between Khartum and Gondokoro, as the Marchand expedition from the Congo to Fashoda demonstrated. The Nile constitutes, in the words of Lord Cromer, the true justification of the policy of re-occupation, and makes the Sudan a priceless possession for Egypt.2

The Sudan having been reconquered by the joint military and financial efforts of Great Britain and Egypt, the British government claimed “by right of conquest” to share in the settlement of the administration and legislation of the country. To meet these claims an agreement (which has been aptly called the constitutional charter of the Sudan) between Great Britain and Egypt, was signed on the 10th of January 1899, establishing the joint sovereignty of the two states throughout

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1 In the autumn of 1903 Mahomed-el-Amin, a native of Tunis, proclaimed himself the Mahdi and got together a following in Kordofan. He was captured by the governor of Kordofan and publicly executed at El Obeid in April. 1899, Abd-el-Kader, a Hauzin Arab and ex-dervish, rebelled in the Blue Nile province, claiming to be the prophet Issa (Jesus). On the 29th of that month he murdered Mr C. C. Scott-Moncrieff, deputy inspector of the province, and the Egyptian garrison was promptly crushed. Abd-el-Kader was captured and was hanged on the 17th of May.

2 Egypt, No. 1 (1905), p. 119.
commercial development of the country, a railway from the Nile near Berber to the Red Sea was built (1904-1906). This line shortened the distance from Khartoum to the nearest seaport by nearly 1000 m., and by reducing the cost of carriage of merchandise enabled Sudan produce to find a profitable outlet in the markets of the world. At the same time river communications were improved and the numbers of wells on caravan roads increased. The government, which was anxious to prevent works to regulate the Nile floods, and those of the river Gash.

To the promotion of education and sanitation, and in the administration of justice, the government devoted much energy with satisfactory results. Indeed the regenerative work of Great Britain in the Sudan has been fully as successful and even more remarkable than that of Great Britain in Egypt. A large part of this work has been accomplished by officers of the British army. Some of the most valuable suggestions about such matters as land settlement, agricultural loans, &c., emanated from officers who a short time before were performing purely military duties. Nevertheless civil servants gradually replaced military officers in the work of administration, army officers being liable to be suddenly removed for war or other service, often at times when the presence of officials possessed of local experience was most important. In efficiency and devotion to duty the Egyptian officials under the new régime also earned high praise.

The relations of the Sudan government with its Italian, Abyssinian and French neighbours was marked by cordiality, but with the Congo Free State difficulties arose over claims made by that state to the Bahr-el-Ghazal (Sudan, Sec. 3). Congo State troops were in 1904 stationed in Sudanese territory. The difficulty was adjusted in 1906 when the Congo State abandoned all claims to the Ghazal province (whence its troops were withdrawn during 1907), and it was agreed to transfer the Lado enclave (q.v.) to the Sudan six months after the death of the king of the Belgians. Under the terms of this agreement the Lado enclave was incorporated in the Sudan in 1910. As to the general state of the country Sir Eldon Gorst after a tour of inspection declared in his report for 1909, "I do not suppose that there is any part of the world in which the mass of the population have fewer unsatisfied wants."

**AUTHORITIES.—Summaries of ancient and medieval history will be found in E. A. Wallis Budge, The Egyptian Sudan (2 vols., 1907) and The Anglo-Egyptian Sudan (1905), edited by Count Gleichen. The story of the Egyptian conquest and events up to 1899 will be found in A. Delaporte, Histoire de l'Egypte Moderne (1899). Mahdistie History is treated under the name of Mehemet Ali (Paris, 1898). For the middle period of Egyptian rule see Sir Samuel Baker's Ismaïlia (1874); Col. Gordon in Central Africa, edited by G. Birkbeck Hill (4th ed., 1885), being extracts from Gordon's private papers. See Soudan by G. E. A. Slatin (1900), and Soudan by Gessi Pasha (1892); and Der Sudan unter ägyptischer Herrschaft, by R. Buchta (Leipzig, 1889). The rise of Mahdistie and events down to 1900 are set forth in (Sir) F. R. Wingate's Mahdistie and the Egyptian Sudan (1903). This book contains translations of letters and proclamations of the Mahdi and Khalifa. For this period the Journals of Major General Gordon at Khartoum (1885); F. Power's Letters from Khartoum during the Siege (1885), and the following four books written by prisoners of the derelicts are specially valuable: Slatin Pasha, Fire and Sword in the Sudan (1896); Father J. Ohrwalder (from the MSS. of, by F. R. Wingate), Ten Years' Captivity in the Hotel's Camp (1882-1892) (1902); Father Paolo Rosendoli, I miei dodici anni di prigionia in mezzo ai servizi del Sudan (Mondovi, 1903); C. Neufeldt, A Prisoner of the Khaleefa (1890). See also G. Dujarric, L'Etat mahdiste du Soudan (Paris, 1901). For the British official history see the Sudan Campaign (1890); for the campaigns of 1896-98, H. S. L. Allford and W. D. Sword, The Egyptian Soudan, its Loss and Recovery (1896); G. W. Steevens, With Kitchener to Khartoum (Edinburgh, 1899). The story of the Fashoda incident is told in British official despatches; consult also for this period G. Hanotaux, Fashoda (Paris, 1912); Paulin, La Fashoda, de la France 1898-1899 (Paris, 1899), and R. K. de Caix, Fashoda, la France et le protectorat de l'Egypte (Paris, 1899). Lord Cromer's Modern Egypt (1908) covers Sudanese history for the years 1881-1907. Consult also the authorities cited under Egypt, Modern History, and El-F.'s, History of the Egyptian Sudan (London, 1895). Unless otherwise stated the place of publication is London."

**SUDATORIUM**—SUDURY. In order to obtain the great heat required, the whole wall was lined with vertical terra-cotta flue pipes of rectangular section, placed side by side, through which the hot air and the smoke from the suspensura passed to an exit in the roof.

**SUDURY, SIMON OF** (d. 1381), archbishop of Canterbury, was born at Sudbury in Suffolk, studied at the university of Paris, and became one of the chaplains of Pope Innocent VI., who sent him, in 1356, on a mission to Edward III. of England. In October 1361 the pope appointed him bishop of London, and he was soon serving the king as an ambassador and in other ways. In 1373 he succeeded William Witlesey as archbishop of Canterbury, and during the rest of his life was a partisan of John of Gaunt. In July 1377 he crowned Richard II., and in 1378 John Wycliffe appeared before him at Lambeth, but he only took proceedings against the reformer under great pressure. In January 1380 Sudbury became chancellor of England, and the revolting peasants regarded him as one of the principal authors of their woes. Having released John Ball from his prison at Maidstone, the Kentish insurgents attacked and damaged the archbishop's property at Canterbury and Lambeth; then, rushing into the Tower of London, they seized the archbishop himself. Sudbury was dragged to Tower Hill and, on the 14th of June 1381, was beheaded. His body was afterwards buried in Canterbury Cathedral. Sudbury rebuilt part of the church of St Gregory at Sudbury, and with his brother, John of Chertsey, he founded a college in this town; he also did some building at Canterbury. His father was Nigel Theobald, and he is sometimes called Simon Theobald or Tybald.


**SUDURY, a post town and outport of Nipissing district, Ontario, Canada, on the Canadian Pacific railway, 443 m. W. of Montreal. Pop. (1901), 7199. It lies on the river Stour (which is navigable up to the town), 59 m. N.E. from London by the Great Eastern railway. All Saints' parish church, consisting of chancel, nave, aisles and tower, is chiefly Perpendicular—the chancel being Decorated. It possesses a few ancient monuments, and in 1882 was purchased for £2,000 by St Peter's, a new church. St Peter's is Perpendicular, with a finely carved nave roof. St Gregory's, once collegiate, is Perpendicular. It has a rich spire-shaped font-cover of wood, gilt and painted. The grammar school was founded by William Wood in 1491. There are some old half-timbered houses, including one very fine example. The principal modern buildings are the town-hall, Victoria hall and St Leonard's hospital. Coco-nut matting is an important manufacture; silk manufactures were transferred from London during the 19th century, and horsehair weaving was established at the same time. There are also flour-mills, malt-kilns, lime-works, and brick and tile yards. The town is governed by a mayor, 4 aldermen and 12 councillors. The borough lies wholly in the administrative county of West Suffolk. Area, 1925 acres.

The ancient Saxon borough of Sudbury (Sudbury, Suderby, Suthberia) was the centre of the southern portion of the East Anglian kingdom. Before the Conquest it was a borough owed by the mother of Earl Morcar, from whom it was taken by William I., who held it in 1086. It was alienated from the Crown to an ancestor of Gilbert de Clare, 9th earl of Gloucester. In 1271 the earl gave the burgesses their first charter confirming to them all their ancient liberties and customs. The earl of March granted a charter to the mayor and bailiffs of Sudbury in 1290, and again in 1445 the men and tenants of Sudbury obtained a royal confirmation of their privileges. They were incorporated in 1553 under the name of the mayor, aldermen and burgesses of Sudbury, and charters were granted to the town by Elizabeth, Charles II. and James II. Its constitution was reformed by the act of 1835. It was represented in parliament by two burgesses from 1558 till its disfranchisement in
SUDD—SUEBI

1844. The lord of the borough had a market and fair in the 13th century, and three fairs in March, July and December were held in 1792. Markets still exist on Thursdays and Saturdays. Weavers were introduced by Edward III., and the town became the chief centre of the Suffolk cloth industry after the Restoration.

SUDD, or Sando (an Arabic word meaning “to dam”), the name given to the vegetable obstruction which has at various dates closed the lower Nile to navigation. It is composed of masses of papyrus and um suf (Vossia corbea) and the earth adhering to the roots of those reeds. Mingled with the papyrus and um suf (Arabic for “mother-of-wool”) are small swimming plants and the light brittle amble. The papyrus are sometimes found along the Nile banks and the connected lagoons between 7° N. and 13° N. Loosened by storms these reeds drift until they lodge on some obstruction and form a dam across the channel, converted by fresh arrivals into blocks that are sometimes 25 m. in length, and extend 15 to 20 ft. below the surface. These masses of decayed vegetation and earth, resembling peat in consistency, are so much compressed by the force of the current that men can walk over them everywhere. In parts elephants could cross them without danger. The present day breach at Sudd near Bahr el-Ghazal was opened or the burst of the Sudd. (For sudd cutting see Nile.)

In the Bahr-el-Ghazal the sudd, being chiefly composed of small swimming plants, is of less formidable nature than that of the main stream.

Consult, O. Deuerling, Die Pflanzeneren der afrikanischen Flüsse (Munich, 1909), a valuable monograph; and the bibliography under Nile, especially Captain H. G. Lyona, The Physiography of the Nile and its Basin (Cairo, 1906).

SUDERMANN, Hermann (1857— ), German dramatist and novelist, was born on the 30th of September 1857 at Matziken in East Prussia, close to the Russian frontier, of a Mennonite family long settled near Elbing. His father owned a small brewery, and his mother, the former Amalie Gier, received his early education at the Realschule in Elbing, but, his parents having been reduced in circumstances, he was apprenticed to a chemist at the age of fourteen. He was, however, enabled to enter the Realgymnasium in Tilsit, and to study philosophy and history at Königsberg University. In order to complete his studies Sudermann went to Berlin, where he was tutor in several families. He next became a journalist, was from 1881-1882 editor of the Deutschen Reichsbalt, and then devoted himself to novel-writing. The novels and romances Im Zwielicht (1886), Frau Sorge and Der Katensteg (1888), and Der Katensteg (1894) failed to bring the young author as much recognition as his first drama Die Ehre (1899), which inaugurated a new period in the history of the German stage. Of his other dramas the most successful were Sodoms Ende (1891), Heimat (1893), Die Schmetterlingsschlacht (1894), Das Glück im Winkel (1895), Morituris (1896), Johannes (1898), Die drei Reiferedern (1900), Johannesfeuer (1900), Es lebe das Leben! (1902), Der Sturmgesselse Sobrates (1903) and Stein unter Steinen (1905). Sudermann is also the author of a powerful social novel, Es war (1904), which, like Frau Sorge and Der Katensteg, has been translated into English.

See W. Kawerau, Hermann Sudermann (1897); H. Landsberg, Hermann Sudermann (1902); H. Jung, Hermann Sudermann (1902); H. Schoen, Hermann Sudermann, poète dramatique et romancier (1903); and L. A. X. Körner, Hermann Sudermann (1907).

SUB, EUGÈNE [Joseph Marie] (1804–1857), French novelist, was born in Paris on the 20th of January 1804. He was the son of a distinguished surgeon in Napoleon’s army, and is said to have had the empress Josephine for godmother. Sue himself acted as surgeon both in the Spanish campaign undertaken by France in 1823 and at the battle of Navarino (1828). In 1829 his father’s death put him in possession of a considerable fortune, and he settled in Paris. His naval experiences supplied much of the materials of his first novels, Kernock le pirate (1830), Atar-Gull (1831), La Salamandre (2 vols., 1832), La Concarachia (4 vols., 1833-1834), and others, which were composed at the height of the romantic movement of 1830. In the quasi-historical style he wrote Jean Cavalier, ou Les Fanatiques des Cevennes (4 vols., 1836) and Latelraumont (2 vols., 1837). He was strongly affected by the Socialistic ideas of the day, and these prompted his most famous works: Les Mystères de Paris (10 vols., 1842-1843) and Le Juif errant (10 vols., 1844-1845), which were among the most popular specimens of the roman-feuilleton. He followed these up with some singular and not very edifying books: Les Sept péchés capitaux (16 vols., 1847-1849), which contained stories to illustrate each sin, Les Mystères du peuple (1849-1856), which was suppressed by the censor in 1857, and several others, all on a very large scale, though the names of all too long live in an exaggerated form. Several of his books, among them the Juif errant and the length of his study of the coup d’état of the 2nd of December 1851. This exile stimulated his literary production, but the works of his last days are on the whole much inferior to those of his middle period. Sue died at Annecy (Savoy) on the 3rd of August 1857.

SUEBI, or Suevi, a collective term applied to a number of peoples in central Germany, the chief of whom appear to have been the Marcomanni, Quadi, Hermunduri, Semnones and Langobardi. From the earliest times these tribes inhabited the basin of the Elbe. To the north and west of these barbaric territories seem to have lain about the lower reaches of the river, while the Semnones lay south. The Marcomanni occupied the basin of the Saale, but under their king, Maroboduus, they moved into Bohemia during the early part of Augustus’s reign, while the Quadri, who are first mentioned in the time of Tiberius, lay farther east towards the sources of the Elbe. The former home of the Marcomanni was occupied by the Hermunduri a few years before the Christian era. Some kind of political union seems to have existed among all these tribes. The Semnones and Langobardi were at one time subject to the dominion of the Marcomannic king Maroboduus, and at a much later period we hear of Langobardic troops taking part against the Romans in the Marcomannic War. The Semnones claimed to be the chief of the Suebic peoples, and Tacitus describes a great religious festival held in their tribal sanctuary, at which legations were present from all the other tribes.

Tacitus uses the name Suebi in a far wider sense than that defined above. With him it includes not only the tribes of the basin of the Elbe, but also all the tribes north and east of that river, including even the Swedes (Suiones). This usage, which is not found in other ancient writers, is probably due to a confusion of the Suebi with the agglomeration of peoples under their supremacy, which as we know from Strabo extended to some at least of the eastern tribes.

In early Latin writers the term Suebi is occasionally applied to any of the above tribes. From the 2nd to the 4th century, however, it is seldom used except with reference to events in the neighbourhood of the Pannonian frontier, and here probably means the Quadi. From the middle of the 4th century onward it appears most frequently in the regions south of the Main, and the names Alamanni and Suebi are used synonymously. The Alamanni (q.v.) are the descendants of the ancient Suebi. It is likely that they had been joined by one or more other Suebic peoples, from the Danubian region, or more probably from the middle Elbe, the land of the ancient Semnones. It is probably from the Alamannic region that those Suebi who came who joined the Vandals in their invasion of Gaul, and eventually founded a kingdom in north-west Spain. After the 1st century the term Suebi seems never to have been applied to the Langobardi and seldom to the Bavarii (Bavarians), the descendants of the ancient Marcomanni. But besides the Alamannic Suebi we hear
also of a people called Suebi, who shortly after the middle of the 6th century settled north of the Unstrut. There is evidence also for a people called Suebi in the district above the mouth of the Scheldt. It is likely that both these settlements were colonies from the Suebi of whom we hear in the Anglo-Saxon poem *Widsith* as neighbours of the Angles, and whose name may possibly be preserved in Schwabstedt on the Treene. The question has recently been raised whether these Suebi should be identified with the people whom the Romans called *H eruli*. After the 7th century the name Suebi is practically only applied to the Alamannic Suebi (Schwaben), with whom it remains a territorial designation in Württemberg and Bavaria until the present day.

See *Caesar, De bello gallico*, i. 37, 51 seqq., iv. 1 seqq., vi. 9 seqq.; *Strabo*, p. 290 seqq.; *Tacitus, Germany*, 38 seqq.; K. Zeuss, *Die Deutschen und die Nachbarstämme*, pp. 85 seqq., 315 seqq.; C. Bremer in Paul’s *Grundriss* (2nd ed.), iii. 915-950; H. M. Chadwick, *Origin of the English* (1925). *Suessula* has been identified with a road which ran from Neapolis through Accrae, and on to the Via Appia, which it reached just west of the Caudine pass. On the hills above Cancello to the east of *Suessula* was situated the fortified camp of M. Claudius Marcellus, which covered Nola and served as a post of observation against Hannibal in Capua.

**SUECA**, a town of eastern Spain, in the province of Valencia, near the left bank of the river Júcar, and on the Silla-Cullera railway. Pop. (1900), 14,435. *Sueca* is separated from the Mediterranean Sea (7 m. east) by the Sierra de Cullera. It is a modern town, although many of the houses have the flat roofs, view-turrets (*miradores*) and horseshoe arches characteristic of Moorish architecture. There are a few handsome public buildings, such as the hospital, town-hall and theatre. Sueca has a thriving trade in grain and fruit from the Júcar valley, which is irrigated by waterways created by the Moors.

**SUESS, EMIL** (1834-1914), Austrian geologist, was born in Vienna on the 28th of August 1834, his father, a native of Saxony, having settled there as a German merchant. Three years later the family removed to Prague, and in 1845 to Vienna. Eduard Suess was educated for commercial life, but early displayed a bent for geology. At the age of nineteen he published a short sketch of the geology of Carlsbad and its mineral waters; and in 1852 he was appointed an assistant in the Imperial museum of Vienna. There he studied the fossil Brachiopoda, and manifested such ability that in 1857 he was appointed professor of geology at the university. In 1862 he relinquished his museum duties, and gave his whole time to special research and teaching, retaining his professorship until 1901. Questions of ancient physical geography, such as the former connexion between northern Africa and Europe, occupied his attention; and in 1862 he published an essay on the soils and water-supply of Vienna. He was elected a member of the town council, and in 1869 to a seat in the Diet of Lower Austria, which he retained until 1895. Meanwhile he continued his geological and palaeontological work dealing with the Tertiary strata of the Vienna Basin, also turning his attention to the problems connected with the evolution of the earth’s surface-features, on which he wrote a monumental treatise. This, the great task of his life, embodied the results of personal research and of a comprehensive study of the work of the leading geologists of all countries; it is entitled *Anleitung der Erde*, of which the first volume was published in 1885, the second in 1888, and pt. i. of the third volume in 1901. The work has been translated into French, and (in part) into English. Sueß was elected a corresponding member of the Institute of France in 1889, and a foreign member of the Royal Society in 1894. In 1896 the Geological Society of London awarded to him the Wollaston medal.

**SUESSELA** is a small town of Campania, Italy, in the plain 13 m. W. of the modern Cancello, 9 m. S.E. of the ancient Capua. Its earlier history is obscure. In 339 B.C. it obtained municipal rights from Rome. In the Samnite and Hannibalic wars it was strategically important as commanding the entrance to the Caudine pass. Sula seems to have founded a colony here. It is frequently named as an episcopal see up till the 10th century A.D., and was for a time the chief town of a small Lombard principality. It was several times plundered by the Saracens, and at last abandoned by the inhabitants in consequence of the malaria. The ruins of the town lie within the Bosco d’Acerra, a picturesque forest. They were more conspicuous in the 18th century than they now are, but traces of the theatre may still be seen, and débris of other buildings. Oscar tombs were excavated there between 1878 and 1886, and important finds of vases, bronzes, &c., have been made. The dead were generally buried within slabs of tufa arranged to form a kind of sarcophagus (see F. von Eitner, *Urnenfelder*, ii. p. 235 seqq.). *Suesseula* lay on the line of the Via Popilia, which seems to have been a road which ran from Neapolis through Accrae, and on to the Via Appia, which it reached just west of the Caudine pass.

**SUEZ** (T. A.S. *suevii*; Lat. *suevium*), an ancient tract along the north-west coast of Asia Minor. In the district of Sassin, near the site of the ancient city of Teais. The Sasanians had a large district called *Suecia* there.

**SUETONIUS TRANQUILLUS, GAIUS**, Roman historian, lived during the end of the 1st and the first half of the 2nd century A.D. He was the contemporary of Tacitus and the younger Pliny, and his literary work seems to have been chiefly done in the reigns of Trajan and Hadrian (A.D. 98-118). His father was military tribune in the XXXIst legion, and he himself began life as a teacher of rhetoric and an advocate. To us he is known as the biographer of the twelve Caesars (including Julius) down to Domitian. The lives are valuable as original works, and are without the guidance of Tacitus. As Suétionus was the emperor Caligula’s private secretary (magister epistolatorum), he must have had access to many important documents in the imperial archives, such as the decrees and transactions of the senate. In addition to written and official documents, he picked up in society a mass of information and anecdotes, which, though of doubtful authenticity, need not be regarded as mere inventions of his own. They give a very good idea of the kind of court gossip prevalent in Rome at the time. He was a friend and correspondent of the younger Pliny, who when appointed governor of Bithynia took Suetonius with him. Pliny also recommended him to the favourable notice of the emperor Trajan, "as most upright, honourable, and learned, man, whose persons often remember in their wills because of his merits," and he begs that he may be made legally capable of inheriting these bequests, for which under a special enactment Suetonius was, as a childless married man, disqualified. Hadrian’s biographer, Aelius *Spartianus*, tells us that Suetonius was deprived of his private secretaryship because he had not been sufficiently observant of court etiquette towards the emperor’s wife during Hadrian’s absence in Britain.

The *Lives of the Caesars* always has been a popular work. It is rather a chronicle than a history. It gives no picture of the society of the time, no hints as to the general character and tendencies of the period. It is the emperor who is always before us, and yet the portrait is drawn without any real historical judgment or insight. It is the personal anecdotes, several of which are very amusing, that give the lives their chief interest; but the author panders rather too much to a taste for scandal and gossip. None the less he throws considerable light on an important period, and next to Tacitus and Dio Cassius is the chief (sometimes the only) authority. The language is clear and simple. The work was continued by *John of H处mesius* (330-391), who wrote a history of the emperors from Nerva to Elagabalus (now lost). Suetonius was a voluminous writer. Of his *De viris illustribus*, the lives of Terence and Horace, fragments of those of Livy and the elder Pliny and the greater part of the chapter on grammarians and rhetoricians, are extant. Other works by him (now lost) were: *Praxis* (= *lexipalbriki* = patchwork), in ten books, a kind of encyclopaedia; the *Roman Year*, *Roman Inscriptions*, *General Geography*, *Obituaries* of the Greeks, *Roman Public Spectacles*, *On the Kings*, *On Cicero’s Republic*.

*Editio princeps*, 1470; editions by great scholars: Erasmus, Isaac Casaubon, J. G. Graevius, P. Burmann; the best complete modern edition is still that of G. C. Baumgarten-Crusius (1853); recent editions by H. T. Peck (New York, 1889); Leo Frémond (1906); M. Ihm (1907). Editions of separate lives: *Augustus*, by E. S. Shackburgh (with useful introduction, 1896); *Claudius*, by H. Smilde (1896), with notes and parallel passages from other authorities. The best editions of the text are by C. L. Roth (1886), and A. Reifferscheid (not including the *Lives*, 1890). On the *De viris illustribus*, see
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G. Körte in Dissert. philol. heliog. (1900), vol. iv.; and, above all, A. Macé, Essai sur Sûleône (1800), with an exhaustive bibliography. There are English translations by Philemon Holland (reprinted in the 17th century), and by Thomson and Forester (in Bohn’s Classical Library).

SUEZ, a port of Egypt on the Red Sea and southern terminus of the Suez Canal (q.v.), situated at the head of the Gulf of Suez in 25° 58’ 57” N., 33° 31’ 18” E. It is 86 m. E. by S. of Cairo in a direct line but 148 m. by rail, and is built on the north-west point of the gulf. Pop. (1897), 25,347.

From the quays on the heights to the south, there is a superb view to the south with the Jebel Ataka on the right, Mt Sinai on the left and the waters of the gulf between. Suez is supplied with water by the fresh-water canal, which starts from the Nile at Cairo and is terminated at Suez by a lock which, north of the town, joins it to the gulf. Before the opening of this canal in 1863 water had to be brought from “the Wells of Moses,” a small oasis 3 m. distant on the east side of the gulf. About 2 m. south of the town are the harbours and quays constructed on the western side of the Suez Canal at the point where the canal enters the gulf. The harbours are connected with the town by an embankment and railway built across a shallow, dry at low water save for a narrow channel. On one of the quays is a statue to Thomas Waghorn, the organizer of the “overland route” to India. The ground on which the port is built has all been reclaimed from the sea. The accommodation provided includes a dry dock 470 ft. long, 100 ft. broad and nearly 36 ft. deep. There are separate basins for warships and merchant ships, and in the roadstead at the mouth of the canal is ample room for shipping. Suez is a quarantine station for pilgrims from Mecca; otherwise its importance is due almost entirely to the ships using the canal.

In the 7th century a town called Kolzum stood, on a site adjacent to that of Suez, at the southern end of the canal which then joined the Red Sea to the Nile. Kolzum retained some of the trade of Egypt with Arabia and countries farther east long after the canal was closed, but by the 13th century it was in ruins and Suez itself, which had supplanted it, was also, according to an Arab historian, in decay. On the Ottoman conquest of Egypt in the 16th century Suez became a naval as well as a trading station, and here fleets were equipped which for a time disputed the mastery of the Indian Ocean with the Portuguese. According to Niebuhr, in the 18th century a fleet of nearly twenty vessels sailed yearly from Suez to Jidda, the port of Mecca and the place of correspondence with India. When the French occupied Suez in 1798 it was a place of little importance, and the conflicts which followed its occupation in 1800 by an English fleet laid the greater part in ruins. The overland mail route from England to India by way of Suez was opened in 1837. The regular Peninsular & Oriental steamer service began a few years later, and in 1857 a railway was opened from Cairo through the desert. This line is now abandoned in favour of the railway which follows the canal from Suez to Ismailia, and then ascends the Wadi Tumilat to Zagazig, whence branches diverge to Cairo and Alexandria.

SUEZ CANAL—Before the construction of the Suez Canal there was no direct water communication between the Mediterranean and the Red Sea, but at various eras such communication existed by way of the Nile. Trade between Egypt and countries to the east was originally overland to ports south of the Gulf of Suez; the proximity of the roadstead at the head of that gulf to Memphis and the Delta nevertheless marked it as the natural outlet for the Red Sea commerce of Lower Egypt. The fertile Wadi Tumilat extending east of the Nile valley almost to the head of the gulf (which in ancient times reached north to the Bitter Lakes) afforded an easy road between the Nile and the Red Sea, while the digging of a navigable canal connecting the river and the gulf gave the northern route advantages not possessed by the desert routes farther south, e.g. that between Cairo and Alexandria. Aristotle, Strabo and Pliny attribute to the legendary Sesostris (Kolzum, Arist.) the first of the pharaohs to build a canal joining the Nile and the Red Sea. From an inscription on the temple at Karnak it would appear that such a canal existed in the time of Seti I. (1380 B.C.) This canal diverged from the Nile near BABISTAS and was carried along the Wadi Tumilat to Heroopolis, near Pithom, a port at the head of the Heroopolite Gulf (the Bitter Lakes of to-day). The channel of this canal is still traceable in parts of the Wadi Tumilat, and its direction was frequently followed by the engineers of the fresh-water canal. Seti’s canal appears to have fallen into decay or to have been too small for later requirements, for Pharaoh Necho (660 B.C.) began to build another canal; possibly his chief object was to deepen the channel between the Heroopolite Gulf and the Red Sea, then probably sitting up. Necho’s canal was not completed—according to Herodotus 120,000 men perished in the undertaking. Darius (520 B.C.) continued the work of Necho, rendering navigable the channel of the Heroopolite Gulf, which had become blocked. Up to this time there appears to have been no connexion between the waters of the Red Sea and those of the BABISTAS—HEROPOLOIS canal; vessels coming from the Mediterranean ascended the Pelusiac arm of the Nile to BABISTAS and then sailed north to HEROPOLOIS, where their merchandise had to be transferred to the Red Sea ships. Ptolemy Philadelphus (285 B.C.) connected the canal with the waters of the sea, and at the spot where the junction was effected he built the town of Arsinoe. The dwindling of the Pelusiac branch of the Nile rendered this means of communication impossible by the time of Cleopatra (31 B.C.). Trajan (A.D. 98) is said to have repaired the canal, and, as the Pelusiac branch was no longer available for navigation, to have built a new canal between BABISTAS and BABYLON (Old Cairo), this new canal being known traditionally as AMMIS (600 B.C.) and of course A NNIS AUGUSTUS. According to H. R. Hall, however, “It is very doubtful if all works of this kind, large or small, were undertaken in the times of the Romans; and it is more probable that the new canal was the work of ‘Amr” (the Arab conqueror of Egypt in the 7th century). The canal was certainly in use in the early years of the Moslem rule in Egypt; it is said to have been closed c. A.D. 770 by order of Abu Ja’far Mansur, the second Abbasid caliph and founder of Baghdad, who wished to prevent supplies from reaching his enemies in Arabia by this means. Amr’s canal (of which the Khalig which passed through Cairo and was closed in 1897 is said to have formed part) had its terminus on the Red Sea south of the Heroopolite Gulf near the present town of Suez. In this neighbourhood was the ancient city of Clyisma, to which in Amr’s time succeeded Kolzum, perhaps an Arabic corruption of Clyisma. The exact situation of Clyisma is unknown, but Kolzum occupied the site of Suez, the hills north of which are still called Kolzum. After the closing of the canal in the 8th century it does not appear for certain that it was ever restored, although it is asserted that in the year 1000 Sultan Hakim rendered it navigable. If so it must speedily have become choked up again. Parts of the canal continued to be filled during the Nile inundations until Mehemet Ali (A.D. 1817) ordered it to be closed; the closing, however, was not completely effected, for in 1891 the old canal from BABISTAS still flowed as far as KASSASSIN. This part of the canal, after over 2500 years of service, was utilized by the French engineers in building the fresh-water canal from Cairo to Suez in 1861–1865. This canal follows the lines of that of Amr (or Trajan).

Maritime Canal Projects.—Apart from water communication between the Mediterranean and the Red Sea by way of the Nile, the project of direct communication by a canal piercing the Isthmus of Suez was entertained as early as the 7th century A.D. by Harun-al-Rashid, who is said to have abandoned the scheme, being persuaded that it would be dangerous to lay open the coast of Arabia to the Byzantine navy. After the discovery of the Cape route to India at the close of the 15th century, the Venetians, who had for centuries held the greater part of the trade of the East with Europe via Egypt and the Red Sea, began negotiations with the Egyptians for a canal across the isthmus, but the conquest of Egypt by the Turks put an end to these designs. In 1671 Leibnitz in his proposals to Louis XIV. of France regarding an expedition to Egypt recommended the making of a maritime canal, and the Sheikh al-Balad Ali Bey (c. 1770) wished to carry out the project. Bonaparte when in Egypt in 1798 ordered the
Isthmus to be surveyed as a preliminary to the digging of a canal across it, and the engineer he employed, J. M. Lepère, came to the conclusion that there was a difference in level of 29 ft. between the Red Sea and the Mediterranean. This view was combated at the time by Laplace and Fourier on general grounds, and was finally disproved in 1846-1847 as the result of surveys made at the instance of the Société d'Études pour le Canal de Suez. This society was organized in 1846 by Prosper Enfantin, the Saint Simonist, who thirteen years before had visited Egypt in connection with a scheme for making a canal across the isthmus of Suez, which, like the canal across the isthmus of Panama, was part of the Saint Simonist programme for the regeneration of the world. The expert commission appointed by this society reported by a majority in favour of Paul Tบอล's plan, according to which the canal would have run from Suez to Alexandria by way of Cairo.

For some years after this report no progress was made; indeed, the society was in a state of suspended animation when in 1854 Ferdinand de Lesseps came to the front as the chief exponent of the idea. He had been associated with the Saint Simonists and for many years had been keenly interested in the question. His opportunity came in 1854 when, on the death of Abbas Pasha, his friend Said Pasha became viceroy of Egypt. From Said on the 30th of November 1854 he obtained a concession authorizing him to constitute the Compagnie Universelle du Canal Maritime de Suez, which should construct a ship canal through the isthmus, and soon afterwards in concert with two French engineers, Linant du Delay and Mougel Bey, he decided that the canal should run in a direct line from Suez to the Gulf of Pelusium, passing through the depressions that are now Lake Timsa and the Bitter Lakes, and skirting the eastern edge of Lake Menzala. In the following year an international commission appointed by the viceroy approved this plan with slight modifications, the chief being that the channel was taken through Lake Menzala instead of along its edge, and the northern termination of the canal moved some 17½ m. westward where deep water was found closer to the shore. This plan, according to which there were to be no locks, was the one ultimately carried out, and it was embodied in a second and amplified concession, dated the 5th of January 1856, which laid on the company the obligation of constructing, in addition to the maritime canal, a fresh-water canal from the Nile near Cairo to Lake Timsa, with branches running parallel to the maritime canal, one to Suez and the other to Pelusium. The concession was to last for 99 years from the date of the opening of the canal between the Red Sea and the Mediterranean, after which, in default of other arrangements, the canal passes into the hands of the Egyptian government. The confirmation of the sultan of Turkey being required, de Lesseps went to Constantinople to secure it, but found himself baffled by British diplomacy; and later in London he was informed by Lord Palmerston that in the opinion of the British government the canal was a physical impossibility, that if it were made it would injure British maritime supremacy, and that the proposal was merely a device for French interference in the East.

Although the sultan's confirmation of the concession was not actually granted till 1866, de Lesseps in 1858 opened the subscription lists for his company, the capital of which was 200 million francs in 400,000 shares of 500 francs each. In less than a month 314,404 shares were applied for; of these over 200,000 were subscribed in France and over 96,000 were taken by the Ottoman Empire. From other countries the subscriptions were trifling, and England, Austria and Russia, as well as the United States of America, held entirely aloof. The residue of 85,506 shares was taken over by the viceroy. On the 25th of April 1859 the work of construction was formally begun, the first spadeful of sand being turned near the site of Port Said, but progress was not very rapid. By the beginning of 1862 the fresh-water canal had reached Lake Timis, and towards the end of the same year a narrow channel had been formed between that lake and the Mediterranean. In 1863 the fresh-water canal was continued to Suez.

So far the work had been performed by native labour; the concession of 1856 contained a provision that at least four-fifths of the labourers should be Egyptians, and later in the same year Said Pasha undertook to supply labourers as required by the engineers of the canal company, which was to house and feed them and pay them at stipulated rates. Although the wages and the terms of service were better than the men obtained normally, the system of forced labour was strongly disapproved of in England, and the khedive Ismail who succeeded Said on the latter's death in 1863 also considered it as being contrary to the interests of his country. Hence in July the Egyptian foreign minister, Nubar Pasha, was sent to Constantinople with the proposal that the number of labourers furnished to the company should be reduced, and that it should be made to hand back to the Egyptian government the lands that had been granted it by Said in 1856. These propositions were approved by the sultan, and the company was informed that if they were not accepted the works would be stopped by force. Naturally the company objected, and in the end the various matters in dispute were referred to the arbitration of the emperor Napoleon III. By his award, made in July 1864, the company was allowed 38 million francs as an indemnity for the abolition of the corvee, 16 million francs in respect of its retrocessions of that portion of the fresh-water canal that lay between Wadi, Lake Timis and Suez (the remainder had already been handed back by agreement), and 90 million francs in respect of the lands which had been granted it by Said. The company was allowed to retain a certain amount of land along the canals, which was necessary for purposes of construction, erection of workshops, &c., and it was put under the obligation of finishing the fresh-water canal between Wadi and

1 These formed part of the 176,622 shares which were bought for the sum of 5,976,582 from the khedive by England in 1875 at the instance of Lord Beaconsfield (q.v.).
Suez Canal

Suez to such dimensions that the depth of water in it would be 25 metres at high Nile and at least 1 metre at low Nile. The supply of Port Said with water it was allowed to manage by any means it chose; in the first instance it laid a double line of iron piping from Timsa, and it was recognized that the original plan of supplying the town by a branch of the fresh-water canal was carried out. The indemnity, amounting to a total of 84 million francs, was to be paid in instalments spread over 15 years.

The abolition of forced labour was probably the salvation of the enterprise, for it meant the introduction of mechanical appliances and of modern engineering methods. The work was divided into four contracts. The first was for the supply of 250,000 cubic metres of concrete blocks for the jetties of Port Said; the second, for the first 60 kilometres of the channel from Port Said, involved the removal of 22 million cubic metres of sand or mud; the third was for the next length of 13 kilometres, which included the cutting through the high ground at El Ghar; and the fourth and largest was for the portion between Lake Timsa and the Red Sea. The contractors for this last section were Paul Borel and Alexandre Levalley, who ultimately became responsible also for the second or 60 kilometres contract. For the most part the material was soft and therefore readily removed. At some points, however, as at Shaluf and Serapeum, rock was encountered. Much of the channel was formed by means of dry docks. Through Lake Menzala, for instance, native workmen made a shallow channel by scooping out the soil with their hands and throwing it out on each side to form the banks; dredgers were then floated in and completed the excavation to the required depth, the soil being delivered on the other side of the banks through long spouts. At Serapeum, a preliminary shallow channel having been dug out, water was admitted from the fresh-water canal, the level of which is higher than that of the ship canal, and the work was completed by dredgers from a level of about 20 ft. above the sea. At this point the soil, composed largely of loose sand, risen 60 ft. above the sea, the contractor, Alphonse Couvreux, employed an excavator of his own design, which was practically a bucket-dredger working in the dry. A long arm projecting downwards at an angle from an engine on the bank carried a number of buckets, mounted on a continuous chain, which scooped up the stuff at the bottom and discharged it into wagons at the top.

In 1865 De Lesseps, to show the progress that had been made, entertained over 100 delegates from chambers of commerce in different parts of the world, and conducted them over the works. In the following year the company, being in need of money, realized 10 million francs by selling to the Egyptian government, the estate of El Wadi, which it had purchased from Said, and it also succeeded in arranging that the money due to it under the award of 1864 should be paid off by 1869 instead of 1875. Its financial resources still being insufficient, it obtained in 1867 permission to invite a loan of 100 million francs; but though the issue was offered at a heavy discount it was only fully taken up after the attractions of a lottery scheme had been added to it. Two years later the company got 30 million francs from the Egyptian government in consideration of abandoning certain special rights and privileges that still belonged to it and of handing over various hospitals, workshops, buildings, &c., which it had established on the isthmus. The government liquidated this debt, not by a money payment, but by agreeing to forego for 25 years the interest on the 176,602 shares it held in the company, which was thus enabled to raise a loan to the amount of the debt. Altogether, up to the end of the year (1869) in which the company was sufficiently advanced to be opened for traffic, the accounts of the company showed a total expenditure of 432,867,882 francs, though the International Technical Commission in 1859 had estimated the cost at only 200 million francs for a canal of larger dimensions.

The formal opening of the canal was celebrated in November 1869. On the 16th there was an inaugural ceremony at Port Said, and next day 68 vessels of various nationalities, headed by the "Aigle" with the empress Eugénie on board, began the passage, reaching Ismailin (Lake Timsa) the same day. On the 19th they continued their journey to the Bitter Lakes, and on the 20th they arrived at Suez. Immediately afterwards regular traffic began. In 1870 the canal was used by nearly 500 vessels, but the receipts for the first two years of working were considerably less than the expenses. The company attempted to issue a loan of 20 million francs in 1871, but the response was small, and it was only saved from bankruptcy by a rapid increase in its revenues.

The total length of the navigation from Port Said to Suez is 100 m. The canal was originally constructed to have a depth of 8 metres with a bottom width of 22 metres, but it soon became evident that its dimensions must be enlarged. Certain improvements in the channel were started in 1876, but a more extensive plan was adopted in 1885 as a result of the inquiries of an international commission which recommended that the depth should be increased first to 8.1 metres and finally to 9 metres, and that the width should be made on the straight parts a minimum of 65 metres between Port Said and the Bitter Lakes, and of 75 metres between the Bitter Lakes and Suez, increasing on curves to 80 metres. To pay for these works a loan of 100 million francs was issued. These wide-laws greatly improved the facilities for ships travelling in opposite directions to pass each other. In the early days of the canal, except in the Bitter Lakes, vessels could pass only one at a time, and on the remaining part of the canal a collective length of less than 4 miles, but owing to the widenings that have been carried out, passing is now possible at any point over the greater part of the canal, one vessel stopping while the other proceeds on her way. From March 1887 navigation by night was permitted to ships which were provided with electric search-lights, and now the great majority avail themselves of this facility. By these measures the average time of transit, which was about 36 hours in 1886, has been reduced by half. The maximum speed permitted in the canal itself is 10 kilometres an hour.

The company of the canal was authorized to charge by its concession of 1856 was 10 francs a ton. In the first instance they were levied on the tonnage as shown by the papers on board each vessel, but from March 1872 they were charged on the gross register tonnage, computed according to the method of the British Merchant Shipping Act 1854. The result was that the shipowners had to pay more, and, objections being raised, the whole question of the method of charge was submitted to an international conference which met at Constantinople in 1875. It fixed the dues at 10 francs per net register ton (English reckoning) with a surtax of 4 francs per ton, which, however, was to be reduced to 1 franc in the case of ships having on board papers showing their net tonnage calculated in the required manner. It also decided that the surtax should be gradually diminished as the traffic increased, until in the year after the net tonnage passing through the canal reached 2,600,000 tons it should be abolished. De Lesseps protested against this arrangement, but on the sultan threatening to enforce it, if necessary by armed intervention, he gave in and brought the new tariff into operation in April 1874. By an arrangement with the canal company, signed in 1876, the British government, which in 1875 by the purchase of the khedive's shares, had become the largest single investor, agreed to negotiate to secure that the successive reductions of the tariff should take effect on fixed dates, the sixth and last installment of 50 centimes being removed in January 1884, after which the maximum rate was to be 10 francs per official net ton. But before this happened British shipowners had started a vigorous agitation against the rates, which they alleged to be excessive, and had even threatened to construct a second canal. In consequence a meeting was arranged between them and representatives of the canal company in London in November 1883, and it was agreed that in January 1885 the dues should be reduced to 9 francs a ton, that subsequently they should be lowered on a sliding scale as the dividend increased, and that after the dividend reached 25% all the surplus profits should be applied in reducing the rates until they were lowered to 5 francs a ton. Under this arrangement they were fixed at 7½ francs.
SUFFOLK, EARLS AND DUDES OF SUFFOLK, 1ST DUKE OF

per ton at the beginning of 1906. For ships in ballast reduced rates are in force. For passengers the duties remain at 10 francs a head, the figure at which they were originally fixed.

By the concessions of 1854 and 1856 the dues were to be the same for all nations, preferential treatment of any kind being forbidden, and the canal and its ports were to be open "comme passages neutres" to every merchant ship without distinction of nationality. The question of its formal neutralization by international agreement was raised in an acute form during the Egyptian crisis of 1882-83, and in August of the latter year a few weeks before the battle of Tel-el-Kebir, navigation upon it was suspended for four days at the instance of Sir Garnet Wolseley, who was in command of the British fleet which was then sitting at Constantinople. Various proposals were put forward to ensure the use of the canal to all nations, and ultimately at Constantinople on the 20th of October 1888 Great Britain, Germany, Austria, Spain, France, Italy, the Netherlands, Russia and Turkey signed the Suez Canal Convention, the purpose of which was to ensure that the canal should "always be free and open, in time of war as in time of peace, to every vessel of commerce or of war, without distinction of flag." Great Britain, however, in signing, formulated a reservation that the provisions of the convention should not in any way be so far as they were compatible with the actual situation, namely the "present transitory and excep-
tional condition of Egypt," and so far as they would not fetter the liberty of action of the British government during its occupancy of that country. But by the Anglo-French agreement of the 8th of April 1904 Great Britain declared her adherence to the stipulations of the convention, and agreed to their being put in force, except as regards a provision by which the agents in Egypt of the signatory Powers of the convention were to meet once a year to take note of the due execution of the treaty. It was by virtue of this new agreement that the Russian warships proceeding to the East in 1904-1905 were enabled to use the Canal although passages were promised to Spanish warships in 1808 during the war between Spain and the United States.

L'Isthme et le Canal de Suez, historique, état actuel, by J. Charles-Roux (2 vols., Paris 1901), contains reprints of various official documents relating to the canal, with plates, maps and a bibilography extending to 1499 entries.

SUFFOLK, EARLS AND DUKES OF. These English titles were borne in turn by the families of Ufford, Pole, Brandon, Grey and Howard. A certain holder of land in Suffolk, named John de Peyton, had a younger son Robert, who acquired the lordship of Ufford in that county and was known as Robert de Ufford. He held an important place in the government of Ireland under Edward I. and died in 1298; his son Robert (1279-1316) was created Baron Ufford by a writ of summons to parliament in 1309, and increased his possessions by marriage with Cicely, daughter and heiress of Robert de Valois. This Robert had several sons, one of whom was Sir Ralph de Ufford (d. 1346), justicier of Ireland, who married Maud, widow of William de Burgh, earl of Ulster, and daughter of Henry Plantagenet, earl of Lancaster. Robert's eldest surviving son, another Robert (d. 1358-1369), was an associate of the young king Henry III., and one of the nobles who arrested Roger Mortimer in 1330. In 1337 he was created earl of Suffolk. The earl was employed by Edward III. on high military and diplomatic duties and was present at the battles of Crecy and Poitiers. His son William, the 2nd earl (c. 1339-1382), held important appointments under Edward III. and Richard II. He played a leading part in the suppression of the Peasants' Revolt in 1381, but in the same year he supported the popular party in parliament in the attack on the misgovernment of Richard II. Although twice married he left no sons, and his earldom became extinct, his extensive estates reverting to the Crown.

In 1385 the earldom of Suffolk and the lands of the Uffords were granted by Richard II. to his friend Michael Pole (c. 1350-1389), a son of Sir William atte Pole, a baron of the exchequer and a merchant (see Pole Family). After an active public life as the trusted advisor of Richard II. Pole was dismissed from his office of chancellor, was impeached and sentenced to death, but escaped to France, where he died. His titles and estates were forfeited, but in 1399 the earldom of Suffolk and most of the estates were restored to his son Michael (c. 1361-1415). Michael, the 3rd earl (1394-1415), was killed at the battle of Agincourt, and the earldom passed to his brother William (1396-1459), who was created earl of Pembroke in 1443, marquess of Suffolk in 1444, and duke of Suffolk in 1448 (see Suffolk, William de la Pole, Duke of). The duke's son, John, 2nd duke of Suffolk (1447-1491), married Elizabeth, daughter of York, duke of Clarence, and King Edward IV., by whom he had six sons. The eldest, John (c. 1466-1510), was created earl of Lincoln, and was named heir to the throne by Richard III. He was killed fighting against Henry VII. at the battle of Stoke, and was attainted. His brother Edmund (c. 1472-1513) should have succeeded his father in the dukedom in 1491, but he surrendered this to Henry VII. in return for some of the estates forfeited by the earl of Lincoln, and was known simply as earl of Suffolk. Having incurred the displeasure of the king, he left his own country in 1501 and sought help for an invasion of England. Consequently he was sentenced to death 1504, having entered into a marriage contract with a lord of the French court. He was kept in prison until 1513, when he was beheaded by Henry VIII. His brother Richard now called himself duke of Suffolk, and put forward a claim to the English crown. Known as the "white rose," he lived abroad until 1525, when he was killed at the battle of Pavia.

In 1514 the title of duke of Suffolk was granted by Henry VIII. to his friend, Charles Brandon (see Suffolk, Charles Brandon, Duke of) and it was borne successively by his two sons, Henry and Charles, becoming extinct when Charles died in July 1551. In the same year it was revived in favour of Robert Pole, 3rd earl of Lincoln, and the earldom of Dorset, who had married Frances, a daughter of the first Brandon duke. Grey, who bore the title of marquis of Dorset in 1530, was a prominent member of the reforming party during the reign of Edward VI. He took part in the attempt to make his daughter, Jane, queen of England in 1553, but as he quickly made his peace with Mary he was not seriously punished. In 1554, however, he took part in the rising headed by Sir Thomas Wyatt; he was captured, tried for treason and beheaded in February 1554, when the dukedom again became extinct. In 1603 Thomas Howard, Lord Howard de Walden, son of Thomas Howard, 4th duke of Norfolk, was created earl of Suffolk, and the earldom has been held by his descendants to the present day (see Suffolk, Thomas Howard, 1st earl of).
of France. He was accredited to negotiate various matters with Louis, and on his death was sent to congratulate the new king Francis I. An affection between Suffolk and the dowager queen Mary had subsisted before her marriage, and Francis roundly charged him with an intention to marry her. Francis, perhaps in the hope of Queen Claude's death, had himself been on of her suitors for the widow of her first husband, and Mary asserted that she had given him her confidence to avoid his importunities. Francis and Henry both professed a friendly attitude towards the marriage of the lovers, but Suffolk had many political enemies, and Mary feared that she might again be sacrificed to political considerations. The truth was that Henry was anxious to obtain from Francis the gold plate and jewels which had been given or promised to the queen by Louis in addition to the reimbursement of the expenses of her marriage with the King; and he practically made his acquiescence in Suffolk's suit dependent on his obtaining them. The pair cut short the difficulties by a private marriage, which Suffolk announced to Wolsey, who had been their fast friend, on the 5th of March. Suffolk was only saved from Henry's anger by Wolsey, and the pair eventually agreed to pay to Henry £24,000 in yearly instalments of £1,000, and the whole of Mary's dowry from Louis of £20,000, together with her plate and jewels. They were openly married at Greenwich on the 13th of May. The duke had been twice married already, to Margaret Mortimer and to Anne Browne, one of whom, Anne, was sent to the court of Margaret of Savoy. After his marriage with Mary, Suffolk lived for some years in retirement, but he was present at the Field of the Cloth of Gold in 1520, and in 1523 he was sent to Calais to command the English troops there. He invaded France in company with Count de Buren, who was at the head of the Flemish troops, and laid waste the north of France, but disbanded his troops at the approach of winter. Suffolk was entirely in favour of Henry's divorce; but Catherine of Aragon, and in spite of his obligations to Wolsey he did not scruple to attack him when his fall was imminent. The cardinal, who was acquainted with Suffolk's private history, reminded him of his ingratitude: "If I, simple cardinal, had not been, you should have had no tongue to make any such report in despite of us." At Wolsey's disgrace Suffolk's influence in court daily increased. He was sent with the duke of Norfolk to demand the great seal from Wolsey; the same noblemen conveyed the news of Anne Boleyn's marriage to Queen Catherine, and Suffolk acted as high steward at the new queen's coronation. He was one of the commissioners appointed by Henry to dismiss Catherine's household, a task which he found distasteful. He supported Henry's ecclesiastical policy, receiving a large share of the plunder after the suppression of the monasteries. In 1544 he was for the second time in command of an English army for the invasion of France. He died at Guildford on the 24th of August in the following year.

After the death of Mary Tudor on the 24th of June 1533 he had married in 1534 his ward Catherine (1520-1580), Baroness Willoughby de Eresby in her own right, then a girl of fifteen. His daughters by his marriage with Anne Browne were Anne, who married firstly Edward Grey, Lord Powys, and, after the dissolution of this union, Randal Harworth; and Mary (b. 1510), who married Thomas Stanley, Lord Montague. By Mary Tudor he had a son, Edward, earl of Lincoln (1516-1534); Frances, who married Henry Grey, marquess of Dorset, and became the mother of Lady Jane Grey; and Eleanor, who married Henry Clifford, second earl of Cumberland. By Katherine Willoughby he had two sons who showed great promise, Henry (1535-1553) and Charles (c. 1537-1557), dukes of Suffolk. They died of the sweating sickness within an hour of one another. Their tutor, Sir Thomas Wilson, compiled a memoir of them, Vita et obitus duorum fratrum Suffolkensium (1553).

There is abundant material for the history of Suffolk's career in the Letters and Papers of Henry VIII. (ed. Brewer in the Rolls Series). See also Dugdale, Baronage of England (1657), and G. E. C., Complete Peerage. An account of his matrimonial adventures is in the historical appendix to a novel by E. S. Holt entitled The Harvest of Yesterday.

**SUFFOLK, THOMAS HOWARD, 1ST EARL OF (1561-1626),** second son of Thomas Howard, 4th duke of Norfolk, was born on the 24th of August 1561. He behaved very gallantly during the attack on the Spanish armada and afterwards took part in other naval expeditions, becoming an admiral in 1590. Created Duke of Norfolk by James I in 1607, he married in July 1603, he was lord chamberlain of the royal household from 1603 to 1614 and lord high treasurer from 1614 to 1618, when he was deprived of his office on a charge of misappropriating money. He was tried in the Star-chamber and was sentenced to pay a heavy fine. Suffolk's second wife was Catherine (d. 1633), widow of the Hon. Richard Rich, a woman whose avarice was partly responsible for her husband's downfall. She shared his trial and was certainly guilty of taking bribes from Spain. One of his three daughters was the notorious Frances Howard, who, after marrying her first husband, Robert Devereux, earl of Essex, married Robert Carr, earl of Somerset, and instigated the poisoning of Sir Thomas Overbury. The earl died on the 28th of May 1626. He built a magnificent residence at Audley End, Essex, which is said to have cost £200,000. One of Suffolk's seven sons was Sir Robert Howard (1585-1653), who inherited Clun Castle, Shropshire, on the death of his brother, Sir Charles Howard, in 1622. He was twice imprisoned on account of his illicit relations with Frances, Viscountess Purbeck (d. 1645), a daughter of Sir Edward Coke, and after sitting in the House of Commons was expelled from the House of Commons for executing the king, and was dismissed from the Privy Council. He died on the 22nd of April 1653. Another of Suffolk's sons was Thomas, earl of Suffolk (d. 1675), who was a member of the royalist party during the Commonwealth, and later he associated himself with the opposition to the arbitrary rule of Charles II., but turning informer he was pardoned for the conviction of Lord William Russell and of Algernon Sydney in 1683. On the death of William's son, Charles, the 4th lord, in 1715 the barony of Howard of Escrick became extinct.

Suffolk's eldest son, THEOPHILUS, 2nd earl of Suffolk (1584-1649), was captain of the band of gentlemen pensioners under James I. and Charles I., and succeeded to the earldom in May 1626, obtaining about the same time some of the numerous offices which had been held by his father, including the lord-lieutenancy of the counties of Suffolk, Cambridge and Dorset. He died on the 3rd of June 1640, when his eldest son James (1619-1689) became 3rd earl. This nobleman, who acted as earl marshal of England at the coronation of Charles II., died in January 1689 when his barony of Howard de Walden fell into abeyance between his two daughters. He later married Thomas Wilson, compiled a memoir of them, Vita et obitus duorum fratrum Suffolkensium (1553).

1 Having thus fallen into abeyance in 1689 the barony of Howard de Walden was revived in 1764 in favour of John Griffin Griffin, 7th viscount Eglinton, who was one of the bishops of Derry, Frederick Augustus Hervey, 4th earl of Bristol, a descendant of the 3rd earl of Suffolk, became the sole heir to the barony. On Bristol's death in 1779, one of his grandsons passed the barony to Augustus Ellis (1799-1868), a grandson of the bishop's eldest son, John Augustus, Lord, Edward (1757-1796), who had predeceased his father. It was thus separated from the marquessate of Bristol, which passed to the bishop's only surviving son, and it has since been held by the family of Ellis.
became 4th earl of Suffolk. George's nephew, Henry, the 6th earl (c. 1670-1718), who was president of the board of trade from 1715 to 1718, left an only son, Charles William (1653-1722), who was succeeded in turn by his two uncles, the younger of them, Charles (1675-1733) becoming 9th earl on the death of his brother Edward in June 1731. This earl was the husband of Henrietta countess of Suffolk (c. 1661-1767), the mistress of George II., who was a daughter of Sir Henry Hobart, bart., of Blickling, Norfolk. When still the Hon. Charles Howard, he and his wife made the acquaintance of the future king in Hanover; after the accession of George I. to the English throne in 1714 both husband and wife gained posts in the household of the prince of Wales, who, when he became king as George II., publicly acknowledged Mrs Howard as his mistress. She was formally separated from her husband before 1731 when she became countess of Suffolk. The earl died on the 28th of September 1733, but the countess, having retired from court and married the Hon. George Berkeley (d. 1746), lived until the 26th of July 1767. Among Lady Suffolk's friends were the poets Pope and Gay and Charles Mordaunt (earl of Peterborough).

A collection of Letters to and from Henrietta Countess of Suffolk, and other Skapery of Samuel Pepys, the Hon. George Berkeley, was edited by J. W. Croker (1824).

The 9th earl's only son Henry, the 10th earl (1706-1745), died without sons in April 1745, when his estate at Audley End passed to the descendants of the 3rd earl, being inherited in 1762 by John Griffin Griffin (1719-1797), afterwards Lord Howard de Walden and Lord Braybrooke. As owners of this estate the ears of Suffolk of the Howard line had hitherto been hereditary visitors of Magdalene College, Cambridge, but this office now passed away from them. The eldest son of Suffolk was inherited by Henry Bowes Howard, 4th earl of Berkshire (1666-1757), who was the great-grandson of Thomas Howard (c. 1396-1450), the 3rd earl of Suffolk, Thomas having been created earl of Berkshire in 1566. Since 1745 the two earldoms have been united, Henry Molyneux Paget Howard (b. 1877) succeeding his father, Henry Charles (1833-1898), as 19th earl of Suffolk and 12th earl of Berkshire in 1898.

SUFFOLK, WILLIAM DE LA POLE, DUKE OF (1396-1450), second son of Michael de la Pole, second earl of Suffolk, was born on the 16th of October 1396. His father died at the siege of Harfleur, and his elder brother was killed at Agincourt on the 15th of October 1415. Suffolk served in all the later French campaigns of the reign of Henry V., and in spite of his youth held high command on the marches of Normandy in 1421-22. In 1423 he joined the earl of Salisbury in Champagne, and shared his victory at Crécy. He fought under John, duke of Bedford, at Verneuil on the 17th of August 1424, and throughout the next four years was Salisbury's chief lieutenant in the direction of the war. When Salisbury was killed before Orleans on the 3rd of November 1428, Suffolk succeeded to the command. After the siege was raised, Suffolk was defeated and taken prisoner by Jeanne d'Arc at Jargeau on the 12th of June 1429. He was soon ransomed, and during the next two years was again in command on the Norman frontier. He returned to England in November 1431, after over fourteen years' continuous service in the field.

Suffolk had already been employed on diplomatic missions by John of Bedford, and from this time forward he had an important share in the work of administration. He attached himself naturally to Cardinal Beaufort, and even thus early seems to have been striving for a general peace. But public opinion in England was not yet ripe, and the unsuccessful conference at Arras, with the consequent defection of Burgundy, strengthened the war party. Nevertheless the cardinal's authority remained supreme in the council, and Suffolk, as his chief supporter, gained increasing influence. The question of Henry VI.'s marriage brought him to the front. Humphrey of Gloucester favoured an Armagnac alliance. Suffolk brought about the match with Margaret of Anjou. Report already represented Suffolk as too friendly with French leaders like Charles of Orleans, and it was with reluctance that he undertook the responsibility of an embassy to France. However, when he returned to England in June 1444, after negotiating the marriage and a two years' truce, he received a triumphant reception. He was made a marquess, and in the autumn sent again to France to bring Margaret home. The French contrived to find occasion for extorting a promise to surrender all the English possessions in Anjou and Maine, a concession that was to prove fatal to Suffolk and his policy. Still for the time his success was complete, and his position as the personal friend of the young king and queen remained secure. Humphrey of Gloucester died in his bed at Exeter on 17th February 1447, within a few days, and six months later Cardinal Beaufort died also. Suffolk was left without an obvious rival, but his difficulties were great. Rumour, though without sufficient reason, made him responsible for Humphrey's death, while the peace and its consequent concessions rendered him unpopular. So also did the supersession of Richard of York by Edmund Beaufort, duke of Somerset, in the French command. Suffolk's promotion to a dukedom in July 1448, marked the height of his power. The difficulties of his position may have led him to give some countenance to a treacherous attack on France's enemies during the summer of 1446 (March 1446). The renewal of the war and the loss of all Normandy and the direct consequences.

When parliament met in November 1449, the opposition showed its strength by forcing the treasurer, Adam Molyneux, to resign. Molyneux was murdered by the sailors at Portsmouth on the 9th of January 1450. Suffolk, realizing that an attack on himself was inevitable, boldly challenged his enemies in parliament, appealing to the long and honourable record of his public services. On the 7th of February and again on the 9th of March the Commons presented articles of accusation dealing chiefly with alleged maladministration and the ill success of the French policy; there was a charge of aiming at the throne by the betrothal of his son to the little Margaret Beaufort, but no suggestion of guilt concerning the death of Gloucester. The articles were in great part baseless, if not absurd. Suffolk, in his defence on the 13th of March, denied them as false, untrue and too horrible to speak more of. Ultimately, as a sort of compromise, the king sentenced him to banishment for five years. Suffolk left England on the 1st of May. He was intercepted in the Channel by the ship "Nicholas of the Tower," and next morning was beheaded in a little boat alongside. The "Nicholas" was a royal ship, and Suffolk's murder was probably illegal on the king's political opponents.

Popular opinion at the time judged Suffolk as a traitor. This view was accepted by Yorkist chroniclers and Tudor historians, who had no reason to speak well of a Pole. Later legend made him the paramour of Margaret of Anjou. Though utterly baseless, the story gained currency in the Mirrour for Magistrates, and was adopted in Shakespeare's 2 Henry VI. (act iii. sc. ii.). Suffolk's best defence is contained in the touching letter of farewell to his son, written on the eve of his departure (Paston Letters, i. 143), and in his noble speeches before parliament (Rolls of Parliament, v. 176, 175). Of the former Lingard said well that it is "difficult to believe that the writer could have been either a false subject or a bad man." The policy of peace which Suffolk pursued was just and wise; he foresaw from the first the personal risk to which its advocacy exposed him. This alone should acquit him of any base motive; his conduct was "throughout open and straightforward" (Stubbs). Whatever his defection as a statesman, he was a gallant soldier, a man of culture and a loyal servant.

Suffolk's wife, Alice, was widow of Thomas, earl of Salisbury, and granddaughter of Geoffrey Chaucer. By her he had an only son John, second duke of Suffolk.

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France. For modern accounts see especially W. Stubbs, Constitutional History (lavoisier), The Political History of England, vol. iv., 1857; E. Pastoreau, Histoire de Charles VII. See also H. A. Napier's Historical Notices of Swincombe and Eveline (1835).

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SUFFOLK, an eastern county of England, bounded N. by Norfolk, E. by the North Sea, S. by Essex and W. by Cambridgeshire. The area is 1486-8 sq. m. The surface is as a whole but slightly undulating. In the extreme north, the Alde district is included. Mildenhall, a small area of fen, is the extreme northwards along the western boundary, and thence by Bury St Edmunds to Thetford. The coast-line has a length of about 62 m., and is comparatively regular, the bays being generally shallow and the headlands rounded and only slightly prominent. The estuaries of the Deben, Orwell and Stour, however, are between 10 and 12 m. in length. The shore is generally low and marshy, with occasional clay and sand cliffs. It includes, in the declivity of the eastern flank of English land. Like the Norfolk coast, this shore has suffered greatly from inroads of the sea, the demolition of the ancient port of Dunwich (2246) forming the most noteworthy example. The principal seaside resorts are Lowestoft, Southwold, Aldeburgh and Felixstowe. The rivers flowing northward are the Lark, in the north-west corner, which passes in a north-westerly direction to the Great Ouse in Norfolk; the Little Ouse or Brandon, also a tributary of the Great Ouse, flowing by Thetford and Brandon and forming part of the northern boundary of the county; and the Waveney, which flows past Yoxford and forms the northern boundary of Suffolk from Palgrave till it falls into the mouth of the Yare at Yarmouth. The Waveney is navigable from Bungay, and by means of Oulton Broad also communicates with the sea at Lowestoft. The rivers flowing in a south-easterly direction to the North Sea are the Blyth; the Alde or Ore, which has a course for nearly 10 m. parallel to the seashore; the Deben, from Debenham, flowing past Woodbridge, up to which it is navigable; the Orwell or Gipping, which becomes navigable at Stowmarket, whence it flows past Needham Market and Ipswich; and the Stour, which forms nearly the whole southern boundary of the county, receiving the Breth, which flows past Lavenham and Hadleigh; it is navigable from Sudbury. At the union of its estuary with that of the Orwell is the important port of Harwich (in Essex). The county has no valuable minerals. Flints are worked, as they have been from pre-historic times; a considerable quantity of clay is raised and lime and whiting are obtained in various districts.

Geology.—The principal geological formations are the Chalk and the Tertiary deposits. The former occupies the uplands, where covered by superficial drift, in the central and north-west portions of the county, and it extends beneath the Tertiaries in the south-east and east. In the extreme north-west round Mildenhall the Chalk borders a tract of fen land in a range of low hills from Haverhill by Newmarket and Bury St Edmunds to Thetford. The Chalk is quarried near Ipswich, Bury St Edmunds, Mildenhall and elsewhere; at Brandon the chalk flints for gunlocks and building have been exploited for nearly thirty years. The Tertiary formations include Thanet sand, seen near Sudbury; and Reading Beds and London Clay which extend from Sudbury through Hadleigh, Ipswich, Woodbridge and thence north-east as far as Wisbech. The boundary of these and the Crag is the "Suffolk Bone Bed," with abundant mammalian and phosphatic nodules. Glacial gravel, sand and chalky boulders are scattered over much of the county, generally forming stiffer soils in the west and lighter sandy soils in the east. Pebble gravels occur W. of Woodbridge and Glemstone, implements, at Hoxne; while old river-gravels of still later date border the present river valleys. The chalk and gault have been penetrated by a boring at Stutton, revealing a hard pan of sandstone rock, 25 ft. thick.

Agriculture.—Suffolk is one of the most fertile counties in England. In the 18th century it was famed for its dairy products. The high prices of grain during the Wars of the French Revolution led to the introduction of corn crops. The boundary, of the county, and its pastures, and it is now one of the principal grain-growing counties in England. There is considerable variety of soils, and consequently in modes of farming in different parts of the county. The sandy soils, prevailing in the south-west, are interspersed with tracts, more or less marshy, on which cattle are grazed. The best land adjoins the northern boundary of Suffolk, with patches of lighter and easier soil. In the south-west and the centre is much finer grain-land having mostly a clay subsoil, but not so tenacious as the clay in Essex. In climate Suffolks has an annual rainfall at Bury St Edmunds is rather less than 24 in. Towards the north-west the soil is generally poor, consisting partly of sand on chalk, and partly of peat and open moor. Some 324,000 acres of the total area of the county is covered with cultivation. barley, oats and wheat are the most important of the grain crops. The breed of horses known as Suffolks is the most valued for agricultural purposes in England. They are best adapted to extensive farming and are especially valuable, the improvement of which great pains have been bestowed. The old Suffolk cows, famous for their great milking qualities, were of various colours, yellow predominating. The improvement in London and Ipswich, &c. Many cattle, mostly imported from Ireland, are grazed in the winter. The sheep are nearly all of the black-faced improved Suffolk breed, a cross between the old Norfolk horned sheep and Southdowns. The breed of pigs most common is black and small.

Manufactures and Trade.—The county is essentially agricultural, and the most important manufactures relate to this branch of industry. They include the raising and rearing of agricultural implements, especially at Ipswich, Bury St Edmunds and Stowmarket, and that of artificial manures at Ipswich and Stowmarket, for which coprolites are dug. Malting is extensively carried on throughout the county, and many of the manufactures at Stowmarket and Woodbridge are gun flints are still made at Brandon. At other towns small miscellaneous manufactures are carried on, including silk, cotton, linen, woollen, and horsehair and coir-netting making. The principal ports are Lowestoft, Southwold, Aldeburgh, Woodbridge and Ipswich. Lowestoft is the chief fishing town. Herrings and mackerel are the fish most abundant on the coast.

Communications.—The main line of the Great Eastern railway, from London to Lowestoft, passes through Suffolk, continuing north into Norfolk. The east Suffolk branch from Ipswich serves Woodbridge, Saxmundham, Halesworth, and Beccles, with the western branch from Felixstowe reaching to Lowestoft; while the Southwold Light railway connects with that town from Halesworth. The other principal branches are those from Stowmarket to Bury St Edmunds and westward into Cambridge, via Sudbury. The Essex lines are from Manningtree to Colchester and Thetford, and from Long Melford to Haverhill, which is the northern terminus of the Colne Valley railway.

Population and Administration.—The area of the ancient county is 952,710 acres, with a population in 1891 of 371,215, and in 1901 of 384,293. Suffolk comprises 21 hundreds, and for administrative purposes divided into the counties of East Suffolk (557,854 acres) and West Suffolk (390,914 acres). The following are municipal boroughs and urban districts:

(1) EAST SUFFOLK. Municipal boroughs—Aldeburgh (pop. 2,405), Blyth (5,698), Ely (3,290), Halesworth (3,815), Lowestoft (6,810), Woodbridge (1,027), and Yarmouth (3,290). Urban districts—Bungay (3,141), Felixstowe and Walton (8,195), Diss (3,295), Leiston-Sizewell (3,295), Oulton Broad (4,044), Saxmundham (1,428), Stowmarket (4,162), Woodbridge (4,640), and Yarmouth (3,295). The county and the towns of any importance are: Brandon, Clare, Debenham, Framlingham, Halesworth, Mildenhall, Needham Market and Orford. For parliamentary purposes the county constitutes five divisions, each returning one member, viz. Ipswich, Lowestoft, Bury St Edmunds, Sudbury, and Woodbridge. The last-named returns one member and Ipswich two; part of the corporal county is in the Great Eastern railway district. There is one court of quarter sessions for the two administrative counties, which is usually held at Ipswich for east Suffolk, and then by
adjournment at Bury St Edmunds for west Suffolk. East Suffolk is divided into 11 and west Suffolk into 8 petty sessional divisions. The boroughs of Bury St Edmunds, Ipswich, Sudbury, Eye, Lowestoft and Southwold have separate commissions of the peace, and the three first-named have also separate courts of quarter sessions. The total number of civil parishes is 519. The ancient county contains 465 ecclesiastical parishes and districts, wholly or in part; it is situated partly in the diocese of Ely and partly in that of Norwich.

History.—The county of Suffolk (Sudbole, Sudholce) was formed from the south part of the kingdom of East Anglia which had been settled by the Angles in the latter half of the 5th century. The most important Anglo-Saxon settlements appear to have been made at Sudbury and Ipswich. Before the end of the Norman dynasty strongholds had arisen at Eye, Clare, Walon and Framlingham. Probably the establishment of Suffolk as a separate shire was scarcely completed before the Conquest, and although it was reckoned as distinct from Norfolk in the Domesday Survey of 1086, the fiscal administration of Norfolk and Suffolk remained under one sheriff until 1575. The boundary of the county has undergone very little change, though its area has been considerably affected by coast erosion. Parts of Gorleston and Thetford, which formerly belonged to the ancient county of Norfolk, are now within the administrative county of Suffolk, and other slight alterations of the administrative boundary have been made. Under the Local Government Act of 1888 Suffolk was divided into the two administrative counties of east and west Suffolk.

At first the whole shire lay within the diocese of Dunwich which was founded c. 631. In 673 a new bishopric was established at Elmham to comprise the whole of Norfolk which had formerly been included in the see of Dunwich. The latter came to an end with the incursion of the Danes, and on the revival of Christianity in this district Suffolk was included in the diocese of Elmham, subsequently removed from South Elmham to Thetford and thence to Norwich. In 1835-1836 the archdeaconry of Sudbury was transferred by the ecclesiastical commissioners to the diocese of Ely. This archdeaconry had been separated from the original archdeaconry of Suffolk in 1127. In 1256 the latter included thirteen deaneries which have since been subdivided, so that at present it contains eighteen deaneries; Sudbury archdeaconry which comprised eight deaneries in 1256 now in 17. There were also three districts under peculiar jurisdiction in Canterbury and one under that of Rochester.

The shire-court was held at Ipswich. In 1831 the whole county contained twenty-one hundreds and three municipal boroughs. Most of these hundreds were identical with those of the Domesday Survey, but in 1086 Babergh was rated as two hundreds, Gosford, Ipswich and Parham as half hundreds and Samford as a hundred and a half. Hoxne hundred was formerly known as Bishop's hundred and the hills which were included later in Thredling hundred were within Claydon hundred in 1086. Two large ecclesiastical liberties extended over more than half of the county; that of St Edmund contained the hundreds of Risbridge, Thedwarray, Thingoe, Gosford, Lackford and Blackbourn in which the king's writ did not run, and St Aethelreda of Ely claimed a similar privilege in the hundreds of Carlesford, Colneis, Plumesgate, Loeis, Wilford and Thredling. Among others who had large lands in the county with co-extensive jurisdiction were the lords of the honor of Clare, earls of Gloucester and Hereford and the lords of the honor of Eye; held successively by the Bigods, the Uffords and the De la Poles, earls of Suffolk. The Wingfields, Bacons and Haves have been closely connected with the county.

Suffolk suffered severely from Danish incursions, and after the Treaty of Wedmore became a part of the Danelag. In 1173 the earl of Leicester landed at Walton with an army of Flemings and was joined by Hugh Bigod against Henry II. In 1237 and the succeeding years a great part of the county was in arms for Thomas of Lancaster. Queen Isabella and Mortimer having landed at Walton found all the district in their favour. In 1330 the county was raised to suppress the supporters of the earl of Kent; and again in 1381 there was a serious rising of the peasantry chiefly in the neighbourhood of Bury St Edmunds. Although the county was for the most part Yorkist it took little part in the Wars of the Roses. In 1525 the artisans of the south strongly resisted Henry VIII.'s forced loan. It was from Suffolk that Mary drew the army which supported her claim to the throne. In the Civil Wars the county was for the most part parliamentarian, and joined the Association of the Eastern Counties for Peace against the Parliamentarians.

The county was constantly represented in parliament by two knights from 1290, until the Reform Bill of 1832 gave four members to Suffolk, at the same time disfranchising the boroughs of Dunwich, Orford and Aldeburgh. Suffolk was early among the most populous of English counties, doubtless owing to its proximity to the continent. Fishing fleets have left its ports to bring back cod and ling from Iceland and herring and mackerel from the North Sea. From the 14th to the 17th century it was among the chief manufacturing counties of England owing to its cloth-weaving industry, which was at the height of its prosperity during the 17th century. In the 18th and 19th centuries its agricultural resources were utilized to provide the rapidly-growing metropolis with food. In the following century various textile industries, such as the manufacture of sail-cloth, cocoa-nut fibre, horse-hair and clothing were established; silk-weavers migrated to Suffolk from Spitalfields, and early in the 19th century an important china factory flourished at Lowestoft.

Antiquities.—Of monastic remains the most important are those of the great Benedictine abbey of Bury St Edmunds, noticed under that town; the college of Clare, originally a cell to the abbey of Beverley, and afterwards to St Peter's Westminster, was converted into a college of secular canons in the reign of Henry VI., still retaining much of its ancient architecture, and now used as a boys' school; the collegiate church of the Augustinian priory of Bury; and the remains of the Grey Friars' friary in Norwich. A peculiarity of the church architecture is the use of flint for purposes of ornamentation, often of a very elaborate kind, especially on the towers and parapets of the towers. Another characteristic is the round towers, which are confined to East Anglia, but are considerably more numerous in Norfolk than in Suffolk, the principal being those of Little Saxham and Hernehithe, both good examples of Norman. It is questionable whether there are any remains of pre-Norman architecture in the county. The Decorated is well represented, but by far the greater proportion of the churches are Perpendicular, fine examples of which are so numerous that it is hard to select examples. But the churches are chiefly in the east and the exquisite ornate building at Lavenham in the west may be noted as typical, while the church of Long Melford, another fine example, should be mentioned. A very fine example of late Perpendicular, and remarkable features are the open roofs and woodwork (as at St Mary's, Bury St Edmunds, Earl Stonham and Stonham Aspall, Ufford and Blithbury), and the fine fonts.

The remains of cricket are comparatively unimportant, the principal being the entrenchments and part of the walls of Bungay, the ancient stronghold of the Bigods; the picturesque ruins of Mettening, built by John de Norwich in the reign of Edward III.; Wingfield, surrounded by a deep moat, with the torrent walls and the drawbridge still existing; the splendid ruin of Framlingham, with high and massive walls, originally founded in the 6th century, but restored in the 13th; the outlines of the extensive fortress of Clare Castle, anciently the baronial residence of the earls of Clare; and the fine Norman keep of Orford Castle, on an eminence overlooking the sea. Among the many fine residences within the county there are several that are of interest: the remains of the abbeys of Clare, Ely, of the Convent of Wilford, the ruins of the priories of Wilford, Holy Cross, the site of the palace of the earls of Huntingdon, and the ruins of the palace of the earls of Gloucester. The abbeys are those of Clare, Ely, and of the manor of Huntingdon, the latter being a Roman fortress.

Editor's note: This text is a portion of the 19th-century history of Suffolk, including details on its history, administration, and cultural elements, such as the role of monasticism and cricket. It provides a comprehensive overview of the county's development from early settlement through to the 19th century, highlighting significant events, economic activities, and architectural features.
SUFFRAGE—SUFFREN SAINT TROPEZ

SUFFRAGE (Lat. suffragium), the right or the exercise of the right of voting in political affairs; in a more general sense, an expression of opinion, assent or approval; in ecclesiastical use, the short intercessory prayers in litanies spoken or sung by the people as distinguished from those of the priests or ministers. (Suffrage, Registration and Voting; and Suffrage Movement; Women: § Political Rights.) The etymology of the Latin word suffragium has been much discussed. It is usually referred to sub- and the root of strangere, to break, and its original meaning must thus have been a piece of broken tile or a potsherd on which the names or initials of the candidates were inscribed and used as a voting tablet or tabella. There is, however, no direct evidence that this was ever the practice in the case of voting upon legislation in the assembly (see W. Corssen, Uber Ausprache, &c., des Lateinischen Sproche, i. 397, and Mommsen, Römische Geschichte, iii. 472 b. i.).

SUFFREN SAINT TROPEZ, PIERRE ANDRÉ DE (1720–1788), French admiral, was the third son of the marquis de Saint Tropez, head of a family of nobles of Provence which claimed to have emigrated from Lucca in the 14th century. He was born in the Château de Saint Canat in the present department of Aix on the 17th of July 1729. The French navy and the Order of Malta offered the usual careers for the younger sons of noble families of the south of France who did not elect to follow the Church. The common lot between the Order and the old French royal navy was close. Pierre André de Suffren was destined by his parents to belong to both. He entered the close and aristocratic corps of French naval officers as a "garde de la marine"—cadet or midshipman, in October 1743, in the "Solide," one of the line of battleships which took part in the confused engagement off Toulon in 1744. He was then in the "Pauline" in the squadron of M. Macémar de a cruise in the West Indies. In 1746 he went through the duc d'Anville's disastrous expedition to retake Cape Breton, which was ruined by shipwreck and placed his reputation. Next year (1747) he was taken prisoner by Hawke in the action with the French convoy in the Bay of Biscay. His biographer Cunat assures us that he found British arrogance offensive. When peace was made in 1748 he went to Malta to perform the cruises with the galleys of the Order technically called "caravans," a reminiscence of the days when the knights protected the pilgrims going from Saint John d'Arc to Jerusalem. In Suffren's time this service rarely went beyond a peaceful tour among the Greek islands. During the Seven Years' War he had an undoubted good fortune to be present as lieutenant in the "Ornée" in the action against the "Neptun" (q.v.), which, if not properly speaking a victory, was at least a defeat for the French and was followed by the surrender of the English garrison of Minorca. But in 1757 he was again taken prisoner, when his ship the "Océan" was captured by Boscawen off Lagos. On the return of peace in 1763 he intended again to do the service in the caravans which was required to qualify him to hold the high and lucrative posts of the Order. He was, however, named to the command of the "Camélion," a 26-pee—a vessel of mixed square and lateen rig peculiar to the Mediterranean—in which he cruised against the pirates of the Barbary coast. Between 1767 and 1771 he performed his caravans, and was promoted from knight to commander of the Order. From that time till the beginning of the War of American Independence he commanded vessels in the squadron of evolution which the French government had established for the purpose of giving practice to its officers. His nerve and skill in handling his ship were highly commended by his chiefs. In 1778 and 1779 he formed part of the squadron of D'Estaing (q.v.) throughout its operations on the coast of North America and in the West Indies. He led the line in the action with Admiral John Byron, off Grenada, and his ship, the "Fantasque" (64), lost 62 men. His letters to his admirals show that he strongly disapproved of D'Estaing's half-hearted methods. In 1780 he was captain of the "Zélie" (74), in the combined French and Spanish fleets which captured a great English convoy in the Atlantic. His candour towards his chief had done him no harm in the opinion of D'Estaing. It is said to have been largely by the advice of this admiral that Suffren was chosen to command a squadron of five ships of the line sent out to help the Dutch who had joined France and Spain to defend the Cape against English attack, and then to go on to the East Indies. He sailed from Brest on the 22nd of March on the cruise which has given him a unique place among French admirals, and puts him in the front rank of sea commanders. He was by nature even more vehement than able. The disasters which had befallen the navy of his country during the last two wars, and which, as he knew, were due to bad administration and timid leadership, had filled him with a burning desire to retrieve its honour. He was by experience as well as by temperament impelled with the formal manner being of his colleagues, which consisted of preserving their own ships rather than at taking the English, and though he did not dream of restoring the French power in India, he did hope to gain some such success as would enable his country to make an honourable peace. On the 16th of April 1782 he found the English expedition on its way to the Cape under the command of Commodore, commonly called Governor, George Johnstone (1730–1787), at anchor in Porto Praya, Cape de Verdes Islands. Remembering how little respect Boscawen had shown for the neutrality of Portugal at Lagos, he attacked at once. Though he was definitely supported as there was not much injury as he suffered and proposed to the English that in him they had to deal with an admiral of quite a different type from the Frenchmen they had been accustomed to as yet. He pushed on to the Cape, which he saved from capture by Johnstone, and then made his way to the Isle de France (Mauritius), then held by the French. M. D'Orves, his superior officer, died as the united squadrons, now eleven sail of the line, were on their way to the Bay of Bengal. The campaign, which Suffren now conducted against the English admiral Sir Edward Hughes (1720?–1794), is famous for the number and severity of the encounters between his ships and those of his officers. On the 31st of March 1782, he took the French ship "Aussprache" (q.v.) in the battle of February 1782, south of Madras; on the 12th of April near Trincomalee; on the 6th of July off Cuddalore, after which Suffren seized upon the anchorage of Trincomalee compelling the small British garrison to surrender; and again near that port on the 3rd of September. No ship was lost by Sir Edward Hughes in any of these actions, but none were taken by him. Suffren attacked with unprecedented vigour on every occasion, and if he had not been ill-supported by some of his captains he would undoubtedly have gained a distinct victory; as it was, he maintained his squadron without much loss. In the action of April 1782, he fought his last battle against Hughes (April 20, 1783), with fourteen ships to eighteen he forced the English admiral to retire to Madras, leaving the army then besieging Cuddalore in a very dangerous position. The arrival of the news that peace had been made in Europe put a stop to hostilities, and Suffren returned to France. While refitting at the Cape on his way home, several of the vessels also returning put in, and the captains waited on him. Suffren said in one of his letters that their praise gave him more pleasure than any other compliment paid him. In France he was received with enthusiasm, and an additional office of vice-admiral of France was created for him. He had been promoted bailli in the Order of Malta during his absence. His death occurred very suddenly on the 8th of December 1788, when he was about to take command of a fleet collected in Brest. The official version of the cause of death was apoplexy, and as
he was a very corpulent man it appeared plausible. But many years afterwards his body servant told M. Jal, the historiographer of the French navy, that he had been killed in a duel by the prince de Mirepoix. The cause of the encounter, according to the servant, was that Sufien had refused in very strong language to use his influence to secure the restoration to the navy of two of the prince’s relations who had been dismissed for misconduct.

Sufien was crippled to a large extent by the want of loyal and capable co-operation on the part of his captains, and the vehemence of his own temperament sometimes led him to disregard prudence, yet he had an indefatigable energy, a wealth of resource, and a thorough understanding of the fickle and usually disregarded by French naval officers—success at sea is won by defeating an enemy and not by merely outmanoeuvring him; and this made him a most formidable enemy. The portraits of Sufien usually reproduced are worthless, but there is a good engraving by Mme de Cerneal after an original by Gérard.

The standard authority for the life of Sufien is the Histoire du Bailli de Sufien by Ch. Camut (1852). The Journal de Bord du Bailli de Sufien dans l’Inde, edited by M. More, was published in 1888. There is an appreciative study in Captain Mahan’s Sea Power in History, (D. H.) Sufien (�فیں), a term used by Moslems to denote any variety of mysticism, is formed from the Arabic word Sāfī, which was applied, in the 2nd century of Islam, to men or women who adopted an ascetic or quietist way of life. There can be no doubt that Sāfī is derived from sūf (wool) in reference to the woolen garments often, though not invariably, worn by such persons: the phrase labisā’t-sāfī (“he clad himself in wool”) is commonly used in this sense, and the Persian word pashmina-pašī, which means literally “clothed in a woolen garment,” is synonymous with Sāfī. Other etymologies, such as Sāfīd (purity)—a derivation widely accepted in the East—and sosōs, are discredited.

In order to trace the origin and history of mysticism in Islam we must go back to Mahomet. On one side of his nature the Prophet was an ascetic and in some degree a mystic. Notwithstanding his condemnation of Christian monkry (rakbāniya), i.e. of celibacy and the solitary life, the example of the Ḥanifs, with some of whom he was acquainted, and the Christian hermits made a deep impression on his mind and led him to preach the efficacy of ascetic exercises, such as prayer, vigils and fasting. Again, while Allah is described in the Koran as the One God working his arbitrary will in unapproachable supremacy, other passages lay stress on his all-pervading presence and intimate relation to his creatures, e.g. “Wherever ye turn, there is the face of Allah” (ii. 109). “We (God) are nearer to him (Man) than his neck-vein” (I. 15). The germs of mysticism latent in Islam from the first were rapidly developed by the political, social and intellectual conditions which prevailed in the two centuries following the Prophet’s death. Devastating civil wars, a ruthless military despotism caring only for the things of this world, Messianic hopes and presages, the luxury of the upper classes, the hard mechanical piety of the orthodox creed, the spread of rationalism and freethought, all this produced a condition of the deepest moral, spiritual and emotional degradation. Thousands, wolves, and disowned with worldly vanities, devoted themselves to God. The terrors of hell, so vividly depicted in the Koran, awakened in them an intense consciousness of sin, which drove them to seek salvation in ascetic practices.

Sūfism was originally a practical religion, not a speculative system; it arose, as Junayd of Bagdad says, “from hunger and taking leave of the world and breaking familiar ties and renouncing what men deem good, not from disputation.” The early Sūfis were closely attached to the Mahomedan church. It is said that Abū Hāshim of Kūfa (d. before A.D. 800) founded a monastery for Sūfis at Ramleh in Palestine, but such fraternities seem to have been exceptional. Many ascetics of this period used to wander from place to place, either alone or in small parties, sometimes living by alms and sometimes by their own labour. They took up and emphasized certain Koranic terms. Thus dhikr (praise of God) consisting of recitation of the Koran, repetition of the Divine names, &c., was regarded as superior to the five canonical prayers incumbent on every Moslem, and tawakkul (trust in God) was defined as renunciation of all personal initiative and volition, leaving one’s self entirely in God’s hands, so that some fanatics deemed it a breach of “trust” to seek any means of livelihood, engage in trade, or even take medicine. Quietism soon passed into mysticism. The attainment of salvation ceased to be the first object, and every aspiration was centred in the inward life of dying to self and living in God. “O God!” said Ibrahim ibn Adham, “Thou knowest that the eight Paradises are little compared with the honour which Thou hast done unto me, and bade me love, Thy love, and Thy giving me intimacy with the praise of Thy name, and beside the peace of mind which Thou hast given me when I meditate on Thy majesty.” Towards the end of the 2nd century we find the doctrine of mystical love set forth in the sayings of a female ascetic, Rāhība’t Basra, the first of a long line of saintly women who have played an important rôle in the history of Sūfism. Henceforward the use of symbolical expressions, borrowed from the vocabulary of love and wine, becomes increasingly frequent as a means of indicating holy mysteries which must not be divulged. This was not an unnecessary precaution, for in the course of the 3rd century, Sūfism assumed a new character. Side by side with the quietistic and devotional mysticism of the early period there now sprang up a speculative and pantheistic movement which was essentially anti-Islamic and rapidly came into conflict with the orthodox ulema. It is significant that the oldest representative of this tendency—Ma’rūf of Bagdad—was the son of Christian parents and a Persian by race. He defined Sūfism as a theosophy; his aim was to “apprehend the Divine realities.” A little later Abū Sulâmān al-Dārānī in Syria and Dhu’l-Nün in Egypt developed the doctrine of gnosis (ma’rūf) through illumination and ecstasy. The nestling of this to Pantheism was done by the great Persian Sūfī, Abū Yazīd (Bāyezd) of Bīstām (d. A.D. 874), who introduced the doctrine of annihilation (fana), i.e. the passing away of individual consciousness in the will of God.

It is, no doubt, conceivable that the evolution of Sūfism up to this point might not have been very different even although it had remained wholly unaffected by influences outside of Islam. But, as a matter of fact, such influences made themselves powerfully felt. Of these, Christianity, Buddhism and Neoplatonism are the chief. Christian influence had its source, not in the Church, but in the hermits and unorthodox sects, especially perhaps in the Syrian Euchites, who magnified the duty of constant prayer, abandoned their all and wandered as poor brethren. Sūfism owed much to the ideal of unworldliness which they presented. Conversations between Moslem devotees and Christian ascetics are often related in the ancient Sūf biographies, and many Biblical texts appear in the form of sayings attributed to eminent Sūfis of early times, while sayings ascribed to Jesus as well as Christian and Jewish legends occur in abundance. More than one Sūfi doctrine—that of tawakkul may be mentioned in particular—was decisively Christian in origin. The monastic strain which insinuated itself into Sūfism in spite of Mahomet’s prohibition was derived, partially at any rate, from Christianity. Here, however, Buddhist influence may also have been at work. Buddhism flourished in Balkh, Transoxiana and Turkestan before the Mahomedan conquest, and in later times Buddhist monks carried their religious practices and philosophy among the Moslems who had settled in these countries. It looks as though the legend of İbrahim ibn Adham, a prince of Balkh who one day suddenly cast off his royal robes and became a wandering Sūfī, were based on the story of Buddha. The use of rosaries, the doctrine of fana, which is probably a form of Nirvanism, and the system of “stationa” (maqāmat) on the road thereto, would seem to be Buddhist in their origin. The third great foreign influence on Sūfism is the Neoplatonic philosophy. Between A.D. 800 and 860 the tide of Greek learning, then at its height,
streamed into Islam from the Christian monasteries of Syria, from the Persian Academy of Janedshap in Khustain, and from the Sbians of Haran in Mesopotamia. The so-called "good" (or bad) type of Neo-Platonic theories, and the mystical writings of the pseudo-Diosynius were widely known throughout western Asia. It is not mere coincidence that the doctrine of Gnosis was first worked out in detail by the Egyptian Sufi, Dhu l-Nun (d. A.D. 859), who is described as an alchemist and theurgist. Sufism on its theosophical side was largely a product of Alex andean speculation.

By the end of the 3rd century the main lines of the Sufi mystic apprehensions were already fixed. It was now fast becoming an organized system, a school for saints, with a framework of discipline. The true devotee who longed to learn from his spiritual director, to whose guidance he submitted absolutely. These directors regarded themselves as being in the most intimate communion with God, who bestowed on them miraculous gifts (karāmāt). At their head stood a mysterious personage called the Qub (Axis): on the hierarchy of saints over which he presided the whole order of the universe was believed to depend. During the next two hundred years (A.D. 900–1100), various manuals of theory and practice were compiled: the Kitāb al Lami (the "Kulshā" by al-Qulub, the Risala of Qutb al-Mahjūb, the Kubbat al-Sakhā, the Brīda of Sakhārī, the Persian Kashf al-Mahjūb by 'Ali ibn 'Uthmān al-Hujwī in, and the famous Iḥyā by Ghazzālī. Inasmuch as all these works are founded on the same materials, viz., the Koran, the Traditions of the Prophet and the sayings of well-known Sufi teachers, they necessarily have much in common, although the subject is treated by each writer from his own standpoint. They all expatiate on the discipline of the soul and describe the process of purgation which it must undergo before entering on the contemplative life. The traveller journeying towards God passes through a series of ascending "stations" (ka'ba). He who traverses these (1) repentance, (2) abstinence, (3) renunciation, (4) poverty, (5) patience, (6) trust in God, (7) acquiescence in the will of God. After the "stations" comes a parallel scale of "states" of spiritual feeling (ajwāl), such as fear, hope, love, &c., leading up to contemplation (musākhahad) and intuition (yaqīn). It only remained to provide Sufism with a metaphysical basis, and to reconcile it with orthodox Islam. The double task was finally accomplished by Ghazzālī (q.v.). He made Islamic theology mystical, and since his time the revelation (kaḥf) of God has taken its place beside tradition (naql) as the reason (qap) as a source and fundamental principle of the faith. Protests have been and are still raised by theologians, but Musulon sentiment will usually tolerate whatever is written in sufficiently abstruse philosophical language or spoken in manifest ecstasy.

The Sūfis do not form a sect with definite dogmas. Like the monastic orders of Christendom, they comprise many shades of opinion, many schools of thought, many divergent tendencies—from asceticism and quietism to the wildest extravagances of pantheism. European students of Sūfism are apt to identify it with the pantheistic type which prevails in Persia. This, although more interesting and attractive than any other, throws the transcendental and visionary aspects of Sūfism into undue relief. Nevertheless some aspects are must be given here of the Persian theosophy which has fascinated the noblest minds of that subtle race and has inspired the most beautiful religious poetry in the world. Some of its characteristic features occur in the sayings attributed to Ḥāyezīd (d. A.D. 874), whom Buddhistics refuse unquestioningly. He said, for example, "I am the winewar and the wine and the cup-bearer, and again, "I went from God to God, until they cried from me in me, 'O Thou!'." The peculiar imagery which distinguishes the poetry of the Persian Sūfis was more fully developed by a native of Khorasan, Abā Sa'id ibn Abī l-Khair (d. A.D. 1049) in his mystical quatrains. The relationship between mirrors and the reflection thereof is by glowing and fantastic allegories of earthly love, beauty and intoxication. Henceforward, the great poets of Persia, with few exceptions, adopted as symbolic language either seriously or as a conventional manner. The Christian mystics professed: "The real basis of their poetry," says A. von Krenmer, "is a softly incubated ethical system, which recognizes in purity of heart, charity and peace the background and brings to the necessary conditions of eternal happiness. Attached to this is a pantheistic theory of the emanation of all things from God and their ultimate reunion with him. Although on the surface Islam is not directly assailed, it sustains many indirect attacks, and frequently the thought flashes out, that all religions and revelations are only the rays of a single eternal sun; that all prophets have only delivered and preserved the same truth, and that each has in due course died of beauty and eternal truth which flow from the divine soul of the world." The whole doctrine of Persian Sūfism is expounded in the celebrated Mathnawī of Jalāl ad-Dīn Rūmī, a more or less unscientific融化 and unscientific manner that its leading principles are not easily grasped. They may be stated briefly as follows:

God is the sole reality (al-Haqq) and is above all names and definitions. He is not an object of sense, but a principle, and therefore ABsolute Beauty. It is the nature of beauty to desire manifestation; the phenomenal universe is the result of this desire, according to the famous Tradition in which God says, "I was a being, and thou knowest not, and I was no being, and thou knewest me in order that I might be known." Hence the Sūfīs, influenced by Neoplatonic theories of emanation, postulate a number of intermediate worlds or descending plates of existence from the eternal universe, which accordingly has no more reality than a shadow cast by the sun. Its central point is Man, the microcosm, who reflects in himself all the Divine attributes. Man is the one, for the Sūfis by profession, who is born within him a spark of pure Being. The human soul belongs to the spiritual world and is ever seeking to be united to its source. Such unification, being a naturally attainable until death, can be enjoyed at times in the state called ecstasy (kadd), when the veil of sensual perception is rent asunder and the soul is merged in God. In the state of ecstasy the achievement of which self-annihilation is wrought by means of that divine love, to which human love is merely a stepping-stone. The true lover feels himself one with God, the only real being and agent in the universe; he is also the soul of every other being and thing, a doctrine since it is the Sūfī theosophy as it appears in Persian and Turkish poetry. Its perilous consequences are plain. It tends to abolish the distinction between God and man and to identify the concept of Not-being and has no real existence—and it leads to the delusion of the hierophant who can say, like Ḫusāin b. Manṣūr al-Hallāj, "I am the Truth." Sūfī fraternities, living in a convent under the direction of a sheikh, became widely spread before A.D. 1100 and gave rise to Dervish orders, most of which indulge in the practice of exciting ecstasy by music, dancing, drugs and various kinds of hypnotic suggestion (see Dervish).

Gentleman, the sugar, p. 327.

Gentleman, the sugar, p. 327.

Gentleman, the sugar, p. 327.
beet, carrot and other roots were identical with cane sugar.

The sugars obtained from honey were investigated by Lowitz and Proust, and the latter decided on three species: (1) cane sugar, (2) grape sugar, and (3) fruit sugar; the first has the formula C\textsubscript{6}H\textsubscript{12}O\textsubscript{6}, the others C\textsubscript{6}H\textsubscript{12}O\textsubscript{6}. This list has been considerably developed by the discovery of natural as well as of synthetic sugars.

It is convenient to divide the sugars into two main groups: monosaccharides (formerly simple sugars), and disaccharides (formerly saccharoses). The first term includes simple sugars containing two to nine atoms of carbon, which are known severally as bioses, trioses, tetroses, pentoses, hexoses, &c.; whilst those of the second group have the formula C\textsubscript{n}H\textsubscript{2n}O\textsubscript{n}, and are characterized by yielding two monosaccharose molecules on hydrolysis. In addition tri- and tetroses are known of the formula C\textsubscript{4}H\textsubscript{6}O\textsubscript{5}; these on hydrolysis yield two monosaccharose and one of a disaccharose type of three or one of a monosaccharose. It is found also that some monosaccharose behave as aldehydes whilst others contain a keto group; those having the first character are called aldoses, and the others ketoses. All sugars are colourless solids or syrups, which clear on strong heating; they are soluble in water, forming sweet solutions but difficultly soluble in alcohol. Their solutions are optically active, i.e. they rotate the plane of polarized light; the amount of the rotation is dependent upon the type of sugar and, in some cases, on the age of the solution (cf. GLUCOSE).

The rotation serves for the estimation of sugar solutions (saccharimetry). The sugar is neutral to litmus and do not combine with alkali or bases; strong bases, such as lime and baryta, yield saccharates, whilst, under certain conditions, acids and acid anhydrides may yield esters. Sugars are also liable to fermentation.\(^1\) Our knowledge of the chemical structure of the monosaccharose may be traced back as far as 1880, when Ziecke suspected some to be ketose sugars, for it was known that glucose and fructose, for example, yielded penta-acetates, and on reduction gave hexahydric alcohols, which, when reduced by hydric acid, gave normal and secondary hydroxylic alcohol. The facts suggested that the six carbon atoms formed a chain, and that a hydroxy group was attached to five of them, for it is rare that two hydroxy groups to be attached to the same carbon atom. The remaining oxygen atom is aldehydic or ketonic, for the sugars combine with hydrocyanic acid, hydroxylamine and phenylhydrazine. The correctness of this view was settled by converting from the monosaccharose to two members of the ketose fructose and and fructose, hydrolysed them to the corresponding oxo-acids, from which the hydroxy groups were split out by reduction; it was found that glucose yielded normal heptic acid and fructose normal hexahydric acid; hence glucose is an aldehyde alcohol CH\textsubscript{2}O\textsubscript{H}., CH\textsubscript{2}O\textsubscript{H}., and fructose is a keto alcohol CH\textsubscript{2}O\textsubscript{H}., CO.CH\textsubscript{2}O\textsubscript{H}.\(^2\) Kiliani also showed that arabinose, C\textsubscript{5}H\textsubscript{10}O\textsubscript{5}, a sugar found in cherry gum, was a aldopentose, and thus the common formula C\textsubscript{n}H\textsubscript{2n}O\textsubscript{n}.

Before proceeding to the actual synthesis of the sugars, it is advisable to discuss their decompositions and transformations.

1. by hydrolysia a sugar may be decomposed into monomer-carboxylic acids, which yield lactones; these compounds when reduced by sodium amalgam in sulphuric acid solution yield a sugar containing one more carbon atom. This permits the formation of sugar from a lower sugar (E. Fischer).

\[ \text{CHOH} \rightarrow \text{CHOH} \rightarrow \text{CHO} \rightarrow \text{CHO} \rightarrow \text{CHO} \]

Pentose \rightarrow Cyanhydrin \rightarrow Lactone \rightarrow Hexose.

2. Oximes.—The oximes permit the reverse change, i.e. the passage from a higher to a lower sugar. Wohl forms the oxime and converts it into an acetylated nitrile by means of acetic anhydride and acetic anhydride, acetic anhydride and acetic acid, and acetic anhydride and hydrochloric acid and the resulting acetate is hydrolysed by acting with ammonia to form an amide, which is finally decomposed with sulphuric acid.

\[ \text{CHOH} \rightarrow \text{CHOH} \rightarrow \text{CHOH} \rightarrow \text{CHOH} \rightarrow \text{CHOH} \rightarrow \text{CHOH} \]

CHO \rightarrow CN + CO + CHO.

Pentose \rightarrow Oxime \rightarrow Nitrile \rightarrow Pentose.

Ruff effects the same change by oxidizing the sugar to the oxo-acid, and further oxidizing this with Fenton's reagent, i.e. hydrogen peroxide and a trace of a ferrous salt:

\[ \text{C}_4\text{H}_6\text{O}(\text{CH}_2\text{OH}.)-\text{CHO} \rightarrow \text{C}_6\text{H}_5\text{O}_4(\text{CH}_2\text{OH}.)-\text{CO}_2\text{H} \rightarrow \text{C}_4\text{H}_6\text{O}(\text{CH}_2\text{OH}.) \]

3. Phenylhydrazine Derivatives.—Fischer found that if a molecule of phenylhydrazine acted upon one molecule of an aldose or ketose a hydrazone resulted which in most cases was very soluble in water; if three of these hydrazines reacted (one of which is reduced to ammonia and aniline) insoluble crystalline substances resulted, termed osazones, which readily characterized the sugar from which it was obtained.

\[ R \rightarrow R \rightarrow R \rightarrow R \rightarrow R \rightarrow R \]

CHO \rightarrow CH-OH \rightarrow CH-NHPh. \rightarrow CH-NHPh.

Aldose \rightarrow Hydrazone \rightarrow Osazone.

R \rightarrow R \rightarrow R \rightarrow R \rightarrow R \rightarrow R

CHO \rightarrow CH-NHPh. \rightarrow CH-NHPh. \rightarrow CH-NHPh.

A ketone \rightarrow Hydrazone \rightarrow Osazone.

On warming the osazone with hydrochloric acid the phenylhydrazone residues are removed and an osone results, which on reduction with zinc and acetic acid gives a ketose.

\[ R \rightarrow R \rightarrow R \rightarrow R \rightarrow R \rightarrow R \]

C\textsubscript{6}H\textsubscript{5}-NHPh. \rightarrow CO \rightarrow CO \rightarrow CH\textsubscript{2}OH.

Osazone \rightarrow Osone \rightarrow Ketose.

A ketose may also be obtained by reducing the osazone with zinc and acetic acid to an osmine, which with nitric acid gives the ketose.

\[ R \rightarrow R \rightarrow R \rightarrow R \rightarrow R \rightarrow R \]

C\textsubscript{6}H\textsubscript{5}-NHPh. \rightarrow CO \rightarrow CO \rightarrow CH\textsubscript{2}OH.

Osazone \rightarrow Osamine \rightarrow Ketose.

These reactions permit the transformation of an aldose into a ketone; the reverse change can only be brought about by reducing the ketone to an alcohol, and oxidizing this compound to an aldehyde. It is seen that aldoses and ketoses which differ stereochimically in the two final carbon atoms must yield the same osazone; and since d-mannose, d-glucose, and d-fructose do form the same osazone (d-glucosazine) differences either structural or stereochemical must be placed in the two final carbon atoms.\(^4\)

It may here be noticed that in the sugars there are asymmetric carbon atoms, and consequently optical isomers are to be expected. Thus glucose, containing four such atoms, can exist in 16 forms; and the realization of many of these isomers by E. Fischer may be regarded as one of the most brilliant achievements in modern chemistry. The general principles of stereochemistry being discussed in Stereiosomerism (q.v.), we proceed to the synthesis of glucose and fructose and then to the derivation of their configurations.

In 1861 Butlerow obtained a sugar-like substance, methylenitan, by fermenting the triose, acetone, and solid polyacrylonitrile; and since 188, by decomposing acrolein dibromide with baryta, and subsequently prepared by oxidizing cyanuric with bromine in alcoholic solution, and treating the product with dilute alkali at \(\alpha^2\) . Glycerin appears to yield, on mild oxidation, an aldehyde, CH\textsubscript{2}O\textsubscript{H}-(CH\textsubscript{2}OH.)-CHO, and a ketone, CH\textsubscript{2}O\textsubscript{H}-CO-CH\textsubscript{2}O\textsubscript{H}, and these condense as shown in the equation:

\[ \text{CH}_2\text{O}-(\text{CH}_2\text{OH})-(\text{CH}_2\text{OH})-(\text{CH}_2\text{OH})-(\text{CH}_2\text{OH})-\text{CH}_2\text{O}-(\text{CH}_2\text{OH})-\text{CHO} \]

The osazone prepared from α-acrose resembled most closely the glucosazine yielded by glucose, mannose, and fructose, but it was optically inactive; also the ketose which it gave after treatment with hydrochloric acid and reduction of the osone was like ordinary fructose. It was not, however, a ketose, for it was a mixture of dextro and laevo fructose, a supposition which was proved correct by an indirect method. The starting material (α-acrose) can reach mannite (a natural 1,5- O-mannitol), and both are readily converted into d-glucose, the α-acrose being formed from d-glucose, by the alcohol obtained by reducing α-acrose, with regard to optical activity. Mannite on oxidation yields an aldose, mannose, C\textsubscript{6}H\textsubscript{12}O\textsubscript{6}, which

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\(^1\) See Fermentation; and for the relation of this property to structure see Stereoisomerism.\(^2\) Aldoses and ketoses require modification in accordance with the views of Lowry and E. F. Armstrong, which postulate a γ oxide structure (see GLUCOSE). This, however, does not disturb the tenor of the following arguments.

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**XXVI. 2.**
on further oxidation gives a manonic acid, C\(_6\)H\(_{12}\)(OH)\(_2\)-COH; this acid readily yields a lactone. Also Killiani found that the lactone decomposed by fractional crystallization of the strychnine or brucine salts. A separation of a-acrose was made by acting with beer yeast, which destroyed the ordinary fructose and left l-fructose which was isolated as its osazone. Also (\(d+\)l) manonic acid can be split into the \(d\) and \(l\) acids by fractional crystallization of the strychnine or brucine salts. The acid yields, on appropriate treatment, \(d\)-mannose and \(d\)-maninit. Similarly the l acid yields the laevio derivatives.

The next step was to prepare glucose. This was effected indirectly, by the formation of the tetrose and oxalos of \(d\)-mannose and \(d\)-glucose showed that the stereochemical differences were situated at the carbon atom adjacent to the aldehyde group. Fischer and Piloty therefore indicated that the beetle of converting dextro- into laevo-tartaric acid; he found that both \(d\)-mannonic and \(d\)-gluconic acids (the latter is yielded by glucose on oxidation) were mutually convertible by heating with quinoline under pressure at 140°. It was then found that on reducing the lactone of the acid obtained from \(d\)-mannonic acid, ordinary glucose resulted.

Fischer's a-acrose therefore led to the synthesis of the dextro and laevo forms of mannose, glucose and fructose; and these substances have been connected synthetically with many other sugars by means of his cyahydrin process, leading to higher sugars, and Wohl and Ruff's processes, leading to lower sugars.

Certain of the relations are here summarized (the starting substance is in italics):—

L-Glucose \(\rightarrow\) l-arabinose \(\rightarrow\) l-mannose \(\rightarrow\) l-mannopentose; 

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If the asymmetric system adjoining the COH group, which is that introduced in synthesizing the hexose from the pentose, be eliminated, the formula at disposal may be:

\[ \text{CH}_3(\mathrm{OH}) \quad \text{or} \quad \text{CHOH} \]

When such compounds are converted into corresponding dibasic acids, COH\(_2\text{H}(\text{CH} \text{OH})_2\text{COH},\) the number of asymmetric carbon atoms in the molecule is decreased, and the compound is then no longer associated with four, but with only three different radicles. Hence it follows that the “optical” formulae of the acids derived from two pentoses having the configuration given above will be:

\[ \text{COH}_2 - \text{OH} \quad \text{COH} \]

\[ \text{COH}_2 + \text{COH}_2 \]

and that consequently only one of the acids will be optically active.

As a matter of fact, only arabinose gives an active product on oxidation; it is therefore supposed that arabinose is the compound, and consequently:

\[ \text{CH}_3(\text{OH}) - + + \text{COH} \quad \text{=} \quad \text{L-glucose} \]

\[ \text{CHOH} + + \text{COH} \quad \text{=} \quad \text{L-galucose} \]

When xylose is combined with hydroxyacetic acid and the pyranose is hydrolysed, together with L-xylo-ic acid, a second isomeric acid, L-idic acid, is produced, which on reduction yields the hexalose L-idose. When L-idonic acid is heated with pyridine, it is converted into L-ribose, but the latter is a compound of the same hexose nature as the former, and may be reduced to L-idose in a similar manner be converted into d-idonic acid, from which it is possible to prepare d-idose. It follows from the manner in which d-idose is produced that its configuration is CH\(_3\)(OH)+ + + COH.

The remaining aldohexoses discovered by Fischer are derived from d-galactose by milk-sugar. When oxidized this aldohexose is first converted into the monobasic galactonic acid, and then into d-glucuronic acid; the latter is optically inactive, so that its configuration must be one of those given in the sixth and seventh columns of the table. On reduction it yields an inactive mixture of galactonic acids, some molecules being attacked at one end, as it were, and others at the other end of the carbon chain. On reducing the lactone prepared from the inactive acid an inactive galactose is obtained from which L-galactose may be separated by fermentation. Lastly, when d-galactonic acid is heated with pyridine, it is converted into D-talose, and thence into L-talose, which is the same acid as the L-talose obtained from the fructose radical, while the first molecule is not formed from the aldose but from the ketose. D-Galactose can be obtained from the ketone L-galactose, which is obtained by oxidation of the aldose sugar. The configuration of the penta- and tris-aldoses have been determined by similar arguments; and those of the ketoses can be deduced from the aldoses.

**Disaccharoses.**

The disaccharoses have the formula C\(_6\)H\(_{12}\)O\(_6\) and are characterized by yielding under suitable conditions two molecules of a hexose: C\(_6\)H\(_{12}\)O\(_6\) + C\(_6\)H\(_{12}\)O\(_6\) = 2C\(_6\)H\(_{12}\)O\(_6\). The molecular compounds of the disaccharoses are not necessarily identical: thus cane sugar yields D-glucose and D-fructose (invert sugar); milk sugar and melibiose give D-glucose and D-galactose, whilst maltose yields only glucose. Chemically they appear to be ether arylidrides of the hexoses; but they are effectuated by the aldehyde or alcohol groups, and in consequence they are related to the ethers of glucose and other hexoses, i.e., to the glycosides. The sugar has no reducing power and does not form an hydrazone or osazone in the various other forms, and hence FeHegel’s solution and form hydrazones and osazones. D-Galactose, behaving as aldoses, i.e., as containing the group -CH(\text{OH})\-CHO. The rotation of the disaccharoses to the D- and L-glucosides was established by E. F. Armstrong (Journ. Chem. Soc., 1893, 58, 1395), who showed that cane sugar and maltose were d-glucoses, and raffinose an L-glucose of melibiose. These and other considerations have led to the proposal of an aldehyde group formula for glucose first proposed by Tollens; this view, which has been mainly developed by Armstrong and Fischer, has attained general acceptance (see GLUCOSE, GLUCOSIDE). Fischer has proposed formula for the important disaccharide sugars and has devised a method for determining how the molecule was built up, by forming the osone of the sugar and hydrolyzing, whereupon the hexose obtained indicates the aldose part of the molecule. Lactose is thus found to be glucosido-galactose and melibiose a galactosido-glucose.

Several disaccharoses have been synthetized by acting with hydroxyacetic acids on their sodium salts or sodium salts of acetic acid. Among the compounds of this type obtained from starch, the acetylated starch, is the most important sugar; it is manufactured in large quantities and its preparation is described under acetylated starch. Its preparation is described under acetylated starch.
Cuba, British Guiana and Hawaii, and in India and Java in the Old World. The numerous cultivated varieties are distinguished mainly by the colour of the internodes, whether yellow, red or purple, or striped, and by the height of the culm. Apart from the sugar-cane and the beet, which are dealt with in detail below, a brief reference need only be made here to maple sugar, palm sugar and sorghum sugar.

Maple Sugar.—This is derived from the sap of the rock or sugar maple (Acer saccharum), a large tree growing in Canada and the United States.

The sap is collected in spring, just before the foliage develops, and is procured by making a notch or boring a hole in the stem of the tree. A tree may yield 30 gallons of juice a day and continue flowing for six weeks; but on an average only about 4 lb. of sugar are obtained from each tree, 4 to 6 gallons of sap giving 1 lb. of sugar. The sap is purified and concentrated in a simple manner, the whole work being carried on by farmers, who themselves use much of the product for domestic and culinary purposes.

Jaggery.—That which comes into the European market as jaggery or khahur is obtained from the sap of several palms, the wild date (Phoenix sylvestris), the palmyn (Borassus flabellifer), the coconut (Cocos nucifera), the gomuti (Arenga saccharifera) and other of the palm family which are cultivated in a portion of the Ganges valley to the north of Calcutta. The trees are ready to yield sap when five years old; at eight years the best is obtained, and in such a tree the annual supply will till the reach thirty years. The collection of the sap (toddy) begins about the end of October and continues, during the cool season, till the middle of February. The sap is drawn off from the upper growing portion of the tree, and in the interval of each week an average tree will run in a season 350 lb. of toddy, from which about 35 lb. of raw sugar—jaggery—is made by simple and rude processes. Jaggery production is extensive in India, Ceylon, Java, and the greater part of the count made is consumed locally; it only occasionally reaches the European market.

Sorghum Sugar.—The stem of the Guinea corn or sorghum (Sorghum saccharum) has long been known in China as a source of sugar. The sorghum is harder than the sugar-cane; it comes to maturity in a season, and it retains its maximum sugar content a considerable time, giving opportunity for leisurely harvesting. The sugar is obtained by the same method as cane sugar.

Cane Sugar Manufacture.—The value of sugar-canes at a given plantation or central factory would at first sight appear Commercial Values of sugar to vary directly as the amount of saccharine content of the juice expressed from them varies. Sugar canes, and if canes with juice indicating 6° Beaune are made a basis of value or worth, say at 10s. per ton, then cane sugar with juice indicating 6° Beaune would be worth per ton

<table>
<thead>
<tr>
<th>Degrees Beaune</th>
<th>6°</th>
<th>7°</th>
<th>8°</th>
<th>9°</th>
<th>10°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tons of cane crushed per day</td>
<td>935-6</td>
<td>955-2</td>
<td>977-4</td>
<td>1000</td>
<td>1023-8</td>
</tr>
<tr>
<td>Tons of juice expressed</td>
<td>701-7</td>
<td>717-2</td>
<td>733-1</td>
<td>750</td>
<td>767-9</td>
</tr>
<tr>
<td>Tons of water evaporated</td>
<td>622</td>
<td>622</td>
<td>622</td>
<td>622</td>
<td>622</td>
</tr>
<tr>
<td>Tons of 1st Muscovado sugar</td>
<td>79-7</td>
<td>95-2</td>
<td>111-1</td>
<td>128</td>
<td>145-9</td>
</tr>
<tr>
<td>Tons sugar of all classes recovered</td>
<td>62-2</td>
<td>74-3</td>
<td>86-7</td>
<td>100</td>
<td>114-0</td>
</tr>
<tr>
<td>Total output of sugar in 100 days. Tons</td>
<td>6220</td>
<td>7430</td>
<td>8670</td>
<td>10,000</td>
<td>11,400</td>
</tr>
<tr>
<td>Total value of all sugars per day</td>
<td>$147.6</td>
<td>$159.4</td>
<td>$169.3</td>
<td>$180</td>
<td>$191.2</td>
</tr>
<tr>
<td>Less factory expenses per day</td>
<td>$300</td>
<td>$300</td>
<td>$300</td>
<td>$300</td>
<td>$300</td>
</tr>
<tr>
<td>Leaves per canes crushed.</td>
<td>4/4</td>
<td>6/2</td>
<td>8/2</td>
<td>10/-</td>
<td>11/11</td>
</tr>
</tbody>
</table>

But it is obvious that it would not pay a planter to sell canes at 4s. 2d. a ton instead of at 10s. a ton, any more than it would pay a factory to make only 62-2 tons of sugar in 24 hours, or 6220 tons in the crop of 100 days, instead of 10,000 tons. Hence arises the imperative necessity of good cultivation by the planter, and of circumcision in the purchase and acceptance of canes on the part of the manufacturer.

The details of manufacture of sugar from cane and of sugar from beetroot differ, but there are five operations in the production of the sugar of commerce from either material which are common to both processes. These are:

1. The extraction of the juice.
2. The purification or clarification of the juice.
3. The evaporation of the juice to syrup point.
4. The concentration and crystallization of the syrup.
5. The drying or production of the crystals for the market by separating the molasses from them.

Extraction of Juice.—The juice is extracted from canes by squeezing them between rollers. In India at the present day there are thousands of small mills worked by hand, through which the peasant cultivators pass their canes two or three times, in order to make a sufficient quantity of raw sugar. In Barbadoes there are still many estates making good Mascarbo sugar; but as the juice is extracted from the cane by windmills, and then concentrated in open kettles heated by direct fire, the financial results are disastrous, since nearly half the yield obtainable from the canes is lost. In the best organized modern cane sugar estates as much as 12½% of the weight of the canes treated is obtained in crystal sugar of high polarizing power, although in Louisiana, where cultivation and manufacture are alike more carefully and admirably carried out, the yield in sugar is only about 7½% of the parent material. The canes are also sometimes treated, but seldom, as much as 5%. This is due to conditions of climate, which are much more favorable for the formation of saccharine in the canes than in Cuba. The protection afforded to the planters by their government, however, enables them to pursue the industry with considerable profit, notwithstanding the poor return for their labour in saleable produce.

As an instance of the influence of climatic conditions combined with high cultivation the cane lands of the Sandwich Islands may be taken. Here the tropical heat is tempered by constant trade winds, there is perfect immunity from hurricanes, the soil is peculiarly suited for cane-growing, and by the use of specially-prepared formulae and an ample supply of water at command for irrigation the land yields from 90 to 100 tons of cane per acre, from which 12 to 14% of sugar is produced. To secure this marvellous return, with an annual rainfall of 26 in., as much as 52,000,000 gallons of water is pumped per 24 hours from artesian wells on one estate alone. With an inexhaustible supply of irrigation water obtainable, there is no reason why the lands in Upper Egypt, if scientifically cultivated and managed, should not yield as abundantly as those in the Sandwich Islands.
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In the Paris Exhibition of 1900 a cane-crushing mill was shown with three rollers 32 in. in diameter by 60 in. long. It is driven by a powerful engine through triple gearing of 42 to 1, and speeded to have a surface velocity of rollers of 15 ft. 9 in. per minute. This mill is intended to crush thoroughly and efficiently from 250 to 300 tons of canes in 24 hours. In Louisiana two mills, set one behind the other, each with three rollers 32 in. in diameter by 78 in. long, and driven by one engine through gearing of 15 to 1, can have a surface velocity of rollers of 25 ft. 6 in. per minute (or 60% more than that of the French mill described above), and they are efficiently crushing 900 to 1200 tons of canes in 24 hours. In Mauritius, Demerara, Cuba, Java and Peru double crushing and maceration (first used on a commercial scale in Demerara by the late Hon. William Russell) have been generally adopted; and in many places, especially in the Hawaiian Islands, triple crushing is adopted. By passing the canes through three consecutive sets of rollers, in order to extract everything possible of extraction by pressure) is employed. In the south of Spain, in some favoured spots where sugar-canews can be grown, they are submitted even to four successive crushings.

It has been found in practice advantageous to prepare the canes for crushing in the mills, as above described, by passing them through a preparatory series of rollers which are grooved or indented in such manner as to draw in and flatten down the canes, no matter in which way they are thrown or heaped upon the cane-carrier, and thus prepare them for feeding the first mill of the series; thus the work of crushing is carried on uninterruptedly and without constant stoppages from the mills choking, as is often the case when the feed is heavy and the canes are not prepared.

Although it cannot be said that any one system of extraction is the best for all places, yet the following considerations are of general application:—

a. Whatever pressure be brought to bear upon it, the vegetable or woody fibre of the cane, containing the juice, is held and retinted of the moment a quantity of moisture equal to its own weight, and in practice 10% more than its own weight; or in other words, 100 lb. of the best crushed meglass will consist of 47-62 lb. of fibre and 52-38 lb. of moisture—that is, water with sugar in solution, or juice.

b. Canes vary very much in respect of the quality and also as to the quantity of the juice they contain. The quantity of the juice is the test to which recourse must be had in judging the efficiency of the extraction, while the quality is the main factor to be taken into account with regard to the results of subsequent manufacture.

For the application of the foregoing considerations to practice, the subjoined table has been prepared. It shows the greatest quantity of juice that may be expressed from canes, according to the different proportions of fibre they contain, but without employing maceration or imbibition, to which processes reference is made hereafter. The percentages are representative of the original weight of the uncrushed canes.

<table>
<thead>
<tr>
<th>Percentage of fibre in canes</th>
<th>Percentage of juice in canes</th>
<th>Percentage of juice reduced in meglass</th>
<th>Percentage of maximum for canes</th>
<th>Percentage of best average expression in practice</th>
<th>Percentage of juice left in meglass in practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Cent.</td>
<td>Per Cent.</td>
<td>Per Cent.</td>
<td>Per Cent.</td>
<td>Per Cent.</td>
<td>Per Cent.</td>
</tr>
<tr>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>90</td>
<td>89</td>
<td>88</td>
<td>87</td>
<td>86</td>
<td>85</td>
</tr>
<tr>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>80</td>
<td>78</td>
<td>76</td>
<td>74</td>
<td>72</td>
<td>70</td>
</tr>
<tr>
<td>79</td>
<td>76-9</td>
<td>74-9</td>
<td>72-9</td>
<td>70-6</td>
<td>68-5</td>
</tr>
<tr>
<td>11</td>
<td>12-1</td>
<td>13-2</td>
<td>14-3</td>
<td>15-4</td>
<td>16-5</td>
</tr>
</tbody>
</table>

The British Guiana Planters' Association appointed a sub-committee to report to the West India Commission on the manufacture of sugar, who stated the following:—

With cane containing 12% fibre the following percentages of juice can be expected from it in the form of juice:

<table>
<thead>
<tr>
<th>Single crushing</th>
<th>Double crushing</th>
<th>Double crushing with 12% dilution</th>
<th>Triple crushing with 10% dilution</th>
<th>Diffusion with 25% dilution</th>
</tr>
</thead>
<tbody>
<tr>
<td>76%</td>
<td>85%</td>
<td>88%</td>
<td>88%</td>
<td>94%</td>
</tr>
</tbody>
</table>

These results are equivalent to 66-88% extraction for single crushing, 74-80% for double crushing, 77-74% for double crushing with 12% dilution, 79-70% for triple crushing, and 82-72% for diffusion with 25% dilution.

To prevent the serious loss of juice left in the meglass by even the best double and triple crushing, maceration or imbibition was introduced. The meglass coming from the first mill was saturated with steam and water, in weight equal to between 20% and 25% of its weight, and placed, in the case of fresh sugar-canes, to drive away any added water, but a limit was imposed by the fact that water might be used in excess. Hence in the latest designs for large factories it has been proposed that as much normal juice as can be crushed at one time shall be added to the meglass; and the meglass shall then be so mixed with twice as much water as there is juice remaining in it; after which, on being subjected to a third crushing, it will yield a degraded juice, which would also be treated by heating. It is found that in replacing the juice of these two qualities by syrup, full to pass to the vacuum pans for cooking to crystals, the total amount of evaporation from the degraded juice is about half that required from the normal juice produced by double crushing.

Great improvements have been made in the means of feeding the mills with canes by doing away with hand labour and substituting mechanical feeders. The simplest steam-driven mechanism will take the cane waggons on to the cane-carriers. By the adoption of this system in one large plantation in California, 7000 tons of canes were crushed in 24 hours; the labour of sixty-four hands was dispensed with, and was thus made available for employment in the fields. In Louisiana the use of the mechanical feeder for crushing purposes is very general.

With a view of safeguarding themselves from breakdowns caused by the inequality of feeding, or by the action of malicious persons introducing foreign substances, such as crowbars, bolts, &c., among the canes, machines were adopted—so-called hydraulic attachments, applied either to the meglass roll or the top roll bearings. These attachments, first invented by Jeremiah Howard, and described in the United States Patent Journal as a system of machinery whereby the hydraulic pressure is used against the top cap arrangement is, that if the volume or feed is large enough to lift the top roll from the cane roll, it will simultaneously lift it from the meglass roll, so that the meglass will not be as well pressed as it ought to be; and an objection to the side cap arrangement on the meglass roll as well as to the top cap arrangement is, that in case more cane is fed in at one end of the rolls than at the other, they cannot be pushed out at all. (The object of the hydraulic attachment is, and though it may thus avoid a breakdown of the rolls, it is apt, in so doing, to break the ends off the teeth of the crown wheels by putting them out of line with one another. The toggle-joint attachment, which is simply a cylindrical wooden wheel, with the same end as the hydraulic attachments, is open to the same objections.)

The preparation of cane juice by diffusion (a process more fully described under the head of beetroot sugar manufacture) is adopted in a few plantations in Java and Cuba, in Louisiana and the Hawaiian Islands, and in one or two factories in Egypt; but hitherto, except under exceptional conditions (as at Aska, in the Madras Presidency, where the local price for sugar is three or four times the London price), it would not seem to offer any substantial advantage over double or triple crushing. With the latter system practically as much sugar as is obtained from the canes by diffusion, and the resulting meglass furnishes, in a well-appointed factory, sufficient fuel for the crop. With diffusion, however, in addition to the strict scientific control of the temperature and time of maceration, there is a further danger that the wood—has to be provided for the working off of the crop, since the spent chips or slices from the diffusers are useless for this purpose; also that the cane is truly reduced to as small a mass as possible, and to a certain extent been utilized as fuel by mixing them with a portion of the molasses, otherwise which would have been sold or converted into rum. The best results from extraction by diffusion have been obtained when the cane is boiled. It is not difficult to give the cane good water; but in the Hawaiian Islands, and in Cuba and Demerara, diffusion has been abandoned on several well mounted estates and replaced by double and triple crushing; and it is not likely to be re-introduced again, because of the extra cost of working is made up by the slight increase of sugar produced. In Louisiana diffusion is successfully worked on two or three large estates; but the general body of planters are shy of using it, although there is no lack of water, the Mississippi being near at hand.

Purification.—The second operation is the coagulation of the amalgam, and the separation of it with other impurities from the
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juice which holds them in suspension or solution. The moment
the juice is expelled from the cells of the cane chemical inver-
scum, and the sooner it is stopped the better. This is effec-
ted by the addition of lime to neutralize the free acid. As cold juice
has a tendency to separate into scums and scums, it is best to use
the juice with lime when cold. This is easily done in liming or measur-
ing tanks of known capacity, into which the juice is run from the mill.
The requisite amount of milk of lime set up at 10° Beunné is then
added. In Java and Mauritius, for example, 12° Beunné milk of lime
is sometimes used, and this is equivalent to 3° Beunné milk of lime.
It is a well-known fact that a weaker solution is preferable, since the proper proportion is more
easily adjusted. In Demerara and other places the juice is then
heat under pressure up to 220° F. to 250° F. on
the field, where the juice is then heated by the steam
due to the superheated juice flashes off, and is either utilized for
and the steam supplied to the multiple effect evaporators,
or it is allowed to escape into the atmosphere. The
boiling juice is run down into subasing tanks, where it cools, and
at the same time the albumen, which has been suddenly coagulated
by the heat, is allowed to settle in the tanks. The two
of the tank, carrying with it the vegetable and other matters which
were in suspension in the juice. After reposting some time, the
clear juice is carefully decanted by means of a pipe fixed by a swivel
joint to an outlet in the bottom of the tank, the upper end of the
pipe being always kept at the surface of the liquor by a float attached
to it. Thus clear liquor alone is run off, and the mud and cloudy
liquor which is left in the tank is left undisturbed, and discharged
separately as required.

In Australia a continuous juice separator is generally used, and
preferred to ordinary subasing or filtering tanks. It is a cylin-
derical vessel provided in its bottom with a central outlet of
about the same depth. Such a vessel is conveniently made of a diameter which will give
the required circulation speed at the required distance expressed
from the cane-mill in one hour. The hot liquor is con-
ducted downwards in a continuous steady stream by a central pipe
to eight horizontal branches, from which it issues into the separator at
the level of the junction of the cylindrical and conical portions
of the vessel. Since the specific gravity of hot liquor is less than
that of cold liquor, and since the specific gravity of the scum and
particles of solid matter in suspension separates itself from it and fall to the bottom
and is discharged from the separator. Thus the liquor in the separator is
distributed over a large area relatively to its volume, and while
this is necessarily effected with but little disturbance to the contents
of the vessel, a very slow velocity is ensured for the current of
heating and subasing. In a continuous separator of which the cylindrical
portion measures 13 ft. in diameter and 6 ft. deep (a suitable
size for treating a juice supply of 4000 to 4500 gallons per hour),
the upward current in the separator has a velocity of about 1 in. per hour
and it is found that all the impurities have thus ample time to
separate themselves. The clear juice when it arrives at the top
of the separator flows slowly over the level edges of a cross canal
and reaches the under side of two rotary scrapers, formed of L-irons,
which are turned and driven by a horizontal shaft provided with
a suitable handle. The scums then settle down to the bottom of the cone, whence they are run off to the scum tank. In large separators, the heat
is generated by steam generated in an open boiler, and this
steam being supplied to the separator, and the temperature
is maintained constant. In this apparatus the scums are more perfectly automatic, an arrangement for condensing and
to and mixing with the juice the proper proportion of milk of lime
has been adapted to it; and although it may be objected that once
the albumen has been coagulated, there is a great variation in the quality of the juice coming from the mill owing
to the variations that may occur in the cans fed into the mills,
it is obviously as easy to vary the proportion with the automatic
milk of lime, than to attempt the same by removing or adding
the scum. The separator is already installed in Martinique.

In Cuba, Martinique, Peru and elsewhere the old-fashioned
double-bottomed defecator is used, into which the juice is run
direct, and then limed and heated. This defecator is
made with a hemispherical copper bottom, placed in
an outer cast-iron casing; which forms a steam jacket,
and the juice runs into the bottom through a central pipe
of the bottom. If double-bottomed defecators are used in sufficient
number to allow an hour and a half to two hours for making
each defecation, one hundred and one hundred and
forty minutes are required to be filled up by the cane-mill with juice in ten to twelve minutes.

If double-bottomed defecators are used in sufficient
time to make a perfect defecation as is obtainable by us
system; but their employment involves the expenditure of much
higher proportion of heat. In Martinique, for example, the heat from the juice, already heated
enough through the small surface of the hemispherical bottom
also the use of filter presses for treating the scums. A great
deal of skill and superstition is also required, and first cost is
comparatively large. When a sufficient number of defecators
for a two hours' defecation, it is the practice in some factories to

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powdered megass have been found very efficient for removing the large quantity of impurities contained in the juice expressed from the very vigorous but rank canes grown in that wonderfully fertile country, but unless constant care is taken, it will soon occasion the water in the vacuum pans to take on a smoky and inefficient appearance. To prevent this, there is great risk of inversion in taking place, with consequent loss of sugar.

After the juice has been defatted or purified by any of the means described in the former pages, it is then ready for evaporation, and the operation hereinafter described, where it is concentrated to 26° or 28° Baumé, and is then conducted in a continuous stream either into the service tanks of the vacuum pan, if dark sugars are required, or, if a bellow is used, into rectangular or rectangular vessels, holding from 500 to 1500 gallons each, according to the capacity of the factory, and fitted with steam coils at the bottom and skinning troughs at the top, for the purpose of degreasing the juice, is then made up to the water in the bellow and skinned for about five minutes, when it is run off to the service tanks of the vacuum pans. The heat at which the syrup boils in the clarifiers, 220°F., has the property of separating a great deal of the gum still remaining in it, and thus cleansing the solution of sugar and water for crystallization in the vacuum pans; and if after skinning the syrup is run into separators or subsiders of any description, and allowed to settle down and cool before being drawn into the vacuum pan for crystallization, this cleansing process will be more thorough and the quality of the final product will be improved. Whether the improvement will be profitable or not to the planter or manufacturer depends upon the class of the vacuum pan, and the conditions of foreign tariffs, which are not infrequently hostile.

Evaporation of the Juice to Syrup.—The third operation is the concentration of the approximately pure, but thin and watery, juice to the proportions and density of the sugar cane juice. The commonest method is to pass the water in vacuo through some system of heating and evaporation. Since on an average 70% by measurement of the normal defatted cane juice has to be evaporated in the vacuum pan, this is the most important and most essential part of the total operation necessary in large estates than the open-fire batteries still common in Barbados and some of the West Indian islands, and in small haciendas in Central America and Brazil, but seldom seen elsewhere. By the battery process, the juice is boiled until it was afterwards finished in the vacuum pan, very good sugar was produced, but at a cost that would be ruinous in to-day’s markets.

In the best days of the so-called Jamaican trains in the thirteenth-quarters of a ton of coal in addition to the megass was burned per ton of sugar made, and with this for many years planters were content, because they pointed to the fact that in the central factories, then working in Martinique and Guadeloupe, with charcoal filters and triple-effect evaporator, 750 kilos of coal in addition to the megass were consumed to make 1000 kilos of sugar. All this has now been changed. It is unquestionably better and easier to evaporate in the vacuum pan, and the best and most efficient is the work of Norberto Rilleux in New Orleans in 1840, under whom improvements are in progress every year. It was Rilleux who invented the multiple-effect evaporator, now syrup, and ready to enter the vacuum pan for further concentration and crystallization. In a patent (No. 3507, 1812) granted to E. C. Howard, the principle is that the most uncrystallizable in preference to that which is most crystallizable sugar, and the patentee speaks of “a discovery I have made that no solution, unless highly concentrated, of sugar has the quality of solution of the syrup, or of evaporating water, by which the sugar would not be dissolved, or to be exposed to its boiling temperature during the period required to evaporate such solution to the crystallizing point, and stated it was necessary to make a magma of sugar and water at atmospheric temperature, and heated the same to 190° or 200°F., in a water or steam bath, and then added more sugar or a thinner magma, and the whole being then in a state of imperfect fluidity, boiled as close readily behind the stirrer, was filled into moulds and purged” (drawn). “I do further declare,” he added, “that in the application of heat to the refining of sugar in my said invention or process I have stated and mentioned the temper- ature to be selected, and in the use of the said system of evaporators, at the time it would be dissolved, and by the addition of more and more sugar and water, applied in order to preserve and secure the colour and crystalliz- ability of the sugars, and most easily to be used with precision and uniformity by means of the water bath and steam bath, yet when the same have been condensed, separated, and crystallized, to make use of higher temperatures, although less beneficial.”

Howard at any rate saw clearly what was one of the indispensable requisites for the success of his construction the temperature in order to avoid the formation of soggy colloids—

the treatment of saccharine solutions at temperatures very considerably lower than 212°F., which is the temperature of water boiling at normal atmospheric pressure. Nor was he long in providing means for securing these lower temperatures. His patent (No. 3754 of 1813) describes the closed vacuum pan and the air pump with condenser for steam by injection, the use of a thermometer immersed in the solution in the pan, and a method of ascertaining the temperature of the solution with a proof stick, and by observations of the temperature at which, while fluid and not containing grain, it could be kept boiling under different pressures shown by a vacuum gauge. A table is attached of boiling points from 115°F. to 75°F., corresponding to decreasing power of the vacuum gauge. Since Howard published his invention the vacuum pan has been greatly improved and altered in shape and construction; multiple-effect evaporators have been added, and the advantage of the ideas that the best steam in vacuo having been acknowledged, the system has been adopted in many other industries, and streams of condensers have turned their attention to the principle. In endeavouring to make the best use of the air pump and the balance of power, they have imagined many ingenious mechanical contrivances, such as currents produced mechanically to promote evaporation and crystallization, feeding the pan from many points in order to prevent the feed from soiling the floor and getting cooked, and so on. All their endeavours have obtained at best but a doubtful success, for they have overlooked the fact that the most expensive apparatus is the steam from the vacuum pan at least an equal weight (or in practice about 15% more) of steam must be condensed, and the first cost of mechanical agitators, together with the expenditure they involve for motive power and
maintenance, must be put against the slight saving in the heating surface effected by their employment. On the other hand, the advocates of admitting the feed into a vacuum pan in many minute streams appeal rather to the ignorant and incomprehending, sugar-beet grower. The result is that, roughly, a batch of 10 tons of raw sugar is to be purged at 20 ft. per hour, or 150 tons of raw sugar in a pan in a few hours, feeding it through a single pipe and valve 10 in. in diameter. Nevertheless, in the light of experience, the second position has been gained in the contest of these two theories, and purity and high quotient of impurity are being treated, injecting the feed at a number of different points in the pan does reduce the time required to boil the pan, though of no practical advantage as regards the extent of the manipulation of the size, which impedes circulation and therefore quick boiling. Watt, when he invented the steam engine, laid down the principles on which it is worked, and the separate invention of Watt and fair from the vision of the man who carried them out. The vacuum pan is erected at a height which commands the crystalizers, each of which will, as in days gone by in Cuba, hold the contents of the pan, and these in their turn are set high enough to allow the charge to fall into the feeding-trough of the center. This obviating the necessity of any labour to remove the raw sugar from the time it leaves the vacuum pan to the time it falls into the centrifugals. For this reason alone, and without taking into consideration any increase in the yield of sugar brought about by "crystallization in movement," the system is worthy of adoption in all sugar factories making crystal sugar.

Crystalizers.

There exist two kinds of sugar, the cylindrical or semi-cylindrical vessels, fitted with a strong horizontal shaft running from end to end, which is kept slowly revolving. The shaft carries arms and blades fixed in such a manner that they strike the surface of the mass of syrup, and as a result the syrup is continually thrown back from the arms while at the same time a gentle but sustained evaporation is produced by the continuous exposure of successive portions of the mass to the action of the atmosphere. In this way the crystals already formed are continually maintained in a condition of growth, and not on the idiosyncrasy of the experts who manage them; and there is no doubt that in large commercial processes of manufacture the simpler apparatus used for obtaining a desired result, and the mechanical nicety with which it is carried on for the manufacturer. The sugar made from the first syrups does not require a crystallizer in movement to prepare it for purging in the centrifugals, but it is convenient to run the syrup into the crystallizer and so empty the pan at once and leave it ready to commence another strike, while the second syrups will be better for twenty-four hours' stirring and the third sugars for forty-eight hours' stirring before they are ready for the centrifugals. Electricity has been applied, with indifferent success, but they have been very efficiently driven, each independently of the other, and more yet, by means of a modification of a Pelton wheel, supplied with water from the river, it has been found that comparatively small stream strikes the wheel with a pressure equivalent to a great head, say 300 ft., and as the quantity of water is sufficiently large to keep the wheels and so on, the greatest ease and nicety, each machine can without danger be quickly brought up to its full speed when purging high-class sugars, or allowed to run slowly when purging low-class sugars, until the heavy, gummy molasses have been expelled; and it can then be brought up to its full speed for finally drying the sugar in the basket, a boon which all practical sugar-makers will appreciate. The vacuum forced by the force-pump against the Pelton wheels returns by a waste-pipe to the tank, from which the force-pump takes it again.

Recent Progress.—The manufacture of cane sugar has largely increased in volume since the year 1901-1902. This, apart from the effects of the tariff, allude to the abolition of the sugar duties. This result of the increased employment of improved processes, carried on in improved apparatus, under skilled supervision, and with due regard to the significance of the chemical aspects of the work. Numerous central factories have been established in the countries with plant of large capacity, and many of them work day and night for six days in the week. There were 173 of these factories working in the central factories and the "Chaparra," in the province of Oriente, turned out upwards of 60,000 tons of sugar in the crop of about 1908-1909, nearly all had efficient plant for treating the excellent canes grown in that favoured island. (See Jaarboek voor suiker-

Central Factories.
The use of multiple-effect evaporation made it possible to raise the steam for all the work required to be done in a well-equipped factory, making crystals, under skilful management, and necessary in any speed now known, have been used on a large scale for decades in Essex, ground without, the aid of other fuel. The bagasse so used is now commonly taken straight from the cane mill to be crushed, designed for burning it, in its moist state and without previous drying, obtaining the necessary heat from it to suitable boilers, such as those of the multitube type or of the water-tube type. The value of fresh bagasse, or as it is called in the sugar industry, bagasse with water from which it comes, with their treatment in the mill, and with the skill used in firing; but it may be stated broadly that 1 lb of fresh bagasse will produce from 1½ lb to 2½ lb of steam, according to conditions.

The use of preparing rolls with corrugations, to crush and equalize the feed of canes to the mill, or to the first of a series of mills, has been long known. The Krajewski crusher has two V-shaped steel rolls, with V-shaped corrugations extending longitudinally across them. These rolls run at a speed about 30% greater than the speed of the first mill, to which they deliver the canes well crushed and flattened, forming a close mat of pieces of cane 5 to 6 in. long, so that the subsequent grinding can be carried out without the stoppages occasioned by the mill chocking with a heavy and irregular feed. The crusher is preferably driven by an independent engine set at the same speed by the same engine.

The Krajewski crusher was invented some years ago by a Polish engineer resident in Cuba, who took out a patent for and sold it. The patent has expired. The crushing time in the output for a given time of crushing of the Krajewski crusher has been estimated at 20 to 25% and varies with the quality of the canes; while the yield of juice or extraction is increased by 1% to 1½%.

The process of continuous defecation which was introduced into Cuba from Santo Domingo about 1900 had by 1910 borne the test of some ten years' use with notable success. The method which is known for this purpose in France is well known and has been already described, but it may be mentioned that the regulation of the admission of steam is now simplified and secured by a patent thermostat—a self-acting apparatus in which the unequal expansion of steam and water is utilized, by heat, the steam being expanded, after by the introduction of compressed air, a diaphragm which controls the steam stop-valve—and by this means a constant temperature of 210° F. is maintained in the juice within the defecator during the whole time it is at work.

Earthly matter and other matter precipitated and fallen on the copper double bottom may be dislodged by a slowly revolving scraper—say every twelve hours—and ejected through the bottom discharge cock; and thus the heating surface of the copper bottom will be kept in full efficiency. With ordinary care on the part of the men in charge, Hatton defecators will work continuously, without a skilled attention to them; and all the advantages procurable from the use of Hatton defecators as follows:

- Cold liming; heating gently to the temperature required to coagulate the albumen and not beyond it, whereby disturbance would ensue; the continuous separation of the scums; the gradual drying of the scums so as to make them ready for the fields, without carrying away juice or requiring treatment in filter presses; and the continuous supply of hot defecated juice to the evaporators, without the use of subsiding tanks or eliminators; and, finally, the saving in expenditure on plant, such as filter presses, etc., and wages.

**Beetroot Sugar Manufacture.—** The sugar beet is a cultivated variety of *Beta maritima* (nat. ord. Chenopodiaceae), different varieties of which, under the name of mangold or mangel-wurzel, are known as feeding roots for cattle. About 1760 the Berlin apothecary Marggraff obtained in his laboratory, by means of alcohol, 6-2% from sugar from a white variety of beet and 4.5% from a red variety. At the present day, the cultivation of beet sugar has been subjected to a study of many years, the improvements of cultivation, the careful selection of the variety, the grading and manuring, especially with nitrate of soda, the average beet worked up contains 7% of fibre and 93% of juice, and yields in Germany 12-70% and in France 11-6% of its weight in sugar. In Great Britain in 1910 the cultivation of beet for sugar was being seriously undertaken in Essex, as the result of careful consideration during several years. The pioneer experiments on Lord Denbigh's estates at Newham Paddox, in Warwickshire, in 1900, had produced excellent results, both in respect of the weight of the beets per acre and of the saccharine value and purity of the juice. The average weight per acre was over 253 tons, and the mean percentage of pure sugar in the juice exceeded 15%. The roots were grown under exactly the same cultivation and conditions as a crop of mangel-wurzel—that is to say, they had the ordinary cultivation and manuring of the usual root crops. The weight per acre, the saccharine contents of the juice, and the quotient of purity compared favourably with the best results obtained in Germany or France, proportioned to those achieved in other countries, who between 1868 and 1872 supplied Mr Duncan's beetroot sugar factory at Lavenham; for the weight of their roots rarely reached 15 tons per acre, and the percentage of sugar in the juice appears to have varied between 10 and 12. On the best-equipped and most skilfully managed cane sugar estates, where the climate is favourable for maturing the cane, a similar return is obtained. Therefore, roughly speaking, one ton of beetroot may be considered to-day as of the same value as one ton of cane; the value of the refuse chips in one case, as food for cattle, being about one quarter of the value of the refuse bagasse, as fuel, in the other.

But beetroot had been brought to the very threshold of perfection, and while the factories for its manipulation were worked with hydraulic presses for squeezing the juice out of the pulp produced in the raperies, the cane sugar planter in the West Indies could easily hold his own, notwithstanding the artificial competition created and maintained by sugar bounties. But the degree of perfection attained in the cultivation of the roots and their subsequent manipulation entirely altered this situation and brought about the crisis in the sugar trade referred to in connexion with the bounties (see History below) and dealt with in the Brussels convention of 1902.

In beetroot sugar manufacture the operations are washing, slicing, diffusing, saturating, sulphuring, evaporation, concentration, and packaging.

**Slicing.—** The roots are brought from the fields by carts, canals and railways. They are weighed and then dumped into a washing machine, consisting of a large horizontal cage, submerged in water, in which revolves a horizontal shaft carrying arms. The arms are set in a spiral form, so that in revolving they not only stir the roots, causing them to rub against each other, but also force them forward from the receiving end of the cage to the other end. Here they are discharged (washed and freed from any adhering soil) into an elevator, which carries them up to the top of the building and delivers them into a hopper feeding the slicer. Slicers used to consist of a number of blades, generally 6, which were fitted with knives and made 140 to 150 revolutions per minute, under the hopper which received the roots. This hopper was divided into two parts by vertical division plates, and the roots were adjusted so that they fell simultaneously into the roots and sliced and pulped them. Such machines were good enough when the juice was expelled from the small and, so to speak, polysaccharides and pulp by means of hydraulic presses. But hydraulic presses have now been used in a large number of factories; the juice is universally obtained by diffusion, and the small slices have gone out of use, because the large amount of pulp they produced in proportion to slices is not suitable for the diffusion process, in which evenly cut slices are required, which present a much greater surface with far less resistance to the diffusion water. Instead of the small slicers, machines made on the same principle, but of large dimensions, 3 ft. in diameter and 5 ft. inside, with the necessary division plates for the knives, 50 to 100 revolution under the hopper, run at 140 to 150 revolutions the disks revolve only 60 to 70 times per minute. Such a slicer is capable of efficiently slicing 300,000 kilos of roots per hour, running for 8 hours, against being changed four times in that period, or often if required, for it is simply a series of cylinders from the moment the slices show by their rough appearance that the knives are losing their cutting edges.

**Diffusion.—** The second closed, vertical, cylindrical vessels, holding generally 60 hectolitres, or 1320 gallons, and are arranged in batteries of 12 to 14. Sometimes the cells are erected in a circle, so that the spout below the slicing machine revolving at 140 revolutions, comes into contact with the inside of the centre of any of the cells. In other factories the cells are arranged in rows and are charged from the slicer by suitable telescopic pipes, and other convenient means. A circular disposition of the cells facilitates charging by the use of a single one for them, but it renders the disposal of the hot spent slices somewhat
SUGAR

difficult and inconvenient. The ejection of the cells in straight lines may cause some little complications in charging, but it allows the hot spent slices to be discharged upon a travelling band which takes them to an elevator, an arrangement simpler than any which is practicable when the cells are disposed in a circular form, especially if the sugar mill is in a continuous action and each temperature cell has altered its battery in such manner that instead of having to open a large door below the cells in order to discharge them promptly, he opens a communications door and, as the liquid and gas are expelled, the possibility of the cell, blows the whole contents of spent slices up a pipe to the drying apparatus, thus saving not only a great deal of time but also a great deal of labour of a kind which is both arduous and dangerous, especially during cold weather. The cakes, sold as food for cattle, fetch as much as $4 per ton in Rumania, where four or five beetroot factories are now at work. A cell when filled with fresh slices becomes the head of the battery, and while skilled scientific and industrial help is required to adapt the process, the best and most economical way of heating the slices, previous to admitting the hot liquor from the next cell, is by direct steam; but as the slightest attention or carelessness in the admission of direct steam might have the effect of converting sugar and thereby causing the loss of some portion of saccharine in the slices, water heaters are generally used, through which water is passed and heated up previous to admitting the dried slices. When the cell is filled up and the slices are warmed through, the liquor from the adjoining cell, which hitherto has been running out of it to the saturators, is turned into the new cell, and beginning to displace the fresh slices, runs through the saturation in the normal way. When the new cell comes into operation and becomes the head of the battery, the first or tail cell is thrown out, and number two becomes the new tail cell; or vice versa, being emptied and one filled or charged with slices and heated up, the latter becoming the head of the battery as soon as it is ready.

Saturation.—The juice, previously treated with lime in the diffusion battery, flows thence into a saturator. This is a closed vessel, into which carbonic acid gas (produced as described hereafter, is formed, and combining with the lime in the juice forms carbonate of lime. The juice, thus filled with the clear acid, is run into a filter press, where the clear juice being run off for further treatment, while the carbonate of lime is obtained in cakes which are taken to the fields as manure. The principal improvement made of recent years is in the portion of the process has been the construction of pipes through which the carbonic acid gas is injected into the juice in such a manner that they can be easily withdrawn and a clean set substituted. The filter presses remain substantially unchanged, although many ingenious but slight alterations have been made in their details. The juice, which has now become comparatively clear, is again treated with lime, which is again run through a saturator and filter presses, and comes out still clearer than before. It is then treated with sulphuric acid gas, for the purpose of decolorization, again limed to neutralize the acid, and then passed through a third saturator. The process of saturation is continued until the juice is entirely unalloyed. The number of saturations with corresponding lime and carbonates with corresponding labour and plant only one is required. The coefficient of purity is increased and the viscosity of the juice diminished. The total saving effected is stated to be equivalent to 1.9 franes per ton of beetroot worked. This system is also being tried on a small scale with sugar-cane juice in the West Indies. If by this process a more perfect defecation is obtained, the juice, obtained by treatment, will have no doubt be highly beneficial to the greatest advantage for the processes of refining in lime can be effected, because but very little is used in a cane factory in comparison with the amount used in a beet factory.

Evaporation and Crystallisation.—The clear juice thus obtained is evaporated, and it is again run into a filter press and finally into a vacuum pan, and the sugar is purified in centrifuges. From the centrifuge the sugar is either turned out without washing as raw sugar, or can be further refined. It is well washed with a spray of water and air until white, and then it is hung in the market as refined sugar, although it has never passed through animal charcoal (bone-black). The processes of evaporation and crystallization are carried on as they are in a cane sugar factory, but with this advantage, that the beet solutions are free from impurities and glucose than those obtained from sugar-canes, and are therefore easier to cool.

Carrying.—There are various systems of carrying, so-called refined, sugar or centrifugal sugar, all designed with a view of obtaining the sugar in lumps or tabs, as to appear as if it had been turned out from moulds and not from centrifugals, and great ingenuity and large sums of money have been spent in perfecting these different systems, with more or less happy results. But the great achievement of recent manufacture is the production, without the use of animal charcoal, of a cheaper, but good and wholesome sugar, in rectangular blocks, which are carried as whole units and purposes, except for making preserves of fruits in the old-fashioned way. The domestic manufacturers of the present day use this sugar; they boil the jam in sucrose and secure a product that is more wholesome and blossoms the juice in the branches rather than being exposed for a short time to a greater heat. The commercial advantage of this method is the saving of gas and the time of heating, in lessening the time by one-half a day; in drier weather, the gas is not increased, but the process by which a leaf of cold is run into the highly limed juice in the saturators is made by the calculation of limestone in a klin provided with three cleaning doors, so arranged as to be allowed to pass from 30 to 40 per cent. of fresh water每次, in order to prevent the sugar from becoming too hot in the klin, the temperature is allowed to rise to about 185 degrees C. in three hours. The gas generated in the klin is taken off at the top by a pipe to a gas-washer. In this it passes through four sheets of water, by which it is not only freed from any dust and dirt that might have been introduced, but also cooled to a temperature which permits an air-pump to withdraw the gas from the klin, through the gas-washer, and force it into the saturators, without overheating. In some factories for refining sugar made from beet or cane this system of crystallization is used, and enables the refiner to work with syrups distinctly alkaline and to economize a notable amount of animal charcoal.

Refining.—Briefly, sugar-refining consists of melting raw or unrefined sugar with water into a syrup of 27° or 28° Beaumé, or 1230 specific gravity, passing it through filtering cloth to remove the unalloyed impurities, and boiling it in a mechanical suspension, and then through animal charcoal to remove any remaining matter and lime, thus producing a perfectly clear white syrup, which, cooked in the vacuum pan and crystallized, becomes the refined sugar of commerce.

Melting Pans.—The melting pans are generally circular vessels fitted with a perforated false bottom, on which the sugar to be melted is dumped. The pans are provided with steam worms to keep the mass hot, and hoods are fitted which enable a man to keep it in movement and thoroughly mixed with the water and sweet water which are added to the sugar to obtain a solution of the specific gravity desired. Any sand or heavy matter in suspension is allowed to fall to the bottom of the pan in a "sandbox" before the melted sugar is run off to the cloth filters. In a process employed with great success in some refineries the raw sugars are washed before being melted, and thus a purer article is obtained for subsequent treatment. In this process the raw sugar is mixed with a small amount of syrup so as to form a suitable magma, and is then run into a continuous centrifugal, which separates the debris and the syrup. When it has collected, it is run out, comparatively clean, into the melting pans described above.

Filters.—Tallay bag filters are generally used for clearing the magma, and for its mechanical impurities. They were introduced years ago by the company of the "Batey" in the West Indies. The filter presses are very different in construction to-day from what they were when first employed. They consist of tanks or cisterns fitted with "hoseback" or with the flat bag fitted. Frequently bagged is suspended in a suitable manner, and in some cases the jackets of the all by means of an arched band of cloth. The sugar or liquor to be filtered flows from the melting pans. The bags, though 60 in. or more in circumference, are folded up in such a way that a worker with about 84.5 inches around his neck can pass them over them. Thus a maximum of filtering surface with a minimum of liquor in each bag is obtained, and a far greater number of bags are got into a given area that would otherwise be possible, while the danger of bursting the bags by leaving them unsupported is avoided. As the liquor goes on filtering through the bags they gradually get filled up with slime and sludge, and the bags are very soon changed and the sugar or liquor of the new batch turned on to the other side of the bags and sheaths, and hot water supplied to them to wash out all the sweets they contain. Large doors at the side of the cisterns are then opened, and as soon as the bags are filled with the syrup and are thoroughly cleaned, the cistern is turned over and the contents run off in the open air above the mud tank. By this arrangement the work of a refinery can be carried on with about one-half the cisterns otherwise required, because, although it does not reduce the number of bags with about 84.5 inches, in a given amount of work, it enables the refiner to use one cistern twice a day with
Each arranged the Beaumé mystery to size cwt., uniform filled. long similar the removed. place fitted room, "in the have arranged to come to the cistern and are arranged to form the apparatus fitted with the Charleston cisterns or filters. These are large cylindrical vessels from 20 to 50 ft. high, and of such diameter as to hold a given quantity of animal charcoal (also called "bone-black" and "char") in pig, and which is diverted from the mother-liquor. The usual size of cistern forming a convenient unit is one that will hold 20 tons of char. Each cistern is fitted with a perforated false bottom, on which a blanket or specially woven cloth is placed, to receive the char which is poured in from the trace and packed as evenly as possible until the cistern is filled. The char is then "settled" by water being slowly run on to it, in order to prevent the mixing for channels and not permeating the whole mass evenly. The cistern being thus packed and settled is closed, and the syrup from the bag filters, heated up to nearly boiling point, is admitted at the top until the cistern is quite full. A considerable process of drainage, the cisterns being allowed to escape as it is displaced by the water or syrup. In some refineries this pipe, which is carried to a higher level than the top of the cistern, is fitted with a whistle which sounds as long as the passage is full of syrup. When this passes the char is allowed to be full, and the entrance of further water or syrup is stopped. The syrup in the cistern is allowed to remain for about twelve hours, by which time quantities absorbed all the colouring matter in it, as well as the time. A cistern of practical capacity of 10 tons of char will hold, in addition, about 10 tons of syrup, and after settling, this can be pressed out by allowing second quality syrup to wash in over the first. The syrup is then washed from the top, or it may be pressed out by boiling water. By carefully watching the flow of the discharge cock of the cistern the change from the first liquor to the next is easily detected. The washed liquor runs into both openings at the bottom of the cistern to escape as it is displaced by the water or syrup. A weak solution, called "sweet water," is sometimes used for melting the raw sugar, or it is evaporated in a multiple-effect apparatus to 27° Beaumé density, passed through the char filter, and cooked in the vacuum pan like the other liquors. After the sweets have come away, cold water is passed through the char until the new liquor or lime is found in it; then a large manhole at the bottom of the cistern is opened, the charcoal is removed. In most modern refineries the cisterns are so arranged that the spent char falls on to a travelling band and is conducted to an elevator which carries it up to the drying floor of the refinery.

Retorts for Reburning Char.—The kilns are made with either fixed or revolving retorts. The former perhaps produce a little better char, but cannot be worked automatically, require less labour and attention for an equal amount of working, and consequently have proved very satisfactory. From the drying floor on which the spent char is heated up it falls by gravitation into the retort. These are set in a kiln or oven, and are kept at as even a temperature as possible, corresponding to a dull cherry-red. Below each retort, and attached to it, is a cooler formed of thin sheet-iron, which receives the hot char as it passes from the retort, and at the bottom of the cooler is an arrangement of valves which permit a certain amount of char to drop out and no more. With the fixed retorts these valves are worked from time to time to continuous labour and attention, and make room in the retort for more space. In the newer type the retort is kept open, and the charge is kept going, and the whole of the work in connexion with the char is performed mechanically, with the exception of packing the filter cisterns with fresh char. The retort is divided into several bands, and the whole is divided into a number of bands. In former days, when refining sugar or "sugar balking" was supposed to be a mystery only understood by a few of the initiated, there was a place in the refinery called the "secret room." This was a square, or made up of small rooms, which was, however, it applies not to any room, but to a small copper cistern, constructed with five or six more divisions or small canals, into which all the charcoal cisterns discharge their liquors by passing them into the second or third opening. Each cistern is fitted with a cock and swivel, in such a manner that the liquor from the cistern can be turned into the proper division according to its quality.

Vacuum Pans and Receivers.—The filtered liquors, being collected in the various service tanks according to their qualities, are drawn from the vacuum pans and boiled to crystals. These are then discharged into large receivers, which are filled by means of pumps and stirrers, and from the receivers the cooled mass passes to the centrifugal machines. As in the beetroot factories, these machines are driven by steam, and the sugar is poured into it, and turn out sugar in lumps or tablets presenting an appearance similar to what of loaf sugar made in moulds, as this kind of sugar meets with the greatest demand. Granulated sugar, so called, is made by introducing the molasses into the vacuum pans, and is passed through a large and slightly inclined revolving cylinder with a smaller one inside heated by steam. The sugar fed into the upper end of the cylinder gradually works its way down to the lower, showering itself upon the warm roll, and thus being converted into granules. When passing out at the upper end, carries off the vapour produced by the drying of the sugar, and at the same time assists the evaporation. The dry sugar thus passes into a rotating screen fitted with two meshes, so that three grades of sugar are obtained, the coarsest being that which falls out at the lower end of the revolving screen.

Recent Improvements.—Systematic feeding for the vacuum pan and systematic washing of the massecuite have been recently introduced not only into refineries, but also into sugar houses or factories on plantations of both cane and beetroot, and great advantages have resulted from their employment. The first modification of the process of feeding the cisterns; the second, lowering the level of the massecuite; the third, introducing the vacuum pan with the richest syrup, and then as the crystals form and this syrup becomes thereby less rich the pan is fed with syrup of lower density, and so on till it is equal to that of the mother-liquor to which it is added, and so on till the syrup is reduced to the lowest possible. The systematic washing of the massecuite is the reverse of this process. When the massecuite, worked on different systems, but equally successful, is first washed with syrup of low density, to assist the separation of mother-liquor of similar quality, this washing being supplemented by the injection of pure syrup of high density, or "claire," which is thus termed secondary spirit. The following is an adopted system assert that, as compared with other methods, not only do they obtain an increased yield of sugar of better quality, but also they do so at a less cost for running their machines and with a reduced expenditure on fuel and other provisions, an important fact, as the French term for syrup of 27° to 30° Beaumé specially prepared from the purest sugar.

In the modern refineries in the details of sugar refining which have come into use in late years, it should be mentioned that loaf sugar made in conical moulds, and sugars made otherwise, to resemble loaf sugar, have practically disappeared from the trade, having been replaced by cube sugar, which is found to be more economical as subject to less waste by grocers and housekeepers, and also less troublesome to buy and sell. Its manufacture was introduced into England many years ago by Messrs Henry Tate & Son, and is now generally adopted all over the world. The process and apparatus patented in March 1890 by M Gustave Adant, a foreman sugar refiner of Brussels.

The modern kiln is a combination of the process and apparatus, as communicated by the courtesy of Messrs. Henry Tate & Son.

Groups of cells or moulds are built within and against a cylindrical iron casing, by means of vertical plates inserted in grooves and set in the bottom of the casing. The moulds are inserted, or are made to turn out a slab of sugar about 14 in. long—this being about the height of the cell—and about 8 in. wide and about 3 in. to 4 in. thick. By means of a travelling crane the casing is placed within an iron drum, to which it is secured, and then is brought under an overhead vacuum pan, from which the cells are filled with masseeuite. After cooling, the casing is lifted out of the drum by a crane, assisted by compressed air, and is then conveyed by a travelling crane to a vertical centrifugal, inside of which it is made fast. Suitable provision is made for the egress of syrup from the masseeuite in the cells when undergoing purging in the centrifugal, and the efflux is divided by a fan-like division of injection of refined syrup and completed by that of "claire." When this is done, the casing is hoisted out of the centrifugal and the vertical plates and the slabs of sugar are extracted. The slabs are conveyed through a horizontal conveyor machine, by which cutting machine, provided with knives so arranged that the cutting takes place both downwards and upwards, and here the slabs are cut into cubes. The cubes fall from the cutting machine on to a conveyor machine, which sets them in rows, one to a row, in size from the rest. These latter pass to automatic weighing machines, which drop them, in quantities of 1 cwt., into wooden boxes of uniform measurement, made to contain that weight; and the boxes are then conveyed to the storehouse, ready for sale.

History and Statistics.—Strabo xv. i. 20, has an inaccurate notice from Nearchus of the Indian honey-bearing reed, and various classical writers of the first century of our era notice the sweet sap of the Indian reed or even the granulated salt-like product which was imported from India, or from Arabia
and Opone (these being entrepôts of Indian trade), under the name of saccharum or ἁῦκαρος (from Skr. sarkara, gravel, sugar), and used in medicine. The art of boiling sugar was known in Gangetic India, from which it was carried to China in the first half of the 7th century; but sugar refining cannot have then been known, for the Chinese learned the use of ashes for this purpose only in the Mongol period, from Egyptian visitors. The cultivation of the cane in the west spread from Khūtīzān in Persia. At Gūndē-Shāpur in this region sugar was prepared with art 1 about the time of the Arab conquest, and manufacture on a large scale was carried on at Shuster, Sūs and Askar-Mokram throughout the middle ages. It has been plausibly conjectured that the art of sugar refining, which the farther East learned from the Arabs, 2 was developed by the famous physicians of this region, in whose pharmacopoeia sugar had an important place. Under the Arabs the growth and manufacture of the cane spread far and wide, from India to Sūs in Morocco (Edrīsī, ed. Dozy, p. 62), and were also introduced into Sicily and Andalusia.

In the age of principal food staples sugar became the great disseminators of the cultivation of sugar; the cane was planted in Madeira in 1420; it was carried to San Domingo in 1494; and it spread over the occupied portions of the West Indies and South America early in the 16th century. Within the first twenty years of the 16th century the sugar trade of San Domingo expanded with great rapidity, and it was from the dues levied on the imports brought thence to Spain that Charles V. obtained funds for his palace-building at Madrid and Toledo. In the middle ages Venice was the great European centre of the sugar trade, and towards the end of the 17th century a Venetian citizen received a reward of 100,000 crowns for the invention of the art of making loaf sugar. One of the earliest references to sugar in Great Britain is that of 100,000 lb of sugar being shipped to London in 1319 by Tomasso Loredano, merchant of Venice, to be exchanged for wool. In the same year there appears in the accounts of the chamberlain of Scotland a payment at the rate of 18. 9½d. per lb for sugar. Throughout Europe it continued to be a costly luxury and article of medicine only, till the increasing use of tea and coffee in the 18th century brought it into the list of principal foods. The increase in the consumption is exemplified by the fact that, while in 1700 the amount used in Great Britain was 10,000 tons, in 1800 it had risen to 150,000 tons, and in 1885 the total quantity used was almost 1,100,000 tons.

In 1747 Andreas Sigismund Marggraf, director of the physical classes in the Academy of Sciences, Berlin, discovered the existence of common sugar in beetroot and in numerous other fleshy roots which grow in temperate regions. But no practical use was made of the discovery during his lifetime. The first to establish a beet-sugar factory was his pupil and successor, Franz Carl Achard, at Cunern (near Breslau) in Silesia in 1801. The processes used were at first very imperfect, but the extraordinary increase in the price of sugar on the Continent caused by the Napoleonic policy gave an impetus to the industry, and beetroot factories were established at many centres both in Germany and in France. In Germany the enterprise came to an end almost entirely with the downfall of Napoleon I.; but in France, where at first more scientific and economical methods of working were introduced, the manufacturers were able to keep the industry alive. It was not, however, till after 1830 that it secured a firm footing; but from 1840 onwards it advanced with giant strides.

It was the bounty system, by which the protectionist countries of Europe stimulated the beet sugar industry by bounties on exports, the production of sugar in bounty-paying countries was encouraged and pushed far beyond the limits it could have reached without state aid. At the same time the consumption of sugar was greatly restricted owing to the heavy excise duties imposed mainly to provide for the payment of the bounties. The very large quantity of output made available for export under these exceptional conditions brought about the flooding of the British and other markets with sugars at depressed prices, not unfrequently below the prime cost of production, to the harassment of important industries carried on by British refiners and sugar-growing colonies. In these circumstances, the British government sent out invitations on the 2nd of July 1887 for an international conference to meet in London. The conference met, and on the 30th of August 1888 a convention was signed by all the powers represented except France—namely, by Austria, Belgium, Germany, Great Britain, Italy, the Netherlands, Russia and Spain. France withdrew because the United States was not a party to it. The first article declared that "The high contracting parties engage to take such measures as shall constitute an absolute and complete guarantee that no open or disguised bounty shall be granted on the manufacture or exportation of sugar." The seventh article provided that bountied sugars (sucres primés) must be excluded from import into the territories of the signatory powers, by absolute prohibition of entry or by levying thereon a special duty in excess of the amount of the bounties, from which duty sugars coming from the contracting countries, and not bounty-fed, must be free. The convention was to be ratified on the rat of August 1890, and was to be put in force on the 1st of September 1892.

The convention of 1888 was never ratified, and it is doubtful whether its ratification was urged, for a bill introduced by the British government in 1889 to give it effect was not pressed, and it was manifest that there was hesitation—which presently became refusal—to uphold the policy of the penalties on the importation of bountied sugar imposed by the seventh article, without which the convention would be so much waste paper.

Eight years later, on the 1st of August 1896, the bounties offered by the governments of Germany and Austria-Hungary were approximately doubled, and France had a bill in preparation to increase hers correspondingly; although it was computed that they were even then equivalent to a grant of £3. 5s. per ton. So wrote Mr Chamberlain, the colonial secretary, on the 9th of November following, to the treasury. The minute plainly stated that it had become a question whether the continued enjoyment of advantages resulting from the importation of cheap bounty-fed sugar to some British industries did not involve the ruin of the British sugar-producing colonies; and that he was not prepared, as secretary of state for the colonies, to accept the responsibility of allowing matters to take their course and to acquiesce in the policy of non-intervention hitherto pursued in regard to the colonies without having satisfied himself as to what such a policy might entail as to the colonies and the exchequer. Mr Chamberlain concluded by asking whether the treasury would consent to sending a royal commission to the West Indies to inquire into the effect of the foreign sugar bounties on their principal industry.

The treasury accepted the proposal, and a royal commission proceeded to the West Indies in December 1896, and reported a few months later in 1897. Only one commissioner, however, denounced the bounties as the real cause of the utter breakdown of trade and of the grievous distress which all three had witnessed.
SUGAR

The full text in French, with an English translation, of the Sugar Convention, signed at Brussels on the 5th of March 1902 by plenipotentiaries of the governments of Germany, Austria-Hungary, Belgium, Spain, France, Great Britain, Italy, the Netherlands, and Sweden, will be found in a return presented to parliament in April 1902 (Miscellaneous, No. 5, 1902, Cd. 1013).

Table I.—Amounts (reduced to English money per cwt. avoiding due to the total net sugar bounties granted by European powers according to the computation issued by the secretary of the United States treasury on the 12th of December 1898.

<table>
<thead>
<tr>
<th>Sugar classed as (per cwt.)</th>
<th>Hard Dry Refined.</th>
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<tbody>
<tr>
<td>Less than 98%</td>
<td>98% and over.</td>
</tr>
</tbody>
</table>

Sir H. Bergene reported on the 27th of July 1907 to Sir Edward Grey that—

"The permanent session had met in special session on the 25th of July, to consider the suggestion of His Britannic Majesty's government to the effect that, if Great Britain could be relieved from the obligation to enforce the penal provisions of the convention, they would be prepared to give notice on the 1st of September next of their intention to withdraw from the 1st of September 1908 a notice which they would otherwise feel bound to give at the appointed time," and he added that "At this meeting, a very general desire was expressed that, in these circumstances, arrangements should, if possible, be made which would permit Great Britain to remain a party to the Sugar Convention."

On the 1st of August 1907 the Belgian minister in London transmitted to Sir Edward Grey a draft, additional act prepared by the commission for carrying out the proposal of His Britannic Majesty's government, and on the 28th of August following an additional act was signed at Brussels by the plenipotentiaries of the contracting parties, by which they undertook to maintain the convention of the 5th of March 1902 in force for a fresh period of five years.

On the 2nd of December 1907 Sir H. Bergene wrote to the foreign office from Brussels, reporting that a special session of the permanent commission, established under the sugar bounties convention, had opened on the 18th of November, and the principal matter for its consideration had been the application of Russia to become a party to the convention on special terms. A protocol admitting Russia to the sugar convention was signed at Brussels on the 16th of December 1907.

Sir A. H. Hardinge on behalf of Great Britain made the following declaration:

"The assent of His Majesty's government to the present protocol is limited to the provisions enabling Russia to adhere to the convention, and does not imply assent to the stipulation tending to restrict the importation of Russian sugar."

When, in April 1908, Mr. Asquith became premier, and Mr. Lloyd George chancellor of the exchequer, the sugar convention...
SUGAR

46

TABLE
The

II.

world's trade in cane and beet sugar in tons avoirdupois at decennial periods from 1840 to 1870, inclusive, and yearly from_ 1 871 to
cwt. in shillings and pence. Tons avoirdupois
1901 inclusive, with the percentage of beet sugar and the average price per
of

Year.

2240

ft

= ioi6

kilogrammes.


The cane and beet sugar crops of the world for 1909-1910, with the average of the crops for the seven preceding years from 1902-1903, in tons of 2240 lb.

A.—Cane sugar (compiled from the Weekly Statistical Sugar Trade Journal of Messrs Willett & Gray of New York, and books and reports published under the authority of the government of India).

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</thead>
<tbody>
<tr>
<td>Africa—</td>
<td></td>
<td></td>
<td>Asia—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td>55,000</td>
<td>67,992</td>
<td>Venezuela</td>
<td></td>
<td>3,000</td>
</tr>
<tr>
<td>Mauritius</td>
<td>200,000</td>
<td>181,688</td>
<td>Total in America</td>
<td>3,958,000</td>
<td>3,197,252</td>
</tr>
<tr>
<td>Réunion</td>
<td>45,000</td>
<td>33,299</td>
<td>China</td>
<td>1,000,000</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Natal</td>
<td>45,000</td>
<td>27,857</td>
<td>Dutch Colony</td>
<td>1,200,000</td>
<td>1,019,739</td>
</tr>
<tr>
<td>Total in Africa</td>
<td>356,000</td>
<td>312,435</td>
<td>Java and Madoera</td>
<td>1,200,000</td>
<td>942,255</td>
</tr>
<tr>
<td>America—</td>
<td></td>
<td></td>
<td>Japan and Formosa</td>
<td>130,000</td>
<td>942,255</td>
</tr>
<tr>
<td>Argentina</td>
<td>120,000</td>
<td>132,410</td>
<td>United States possession</td>
<td>145,000</td>
<td>125,468</td>
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<td>Brazil</td>
<td>276,000</td>
<td>218,214</td>
<td>Philippine Islands</td>
<td>7,000</td>
<td>6,000</td>
</tr>
<tr>
<td>British Colonies—</td>
<td></td>
<td></td>
<td>Siam</td>
<td>7,000</td>
<td>6,000</td>
</tr>
<tr>
<td>Trinidad</td>
<td>45,000</td>
<td>45,232</td>
<td>Total in Asia</td>
<td>6,232,000</td>
<td>5,845,432</td>
</tr>
<tr>
<td>Barbados</td>
<td>40,000</td>
<td>37,492</td>
<td>Australia and Polynesia—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jamaica</td>
<td>12,000</td>
<td>13,253</td>
<td>British Colonies—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antigua and St Kitts</td>
<td>25,000</td>
<td>21,857</td>
<td>Fiji Islands</td>
<td>60,000</td>
<td>49,928</td>
</tr>
<tr>
<td>Demerara</td>
<td>115,000</td>
<td>114,922</td>
<td>Queensland</td>
<td>135,000</td>
<td>144,000</td>
</tr>
<tr>
<td>Lesser Antilles</td>
<td>6,000</td>
<td>10,715</td>
<td>New South Wales</td>
<td>14,500</td>
<td>20,706</td>
</tr>
<tr>
<td>Total in British Colonies</td>
<td>241,000</td>
<td>243,871</td>
<td>Total in Australia and Polynesia—</td>
<td>219,500</td>
<td>214,634</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>2,500</td>
<td>2,657</td>
<td>Europe—</td>
<td>16,000</td>
<td>19,473</td>
</tr>
<tr>
<td>Cuba</td>
<td>1,700,000</td>
<td>1,180,203</td>
<td>Total in Europe</td>
<td>16,000</td>
<td>19,473</td>
</tr>
<tr>
<td>Danish Colony, St Croix</td>
<td>15,000</td>
<td>12,587</td>
<td>Summary—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dutch Colony, Surinam</td>
<td>15,000</td>
<td>13,149</td>
<td>Africa</td>
<td>365,000</td>
<td>312,436</td>
</tr>
<tr>
<td>French Colonies—</td>
<td></td>
<td></td>
<td>America</td>
<td>3,958,000</td>
<td>3,107,252</td>
</tr>
<tr>
<td>Martinique</td>
<td>40,000</td>
<td>34,279</td>
<td>Asia</td>
<td>6,232,000</td>
<td>5,845,432</td>
</tr>
<tr>
<td>Guadeloupe</td>
<td>40,000</td>
<td>37,500</td>
<td>Australia and Polynesia</td>
<td>219,500</td>
<td>214,634</td>
</tr>
<tr>
<td>Total in French Colonies</td>
<td>80,000</td>
<td>71,779</td>
<td>Europe</td>
<td>16,000</td>
<td>19,473</td>
</tr>
<tr>
<td>Ecuador</td>
<td>7,000</td>
<td>5,143</td>
<td>Total production of cane sugar in the world</td>
<td>10,787,500</td>
<td>9,499,227</td>
</tr>
</tbody>
</table>
| Guatemala             | 7,500        | 8,016                                       | B.—Beet sugar (compiled from data furnished by the Statistisches Bureau für die Rübenzucker Industrie des Deutschen Reiches, of Mr. F. O. Licht, Magdeburg).

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</tr>
</thead>
<tbody>
<tr>
<td>Austria-Hungary</td>
<td>1,040,687</td>
<td>1,149,516</td>
<td>875,383</td>
<td>1,485,944</td>
<td>1,322,716</td>
<td>1,402,157</td>
<td>1,376,501</td>
<td>1,420,102</td>
<td>1,239,172</td>
</tr>
<tr>
<td>Belgium</td>
<td>220,550</td>
<td>202,233</td>
<td>173,967</td>
<td>323,577</td>
<td>278,338</td>
<td>228,862</td>
<td>254,258</td>
<td>246,051</td>
<td>239,902</td>
</tr>
<tr>
<td>Denmark</td>
<td>35,004</td>
<td>45,258</td>
<td>44,161</td>
<td>64,958</td>
<td>65,042</td>
<td>53,147</td>
<td>64,367</td>
<td>63,973</td>
<td>53,548</td>
</tr>
<tr>
<td>France</td>
<td>820,050</td>
<td>791,600</td>
<td>612,592</td>
<td>1,072,473</td>
<td>744,353</td>
<td>716,218</td>
<td>794,312</td>
<td>811,970</td>
<td>793,658</td>
</tr>
<tr>
<td>Germany</td>
<td>1,734,624</td>
<td>1,697,234</td>
<td>1,572,923</td>
<td>2,909,059</td>
<td>2,263,510</td>
<td>2,095,809</td>
<td>2,049,851</td>
<td>2,007,780</td>
<td>1,900,637</td>
</tr>
<tr>
<td>Holland</td>
<td>100,793</td>
<td>121,600</td>
<td>134,394</td>
<td>203,912</td>
<td>178,351</td>
<td>174,417</td>
<td>210,958</td>
<td>196,841</td>
<td>160,375</td>
</tr>
<tr>
<td>Italy</td>
<td>82,433</td>
<td>128,794</td>
<td>77,143</td>
<td>92,433</td>
<td>104,762</td>
<td>133,618</td>
<td>162,701</td>
<td>114,168</td>
<td>111,718</td>
</tr>
<tr>
<td>Russia</td>
<td>1,236,409</td>
<td>1,187,842</td>
<td>928,508</td>
<td>1,383,404</td>
<td>1,417,386</td>
<td>1,357,732</td>
<td>1,237,590</td>
<td>1,171,849</td>
<td>1,194,105</td>
</tr>
<tr>
<td>United States</td>
<td>192,376</td>
<td>204,847</td>
<td>204,410</td>
<td>279,236</td>
<td>426,171</td>
<td>433,428</td>
<td>377,545</td>
<td>418,288</td>
<td>352,890</td>
</tr>
<tr>
<td>Other countries</td>
<td>201,510</td>
<td>249,254</td>
<td>205,548</td>
<td>246,384</td>
<td>289,220</td>
<td>268,498</td>
<td>299,935</td>
<td>274,594</td>
<td>250,650</td>
</tr>
</tbody>
</table>

The matter temporarily dropped, but certain Liberal members of parliament continued to press for the withdrawal of Great Britain from the convention, it being stated that a promise had been privately given by Sir Henry Campbell-Bannerman that the government would withdraw as soon as practicable. On the 15th of July 1908, Mr Asquith said that Sir Edward Grey had announced in the House of Commons on the 6th of June 1907 that the British government intended to negotiate with the powers for the renewal of the convention, on condition that they would relinquish the penal clause, and that none of the obligations in the convention as renewed were penal or required statutory authority.

Tables II., III. (p. 773) and IV. (p. 774) give statistics of cane and beet sugar production. The quantities for India have been computed from information furnished by the India office, and publications made under authority of the secretary of state and the commercial intelligence department of the Indian government.

The whole of the sugar produced in India is consumed in the country and sugar is imported, the bulk of it being cane sugar coming from Mauritius and Java, and about 85% of the import is of high quality resembling refined sugar.
It would appear that the purchasing power of the inhabitants of India has increased of late years, and there is a growing demand for refined sugar, fostered by the circumstance that modern processes of manufacture can make a quality of sugar, broadly speaking, equal to sugar refined by animal charcoal, without using charcoal, and so the religious objections to the refined sugars of old days have been overcome. (A. C.; V. W. C.)

SUGAR-BIRD, the English name commonly given in the West India Islands to the various members of the genus Cethioidea (belonging to the Passerine family Corvicideae!) for their habit of frequenting the curving-houses where sugar is kept, apparently attracted thither by the swarms of flies. They often come into dwelling-houses, hopping from one piece of furniture to another and carefully exploring the surrounding objects with intent to find a spider or insect. In their figure and motions they remind a northern naturalist of a nuthatch, while their coloration—black, yellow, olive, grey and white—recalls to him a titmouse. They generally keep in pairs and build a domed but untidy nest, laying therein three eggs, white, blotched with rusty-red. Many species are recognized, some of them with a very limited range; three are continental, with a joint range extending from southern Mexico to Peru, Bolivia and south-eastern Brazil, while others are peculiar to certain of the Antilles, and several of them to one island only. Thus C. caboti is limited, so far as is known, to Cozumel (off Yucatan), C. tricolor to Old Providence and the Bahamas, C. flaneola (the type of the genus) to Jamaica and so on, while islands that are in sight of one another are often inhabited by different "species". The genus furnishes an excellent example of the effects of isolation in breaking up an original form, while there is comparatively little differentiation among the individuals which inhabit a large and continuous area. The non-appearance of this genus in Cuba is very remarkable. (A. N.)

SUGER (c. 1062-1151), French ecclesiastic, statesman and historian, was born of poor parents either in Flanders, at St Denis, or at TOURS. In 1111 he entered the abbey of St Denis. Until about 1104 he was educated at the priory of St Denis de l'Estre, and there first met his pupil King Louis VI. From 1104 to 1106 Suger attended another school, perhaps that attached to the abbey of St Benoît-sur-Loire. In 1106 he became secretary to the abbot of St Denis. In the following year he was made provost of Bernevail in Normandy, and in 1109 of Tourn. In 1118 he was sent by Louis VI. to the court of Pope Gelasius II. at Magnaguelle, and lived from 1121 to 1122 at the court of his successor, Calixtus II. In 1127 he was appointed treasurer and in 1128 abbot of St Denis. Until 1127 he occupied himself mainly with the temporal affairs of the kingdom, while during the following decade he devoted himself to the reorganization and reform of St Denis. In 1137 he accompanied the future king, Louis VII., into Aquitaine on the occasion of that prince's marriage to Eleanor of Aquitaine, and during the second crusade was one of the regents of the kingdom (1147-1149). He was bitterly opposed to the king's divorce, having himself advised the marriage. Although he disapproved of the second crusade, he himself, at the time of his death, on the 31st of January 1151, was preaching a new crusade.

Suger was the friend and counsellor both of Louis VI. and Louis VII. He urged the king to destroy the feudal bandits, was responsible for the royal tactics in dealing with the communal movements, and endeavoured to regularize the administration of justice. He left his abbey, which possessed considerable property, enriched and embellished by the construction of a new church built in the nascent Gothic style.

Suger was the foremost historian of his time. He was the author of a panegyric on Louis VI. (Vita Ludovici regis), and part-author of the perhaps more impartial history of Louis VII. (Historia gloriosi regis Ludovici). In his Liber de rebus in administratione sua gestis, and its supplement Libellus de consecratione ecclesiae S. Dionysii, he treats of the improvements he had made to St Denis, describes the treasure of the church, and gives an account of the rebuilding. Suger's works served to imbue the monks of St Denis with a taste for history, and called forth a long series of quasi-official annals. See O. Clerissel Les A. Suger von Saint-Denis (Berlin, 1898); A. Luchaire, Louis le Gros (Paris, 1890); F. A. Gervaise, Histoire de Suger (Paris, 1721).

SUGGESTION. By the older British writers on psychology the words "suggest" and "suggestion" were used in senses very close to those which they have in common speech; one idea was said to suggest another when it recalled that other to mind or (in the modern phrase) reproduced it. Modern studies in mental pathology and hypnotism (q.v.) have led to the use of these words by psychologists in a special and technical sense. The hypnotists of the New School rediscovered the doctrine that the most essential feature of the hypnotic state is the unquestioning obedience and docility with which the hypnotized subject accepts, believes, and acts in accordance with every command or proposition of the hypnotizer. Commands or propositions made to the subject (they may be merely implied by a gesture, a glance, or a chance remark to a third person) and accepted with this peculiarly uncritical and intense belief were called "suggestions"; and the subject that accepted them in this fashion was said to be "hypnotizable." It has also been made abundantly clear, chieflу by the labours of French physicians, that a high degree of "suggestibility" is a leading feature of hysteria, and that this fact is the key to the understanding of very many of its protean manifestations.

It is also becoming widely recognized that the suggestibility of hypnosis and of hysteria is conditioned by a peculiar state of the brain, namely a cerebral or mental dissociation, which in hypnosis is temporarily induced by the operations of the hypnotist, and in hysteria arises from some deficiency of energy in the whole psycho-physical system. In respect to these points there is now a wide consensus of opinion on the leading authorities; but as to the range and scope of suggestion in our mental life great differences of opinion still obtain. We may distinguish three principal views. Firstly, it is maintained by a number of physicians (notably by Professor Pierre Janet, whose profound studies of hysterical patients are justly celebrated) that all hypnotizable persons are hysterical and that suggestibility is a condition peculiar to hysterical subjects. In view of the assertions in recent years of several physicians of high repute to the effect that they find more than 90% of all subjects hypnotizable, it would seem that this view cannot be maintained, and that this restriction of suggestion to hysterical subjects only, and the stigmatization of suggestibility as in every case a morbid symptom, are errors arising from too exclusive occupation with its manifestations in this field. A second group consists of writers who admit that suggestion may operate in normal minds, but who, while recognizing that it is not an essentially pathological process, maintain that it is a process of very peculiar and exceptional nature that has little or no affinity with normal mental operations. They hold that suggestion, whether it occurs in morbid or in healthy subjects, always implies the coming into operation of some obviously conceived faculty or region of the mind, which is not in all men, but which usually lies hidden or submerged beneath the flow of our more commonplace mental activities. This submerged faculty or system of faculties, which is held by these authors to be operative in all processes of suggestion, is variously designated by them the secondary or submerged stratum of consciousness, the subconscious or subliminal self (see SUBLIMINAL SELF). The writers of this group insist upon the more startling of the effects producible by suggestion, the more profound changes of bodily and mental processes, such as paralysis,1

1 Known in French as Guignis, a name used for them also by some English writers. The Guignis of Hernandez (Rer. medic. N. hist. thesaurus, p. 56), a name said by him to be of native origin, can hardly be determined, though thought by Montelland (Hist. nat. oiseaux, v. 359) to be what is now known as Corvëa caercula, but that of later writers is C. cyanea. The name is probably from the Greek, and very likely analogous to the "quit" applied in Jamaica to several small birds.
contracture, hyperaesthesia, increased power of recollection, hallucinations (q.v.), &c.; and they regard dissociation as the process by which the submerged and supernormal faculty (or faculties) that they postulate is liberated from the dominance of the normal waking self.

A third view has been rapidly gaining ground and is now predominant. It connects itself with, and bases itself upon, the view of Professor Bernheim and his colleagues of the Nancy school of hypnotism. According to this view all men are normally suggestible under favourable conditions, and the hypnotic subject and the hysterical patient differ from the normal human being chiefly in that their normal suggestibility is more or less (sometimes very greatly) increased, owing to the prevalence of the state of cerebral dissociation.

According to this third view, suggestion may be defined as the communication of any proposition from one person (or persons) to another in such a way as to secure its acceptance with conviction, in the absence of adequate logical grounds for its acceptance. The idea or belief so introduced to the mind of the recipient is held to operate powerfully upon his bodily and mental processes in proportion to the degree of its dominance over all other ideas or mental processes; and the extraordinary character of the effects, both bodily and mental, of suggestion in hypnotic and hysterical subjects is held to be due to the fact that, in these conditions of mental dissociation, the dominance of the suggested idea is complete and absolute; whereas in the absence of such dissociation the operation of the suggested idea is always subject to the weakening or inhibition through the influence of many opposed or incompatible tendencies and ideas, even if these do not rise into explicit consciousness.

This third view seems justified by the facts that no sharp line can be drawn between the suggestibility of normal men and that of hypnotized or hysterical subjects, and that under favourable conditions many of the most striking results of suggestion (e.g. hallucinations, contractures, inactivity to move, insensibility of various sense-organs, and so forth) may be produced in subjects who present at the time no other symptom of the hypnotic or hysterical condition.

If, then, we recognize as we must, that the alogical production of conviction is the essence of suggestion, and that this frequently occurs in normal minds as well as in those suffering from various degrees of dissociation, it becomes necessary to define the conditions that favour the operation of suggestion in normal minds.

These conditions are resident, on the one hand, in the recipient of the suggestion, and, on the other hand, in the source from which the suggestion comes. Of the conditions of the former class three seem to be of principal importance.

(a) Defect of knowledge: the defect may be quantitative or qualitative, i.e. it may consist in the lack of knowledge of or firmly established beliefs about the subject of the proposition, or it may consist in the lack of systematic organization of such knowledge as the mind possesses. The well-trained mind is relatively insuggestible, firstly because it possesses large stores of knowledge and belief; secondly, because this mass of knowledge and belief is systematically organized in such a way that all its parts hang together and mutually support one another. On the other hand, the young child, the uncultured adult, and especially the savage, are apt to be suggestible in regard to very many topics, first, because they have relatively little knowledge; secondly, because what little they have is of a low degree of organization; i.e. it does not form a logically coherent system whose parts reciprocally support one another. Suggestion in such cases may be said to be conditioned by primitive credulity or the suggestibility of ignorance. (b) But the same person will not be found to be equally suggestible at all times under similar external conditions. There are changes of mental state which, without overstepping the limits of the normal, condition varying degrees of increased suggestibility. A man is least suggestible when his mind works most efficiently, when he is most vigorous and most wide awake; every departure from this state, due to fatigue, bodily ill-health, emotional perturbation, drugs or any other cause, favours suggestibility. (c) Persons of equal degrees of knowledge or ignorance will be found, even at their times of greatest mental efficiency, to be unequally suggestible owing to differences of native disposition; one person is by nature more open than another to personal influence, more easily swayed by others, more ready to accept their dicta and adopt their opinions for his own. Differences of this kind are probably the expression of differences in the inherent capacity of one of the fundamental instinctive dispositions of the human mind, an instinct which is called into play by the presence of persons of superior powers and the excitement of which throws the subject into an attitude of submission or subjection towards the impressive personality.

Considered from the side of the agent, suggestion is favoured by whatever tends to render him impressive to the subject or patient—great bodily strength or stature, fine clothes, a confident manner, superior abilities of any kind, age and experience, any reputation for special capacities, high social position or the occupation of any position of acknowledged authority; in short, all that is summed up by the term “personality,” all that contributes to make a personality “magnetic” or to give it prestige renders it capable of evoking on the part of others the submissive suggestible attitude. A group of persons in agreement is capable of evoking the suggestible attitude far more effectively than any single member of the group, and the larger the group the more strongly does it exert this influence. Hence the suggestive force of the popularly accepted maxims and well-established social conventions; such propositions are collective suggestions which carry with them all the immense collective prestige of organized society, both of the present and the past; they embody the wisdom of the ages. Thus, the main through the suggestive power of moral maxims, endowed with all the prestige of great moral teachers and of the collective voice of society, that the child is led to accept with but little questioning the code of morals of his age and country; and the propagation of all religious and other dogma rests on the same basis. The normal suggestibility of the child is thus a principal condition of its docility, and it is in the main by the operation of normal suggestion that society moulds the characters, sentiments, and beliefs of its members, and renders the mass of its elements harmonious and homogeneous to the degree that is a necessary condition of its collective mental life. Normal suggestion produces its most striking effects in the form of mass-suggestion, i.e. when it operates in large assemblies or crowds, especially if the members have but little positive knowledge and culture. For, when a belief is propagated by collective suggestion through the large mass of men, each falls under the suggestive sway of the whole mass; and under these conditions the operation of suggestion is further aided by the universal tendency of mankind to imitation and sympathy, the tendency to imitate the actions of, and to experience the emotions expressed by, those about one.

Conditions very favourable to mass-suggestion prevailed during the middle ages of European history; for these "dark ages" were characterized by the existence of dense populations, among whom there was free intercourse but very little positive knowledge of nature, and who were dominated by a church wielding immense prestige. Hence the frequent and powerful operations of suggestion on a large scale. From time to time fantastic beliefs, giving rise to most extravagant behaviour, swept over large areas of Europe like virulent epidemics—epidemics of dancing, of flagellation, of hallucination, of belief in the miraculous powers of relics or of individuals, and so forth. In these epidemics all the conditions favourable to normal suggestion were generally present in the highest degree, with the result that in great numbers of persons there were produced the more extreme effects of suggestion, such as are usually associated with the hysterical or hypnotic state. At the present time similar manifestations occur in a modified form, as e.g. the popular pilgrimages to Lourdes, Holywell and other places that from time to time acquire reputations for miraculous curative powers.

Auto-suggestion.—Although auto-suggestion does not strictly fall under the definition of suggestion given above, its usage to
denote a mental process which produces effects very similar to those producible by suggestion is now so well established that it must be accepted. In auto-suggestion a proposition is formulated in the mind of the subject rather than communicated from another mind, and is accepted with conviction in the absence of adequate logical grounds. Generally the belief is initiated by some external event or some bodily change, or through some interpretation of the behaviour of other persons; e.g. a man falls on the road and a wagon very nearly passes over his legs, perhaps grazing them merely; when he is picked up, his legs are found to be paralysed. The event has induced the conviction that his legs are seriously injured, and this conviction operates so effectively as to realize itself. Or a savage, suffering some slight indisposition, interprets the behaviour of some person in a way which leads him to the conviction that this person is compassing his death by means of magical practices; accordingly he lies down in deep despondency and, in the course of some days or weeks, dies, unless his friends succeed in buying off, or in some way counteracting, the malignant influence. Or, as a familiar and trivial instance of auto-suggestion, we may cite the case of a man who, having taken a bread pill in the belief that it contains a strong purgative or emetic, realizes the results that he expects.


**SUHL,** a town of Germany, in the province of Prussian Saxony, picturesquely situated on the Lauter, on the southern slope of the Thuringian Forest, 63 m. N.E. of Meiningen and 29 m. S.W. of Erfurt by rail. Pop. (1905), 13,814. The armourers of Suhl are mentioned as early as the 9th century, but they enjoyed their highest vogue from 1530 to 1634. The knights of south Germany especially prized the swords and armour of this town, and many of the weapons used in campaigns against the Turks and in the Seven Years' War are said to have been manufactured at Suhl. It has suffered considerably in modern times from the competition of other towns in this industry, especially since the introduction of the breech-loading rifle. It still contains, however, large factories for firearms military and sporting, and side arms, besides ironworks, machine-works, potteries and tanneries. The once considerable manufacture of fustian has declined. A brine spring (Soolquelle) at the foot of the neighboring Dominican is said to have been given to the town by St. Stephen, which obtained civic rights in 1527, belonged to the principality of Hennepen, and formed part of the possessions of the kingdom of Saxony assigned to Prussia by the Congress of Vienna in 1815.


**SUICIDE** (from Lat. *suici*, of oneself, and *cidium*, from caedere, to kill), the act of intentionally destroying one's own life. The phenomenon of suicide has at all times attracted a large amount of attention from moralists and social investigators. Its existence is looked upon, in Western civilization, as a sign of the presence of maladies in the body politic which, whether remediable or not, deserve careful examination. It is, of course, impossible to compare Western civilization in this respect with, say, Japan, where suicide in certain circumstances is part of a distinct moral creed. In Christian ethics and Christian law it is wrong, indeed illegal, as a *felo de se*, self-murder. It is within comparatively recent years that the study of suicide by means of the vital statistics of various European countries has demonstrated that while the act may be regarded as a purely voluntary one, yet that suicide as a whole conforms there to certain general laws, and is influenced by conditions other than mere individual circumstances or surroundings. Thus it can be shown that both causes and results of suicide differ from what they are for each country may fluctuate from year to year, yet it maintains practically the same relative proportions to the rates of other countries. The following table shows the suicide-rate for various European countries (Bertillon):—

**Table I.**

<table>
<thead>
<tr>
<th>Country</th>
<th>Period of Observation</th>
<th>Annual Number of Suicides per Million Inhabitants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saxony</td>
<td>1878-1882</td>
<td>139</td>
</tr>
<tr>
<td>Denmark</td>
<td>1880-1882</td>
<td>291</td>
</tr>
<tr>
<td>Switzerland</td>
<td>1878-1882</td>
<td>239</td>
</tr>
<tr>
<td>Baden</td>
<td>1878-1884</td>
<td>198</td>
</tr>
<tr>
<td>Wurttemberg</td>
<td>1878-1882</td>
<td>180</td>
</tr>
<tr>
<td>France</td>
<td>1878-1882</td>
<td>166</td>
</tr>
<tr>
<td>Prussia</td>
<td>1878-1882</td>
<td>100</td>
</tr>
<tr>
<td>Belgium</td>
<td>1878-1882</td>
<td>92</td>
</tr>
<tr>
<td>Sweden</td>
<td>1878-1882</td>
<td>75</td>
</tr>
<tr>
<td>England and Wales</td>
<td>1878-1882</td>
<td>69</td>
</tr>
<tr>
<td>Norway</td>
<td>1877-1881</td>
<td>49</td>
</tr>
<tr>
<td>Scotland</td>
<td>1878-1882</td>
<td>17</td>
</tr>
</tbody>
</table>

In addition to furnishing materials for an approximately accurate estimate of the number of suicides which will occur in any country in a year, statistics have demonstrated that the proportion of male to female suicides is practically the same from year to year, viz. 3 or 4 males to 1 female; that it is possible to predict the month of greatest prevalence, the modes of death adopted by men on the one hand and women on the other, and even the relative frequency of suicide amongst persons following different professions and employments; and that in most of the countries of Europe the suicide-rate is increasing. In England and Wales the annual death-rate per million from suicide has steadily advanced, as is shown by the following figures for quinquennial periods—

<table>
<thead>
<tr>
<th>Year</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Suicide-rate per Million Living</th>
</tr>
</thead>
<tbody>
<tr>
<td>1886</td>
<td>1694</td>
<td>560</td>
<td>2254</td>
<td>82</td>
</tr>
<tr>
<td>1890</td>
<td>1635</td>
<td>570</td>
<td>2205</td>
<td>77</td>
</tr>
<tr>
<td>1895</td>
<td>2071</td>
<td>726</td>
<td>2797</td>
<td>92</td>
</tr>
<tr>
<td>1899</td>
<td>1979</td>
<td>677</td>
<td>2656</td>
<td>86</td>
</tr>
<tr>
<td>1897</td>
<td>2090</td>
<td>702</td>
<td>2792</td>
<td>90</td>
</tr>
<tr>
<td>1898</td>
<td>2166</td>
<td>711</td>
<td>2877</td>
<td>91</td>
</tr>
<tr>
<td>1900</td>
<td>2121</td>
<td>730</td>
<td>2896</td>
<td>90</td>
</tr>
<tr>
<td>1901</td>
<td>2318</td>
<td>803</td>
<td>3121</td>
<td>96</td>
</tr>
<tr>
<td>1902</td>
<td>2460</td>
<td>807</td>
<td>3267</td>
<td>99</td>
</tr>
<tr>
<td>1903</td>
<td>2640</td>
<td>871</td>
<td>3511</td>
<td>105</td>
</tr>
<tr>
<td>1904</td>
<td>2523</td>
<td>822</td>
<td>3345</td>
<td>99</td>
</tr>
<tr>
<td>1905</td>
<td>2683</td>
<td>862</td>
<td>3545</td>
<td>104</td>
</tr>
</tbody>
</table>

The next table illustrates the continued increase in recent years, and at the same time shows the total number and the number of male and female suicides each year from 1886 to 1905.

**Table II.**

<table>
<thead>
<tr>
<th>Year</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Suicide-rate per Million Living</th>
</tr>
</thead>
<tbody>
<tr>
<td>1886</td>
<td>1694</td>
<td>560</td>
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<td>1905</td>
<td>2683</td>
<td>862</td>
<td>3545</td>
<td>104</td>
</tr>
</tbody>
</table>

The reason of the high suicide-rate in some countries as compared with others, and the causes of its progressive increase, are not easily determined. Various explanations have been offered, such as the influence of climate, the comparative prevalence of insanity, and the proportionate consumption of alcoholic drinks, but none satisfactorily accounts for the facts. It may, however, be remarked that suicide is much more common amongst
Protestant than amongst Roman Catholic communities, while Jews have a smaller suicide-rate than Roman Catholics. A point of considerable interest is the increase of suicide in relation to the advance of elementary education. Ogle states that suicide is more common among the educated than the illiterate classes. It is also more prevalent in urban than in rural districts. A curious feature in large towns is the sudden outbreak of self-destruction which sometimes occurs, and which has led to its being described as epidemic. In such cases force of example and imitation undoubtedly play a considerable part, as it is well recognized that both these forces exert an influence not only in causing suicide, but also in suggesting the method, time and place for the act. No age above five years is exempted from furnishing its quota of suicidal deaths, although self-destruction between five and ten years is very rare. Above this age the proportion of suicides increases at each period, the maximum being reached between fifty-five and sixty-five. Among females there is a greater relative prevalence at earlier age periods than among males. The modes of suicide are found to vary very slightly in different countries. Hanging is most common amongst males; then drowning, injuries from fire-arms, stab and cuts, poison and precipitation from heights. Amongst females, drowning comes first, while poison and hanging are more frequent than other methods entailing effusion of blood and disfigurement of the person. The methods used in England and Wales by suicides during 1858–1897, and in Scotland during the years 1851–1897, are given in the following table:

**Table III.**

<table>
<thead>
<tr>
<th>Order of Frequency</th>
<th>Males.</th>
<th>Females.</th>
<th>Both Sexes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hanging</td>
<td>5669</td>
<td>Drowning</td>
<td>2089</td>
</tr>
<tr>
<td>2. Stab-cut</td>
<td>3594</td>
<td>Poison</td>
<td>1652</td>
</tr>
<tr>
<td>3. Drowning</td>
<td>3443</td>
<td>Hanging</td>
<td>1336</td>
</tr>
<tr>
<td>4. Poison</td>
<td>2264</td>
<td>Fire-arms</td>
<td>771</td>
</tr>
<tr>
<td>5. Fire-arms</td>
<td>2152</td>
<td>Other</td>
<td>52</td>
</tr>
<tr>
<td>6. Other</td>
<td>1776</td>
<td>Total</td>
<td>527</td>
</tr>
<tr>
<td>Total</td>
<td>18,805</td>
<td>Total</td>
<td>6427</td>
</tr>
</tbody>
</table>

The season of the year influences suicide practically uniformly in all European countries, the number increasing from the commencement of the year to a maximum in May or June, and then declining again to a minimum in winter. Morselli attempts to account for this greater prevalence during what may well be called the most beautiful months of the year by attributing it to the influence of increased temperature upon the organism, while Durkheim suggests that the determining factor is more probably to be found in the length of the day and the effect of a longer period of daily activity. The suicide-rate is higher in certain male occupations and professions than in others (Ogle). Thus it is high amongst soldiers, doctors, inkeepers and chemists, and low for clergy, barmen, railway drivers and stokers. The suicide-rate is twice as great for unoccupied males as for occupied males.

**Literature.**—Ogle, “Suicides in England and Wales, in relation to Age, Sex, Season, and Occupation,” Journal of the Statistical Society (1886), vol. xlix, Strahan, Suicide and Insanity (London, 1893); Mayr, “Selbstmordstatistik,” in Handwörterbuch der Staatswissenschaften (Jena, 1895); Durkheim, Le Suicide (Paris, 1897). (H. L. L.)

**Suidas**, Greek lexicographer. Nothing is known of him, except that he must have lived before Eustathius (12th–13th century), who frequently quotes him. Under the heading of Adam “the author of the lexicon (which a prefatory note states to be ‘by Suidas’)” gives a brief chronology of the world, ending with the death of the emperor John Zimisces (975), and under “Constantinople” his successors Basil and Constantine are mentioned. It would thus appear that Suidas lived in the latter part of the 10th century. The passages in which Michael Psellus (end of the 11th century) is referred to are considered later interpolations. The lexicon of Suidas is arranged alphabetically with some slight deviations, letters and combinations of letters having the same sound being placed together; thus, ηι and ιε follow δ, and ε followed π. It partakes of the nature of a dictionary and encyclopaedia. It includes numerous quotations from ancient writers; the scholiasts on Aristophanes, Homer, Sophocles and Thucydides are also much used. The biographical notices, the author tells us, are condensed from the Onomatoiogon or Pinax of Hesychius of Miletus; other sources were the excerpts of Constantine Porphyrogenitus, the chronicle of Georgius Monachus, the biographies of Diogenes Laërtius and the works of Atheneus and Philistus. The work deals with scriptural as well as pagan subjects, from which it is inferred that the writer was a Christian. A prefatory note gives a list of dictionaries from which the lexical portion was compiled, together with the names of their authors. Although the work is uncritical and probably much interpolated, and the value of the articles is very unequal, it contains much information on ancient history and life.

Edito princes, by Demetrius Chalcondyles (1499); later editions by L. Küster (1705), T. Gaisford (1834), G. Bernhardt (1834–1853) and I. Bekker (1854); see A. Daub, De S. Biographiocrorum origine scriptorum et adhuc existentibus (1832); and J. E. Sandys, Hist. of Classical Scholarship (1906), p. 497.

**Suido** (Chinese, Sui-din-chen), a town of China, capital of the province of Kulja. It is the residence of the governor-general, and was founded in 1762 during the Musulman rising, and rebuilt in 1883. It is a military town, with provision stores, an arsenal and an arms workshop. Its walls are armed with steel guns.

**Suina**, a group of non-ruminating artiodactyla ungulate mammals typified by the swine (Suidae), but also including the hippopotomus (Hippopotamidae), and certain extinct forms. (See ARTIODACTyla; HIPPOPOTAMUS; PECCARY; SWINE.) Suina occur in the form of a group of dance tunes, mostly in binary form, of a type which may be described as "decorative" (see SONATA FORMS); constituting that classical form of early 18th-century instrumental music which most nearly foreshadows the later sonata. As understood by Bach, it consists essentially of four principal movements with the insertion of one or more lighter movements between the third and the last. The first movement is the allemande, of solid and intricate texture, in slow common time and rich flowing rhythm, beginning with one or three short notes before the first full bar. The second movement is the courante, of which there are two kinds. The French courante is again an intricate movement, also beginning with one or three notes before the main beat, and in a triple time (3/4) which, invariably at the cadences and sometimes elsewhere, drops into a crossing triple rhythm of twice the pace (3/8). The effect is restless and confused, and was supposed to form a contrast to the allemande; but it seldom did so effectively. Bach's study of Copernus led him to use the French courante frequently, but he was happier with the Italian type of corrente, which did not owe its name, like the French type, to the use of spasmodic runs, but was a brilliant continuously running piece in quick triple time (3/4 or 3/8), forming a clear and lively contrast both to the allemande and to the third movement, which is generally a sarabande.

**Suicide**, the act of self-destruction. It is a phenomenon peculiar to civilized society, and is only to be observed among the more advanced. It is more common amongst the educated than amongst Roman Catholic communities, while Jews have a smaller suicide-rate than Roman Catholics. A point of considerable interest is the increase of suicide in relation to the advance of elementary education. Ogle states that suicide is more common among the educated than the illiterate classes. It is also more prevalent in urban than in rural districts. A curious feature in large towns is the sudden outbreak of self-destruction which sometimes occurs, and which has led to its being described as epidemic. In such cases force of example and imitation undoubtedly play a considerable part, as it is well recognized that both these forces exert an influence not only in causing suicide, but also in suggesting the method, time and place for the act. No age above five years is exempted from furnishing its quota of suicidal deaths, although self-destruction between five and ten years is very rare. Above this age the proportion of suicides increases at each period, the maximum being reached between fifty-five and sixty-five. Among females there is a greater relative prevalence at earlier age periods than among males. The modes of suicide are found to vary very slightly in different countries. Hanging is most common amongst males; then drowning, injuries from fire-arms, stab and cuts, poison and precipitation from heights. Amongst females, drowning comes first, while poison and hanging are more frequent than other methods entailing effusion of blood and disfigurement of the person. The methods used in England and Wales by suicides during 1858–1897, and in Scotland during the years 1851–1897, are given in the following table:

**Table III.**

<table>
<thead>
<tr>
<th>Order of Frequency</th>
<th>Males.</th>
<th>Females.</th>
<th>Both Sexes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hanging</td>
<td>5669</td>
<td>Drowning</td>
<td>2089</td>
</tr>
<tr>
<td>2. Stab-cut</td>
<td>3594</td>
<td>Poison</td>
<td>1652</td>
</tr>
<tr>
<td>3. Drowning</td>
<td>3443</td>
<td>Hanging</td>
<td>1336</td>
</tr>
<tr>
<td>4. Poison</td>
<td>2264</td>
<td>Fire-arms</td>
<td>771</td>
</tr>
<tr>
<td>5. Fire-arms</td>
<td>2152</td>
<td>Other</td>
<td>52</td>
</tr>
<tr>
<td>6. Other</td>
<td>1776</td>
<td>Total</td>
<td>527</td>
</tr>
<tr>
<td>Total</td>
<td>18,805</td>
<td>Total</td>
<td>6427</td>
</tr>
</tbody>
</table>

The season of the year influences suicide practically uniformly in all European countries, the number increasing from the commencement of the year to a maximum in May or June, and then declining again to a minimum in winter. Morselli attempts to account for this greater prevalence during what may well be called the most beautiful months of the year by attributing it to the influence of increased temperature upon the organism, while Durkheim suggests that the determining factor is more probably to be found in the length of the day and the effect of a longer period of daily activity. The suicide-rate is higher in certain male occupations and professions than in others (Ogle). Thus it is high amongst soldiers, doctors, inkeepers and chemists, and low for clergy, barmen, railway drivers and stokers. The suicide-rate is twice as great for unoccupied males as for occupied males.

**Authorities.**—Morselli, II Suicidio (Milan, 1879); Legoyt, Le Suicide ancien et modern (Paris, 1881); Wescott, Suicide: its History.
The sarabande is a slow movement in triple time beginning on the full bar, and with at least a tendency to the rhythm of which Handel's aria "Lascia ch'io piana" is a familiar example. Bach's sarabandes are among the most simply eloquent and characteristic of his smaller compositions. Then come the galanteries, from one to three in number. These are the only suite-movements which either have an alternative section and a da capo (with the exception of Couperin's courantes and the courante in Bach's first English suite). The commonest galanteries are: (1) the minuet, often with a second minuet which is called "trio" only when it is in real three-part writing. It is a little faster than the stately minuet in Mozart's Don Giovanni, but it is never so quick as the lively minuets of Haydn's quartets and symphonies which led to the Beethoven scherzo; and it invariably begins, unlike many later minuets, on the full bar; (2) the gavotte, a lively dance in a not too rapid alla breve time, (the textbooks say ¾ time, but there is no case in Bach which could possibly be played so slowly, whatever the time signature may be). The gavotte always begins on the half-bar. A second alternating gavotte is frequently found on a pedal or drone-bass, and is then called musette; (3) the bourrée, which is not unlike the gavotte, but quicker, and beginning on the last quarter of the bar; (4) the passepied, a lively dance in quick triple time, beginning on the third beat. These dances are not always cast in binary form, and there are famous examples of gavottes and passepieds en rondeau. Other less common galanteries are (5) the loures, a slow dance in ¾ time and dotted rhythm (dactylic in accent and amphimacer in quantity); (6) the polonaise, a leisurely triple-time piece, either a shade quicker or (as in the exquisite unattacked examples of Friedemann Bach) much slower than the modern dance-rhythm of that name, with cadences on the second instead of the third beat of the bar; (7) the air, a short movement, quietly flowing, in a more florid style than its name would suggest. It sometimes precedes the sarabande. The suite concludes with a gigue, in the finest examples of which the decorative binary form is combined with a light fugue style of the utmost liveliness and brilliance. The gigue is generally in some triple rhythm, e.g. 8 6 9 12; but examples in a graver style may be found in slow square time with dotted rhythms, as in Bach's first French suite and the sixth Partita of the Klavier-übung. In gigues in the typical fuggato style Bach is fond of making the second part either invert the theme of the first, or else begin with a new subject to be combined with the first in double counterpoint. The device of inversion is also prominent in many of his allemandes and French courantes.

All suites on a large scale, with the exception of Bach's second and third French suites, begin with a prelude in some larger form. Bach's French Suites are small suites without prelude. His English Suites all have a great first movement which, except in the first suite, is in full da capo concerto form. His clavier Partitas show a greater variety of style in the dance movements and are preceded by preludes, in each case of a different type and title. Some large suites have finales after the gigue; the great chaconne for violin solo being the finale of a partita (see Variations).

Handel's suites are characteristically nondescriptive in form, but, in the probably earlier sets published after what is called his first set, there is a most interesting tendency to make several of the movements free variations of the first. Earlier composers had already shown the converse tendency to make variations take the forms of suite movements. In general Handel's suites are effective groups of movements of various lengths, with a tendency to use recognizable suite movements of a Franco-Italian type. In modern times the term "suite" is used for almost any group of movements of which the last is in the same key as the first, and of which a fair proportion show traces of dance-rhythm, or at least use dance titles. It is often said that the suite-forms have shown more vitality under modern conditions than the classical sonata forms. But this only means that when composers do not feel inclined to write symphonies or sonatas they give their groups of movements the name of suite. Certainly there is no such thing as a definite modern suite-form distinguishable from the selection composers make, for use in concert rooms, of incidental music written for plays, such as Grieg's Peer Gynt suites.

(D. F. T.)

SUKKUR, or Sakhaw, a town and district of British India, in Sind, Bombay. The town is situated on the right bank of the Indus, 24 m. N.W. of Skikarpur. Pop. (1901), 31,316. Sukkur has always commanded the trade of Sind, and the river is now crossed by a cantilever bridge carrying the North-Western railway to Kotri. The town was ceded to the Khairpur mirs between 1809 and 1824. In 1833 Shah Shuja defeated the Talpurs here with great loss. In 1842 it came under British rule.

The District of Sukkur was created in 1901 out of part of Shikarpur district, the remainder of which was formed into the district of Larkana. Area, 5403 sq. m. It is chiefly alluvial plain, but there are slight hills at Sukkur and Rohri. In the higher-lying parts are salt lands (Kalr), or even desert in the area known as the Registan. The climate is hot, dry and enervating. The annual rainfall at Sukkur town averages only 44 in. The population in 1901 was 523,345, showing an increase of 10% in the decade. A considerable part of the district is irrigated, the principal crops being wheat, millets, rice, pulses, and oil seeds. Earthen, leathern and metal ware, cotton cloth and tussore silk are manufactured, also pipe-bowls, snuff-boxes and scissors. Lines of the North-Western railway serve the district, and there is a branch from Sukkur towards Quetta.

SULA ISLANDS (Sulla, Xulla; Dutch Soela), a chain of islands forming a prolongation of the eastern peninsula of Celebes and the Banggai Islands, Dutch East Indies. The three main islands are long and narrow (Talibu, 85 m. long, Mangoli or Mangala, 63 m. and Besi, 100 m.). The two first lie in line, separated by the narrow Chapalulu Strait; Besi extends at right angles to the south coast of Mangoli. The natives of Talibu are allied to those of the Banggai Islands and the eastern peninsula of Celebes; but immigrant Malays are the principal inhabitants. Economically, Besi is the most important island. A Dutch commissioner resides at Sanana, at its northern extremity. It is fertile, and produces wax and honey, and coal has been found.

SULCI, an ancient town (mod. S. Antioco), situated on the east coast of an island on the south-west of Sardinia. The date of its foundation is not known, but it is certainly of Carthaginian origin. The assumption that it was originally an Egyptian colony is not justified. It is surrounded by walls, of large rectangular blocks of stone, can be traced for a circuit of upwards of a mile; it extended to the low ground on the shore near the modern cemetery, where a dedicatory inscription set up by the people of Sulci in honour of Hadrian in A.D. 128 was found (F. Vivianet in Notizie degli Scavi, 1897, 407). Various discoveries have been made within the circuit, both of Phoenician and of Roman antiquities, including several statues and inscriptions and many smaller objects, gems, &c., but at present few traces of ancient buildings are left, owing to their continued destruction in medieval and modern times. A cistern of fine masonry, perhaps dating from the Punic period, 1

1 A statue of Drusus, the brother of Tiberius (?) was found in 1889.
in the low ground below the modern town, may be mentioned. Close to it, among the houses of the modern town, a solid base about 25 ft. square, belonging possibly to a lighthouse or a tomb, records the existence of a temple of Isis and Serapis during the imperial period. A bilingual inscription of the 1st century a.C. (?) in Latin and in neo-Punic records the erection of a statue to Himilcat, who had carried out a decree of the local senatus for the erection of a temple to a goddess (described in the Punic version as domina do—possibly Tanit herself) by his son Himilcat (T. Mommsen in Corp. inscr. lat. x. 7513, 7514).

The Phoenician tombs consist of a chamber cut in the rock, measuring about 14 ft. square and 8 ft. high, and approached by a staircase: some of these have been converted into dwellings in modern times. Many of the curious sculptured reliefs found in these tombs are now in the museum of Herculaneum, and proves their Phoenician origin; and the seven-branched candlestick occurs several times. The fort which occupies the highest point—no doubt the acropolis of the Punic period—is quite modern. The long, low isthmus which, with the help of bridges, connects the island with the mainland, is very likely in part or entirely of artificial origin; but neither it nor the bridges show any definite traces of Roman date. On either side of it ships could find shelter then as nowadays. On many of the tombs of Sulci is attributed by Pauserius to the Carthaginians, and the Punic antiquities found there go to indicate the correctness of his account. It is mentioned in the account of the First Punic War as the place at which the Carthaginian admiral Hannibal took refuge after his defeat by C. Sulpicius, but was crucified. In 46 B.C. the city was severely punished by Caesar for the assistance given to Pompey's admiral Nasidius. Under the empire it was one of the most flourishing cities of Sardinia. It was attacked by the Vandals and Saracens, but ceased to exist before the 13th century. Previously to this it had been one of the four episcopal sees into which Sardinia was divided. A castle in the low ground, attributed to the Inca Tulissus, to the south of the modern town, was destroyed in modern times.

See A. Taraveli in Notizie degli scavi (1906), 135; (1908), 145, 192.

(T. As.)

**SULEIMAN I.** The "Magnificent" (1494-1566), sultan of Turkey, succeeded his father Selim I. in 1520. His birth coincided with the opening year of the 10th century of Mussulman chronology (A.H. 900), the most glorious period in the history of Islam. Eventful as the age was both in Europe, where the Renaissance was in full growth, and in India, where the splendour of the emperor Akbar's reign exceeded alike that of his predecessors and his successors, Suleiman's conquests overshadowed all these. It is noteworthy that though in Turkey he is distinguished only as the law-giver (komuni), in European history he is known by such titles as the Magnificent. He was the most fortunate of the sultans. He had no rival worthy of the name. From his father he inherited a well-organized country, a discipline army and a full treasury. He united in his person the best qualities of his predecessors, and possessed the gift of taking full advantage of the talents of the able generals, admirals and viziers who illustrated his reign. If his campaigns were not always so wisely and prudently planned as those of some of his predecessors, they were in the main eminently fortunate, and resulted in adding to his dominions Belgrade, Budapest, Tesmarov, Rhodes, Tabriz, Bagdad, Nakshivan and Rivan, Aden and Algiers, and in his days Turkey attained the culminating point of her glory.

The alliance concluded by him with France reveals him at once as rising superior to the narrow prejudices of his race and faith, which rejected with scorn any union with the unbeliever, and as gifted with sufficient political insight to appreciate the advantage of combining with Francis I. against Charles V. His Persian campaign was doubtless an error, but was due in part to a desire to find occupation, distant if possible, for his Saracens, who were progressively increasing in numbers at the capital. He was perhaps swaying in firmness of character, and the undue influence exercised over him by unscrupulous ministers, or by the seductions of fairer but no less ambitious votaries of statecraft, led him to make concessions which tarnished the glory of his reign, and were followed by baneful results for the welfare of his empire. It is from Suleiman's time that historians date the rise of that occult influence of the harem which has so often thwarted the best efforts of Turkey's most enlightened statesmen.

Suleiman's claims to renown as a legislator rest mainly on the organization of the empire, or clerical class, in its hierarchical order from the Sheik-ul-Islam downwards. He reformed and improved the administration of the country both civil and military, inaugurated a new and improved system for the feudal tenures of limitory fiefs, and his amelioration of the lot of his Christian subjects is not his least title to fame. He was also not unknown to fame as a poet, under the pseudonym of "Muhibbīr" (see Hammer-Purgstall, Gesch. d. Osman. Reichs, ii. 331; and furtherTurkey: History).

Suleiman died on the 5th of September 1566, at the age of 72, conducting the siege of Szegvár. Sultan of Turkey, was a son of Sultan Ibrahim, and succeeded his brother Mahomed IV. in 1587. Forty-six years of enforced retirement had qualified him for the cloister rather than for the throne, and his first feeling when notified of his accession was one of terror for his brother's vengeance. Nor were the circumstances following his elevation to the throne of a nature to reassure him, as one of the most violent of the revolts of the janissaries ended in the murder of the grand vizier and the brutal mutilation of his family, with general massacre and pillage throughout Constantinople. The war with Austria was a succession of disasters. At this time, fortunately for the Ottoman Empire, a third great kuprili (Mustafa) arose and re-established order in the sorely-tried state (see KUPRILU). In the reforms which followed, whereby the situation of the Christian subjects of the Porte was greatly improved, Suleiman is at least to be given the credit of having allowed Mustafa Kuprili a free hand. With an improved administration Turkey's fortunes in the war began to revive, and the reconquest of Belgrade late in 1690 was the last important event of the reign, which ended in 1691 by Suleiman's death. (See also Turkey: History.)

**SULEIMANII, or SULEMANNII, the chief town of a sanjak of the same name in Asiatic Turkey. In the valley of Mosul, situated on a treeless plain in the Kurdistan Mountains, in the region known as Shehrizor, some 40 or 50 m. from the Persian frontier, at an elevation of 2805 ft. It is a military station, and was founded towards the close of the 11th century. The population is about 12,000, of whom 11,000 are Kurds, and the majority of the remaining 1000 Jews.**

**SULIMAN HILLS,** a mountain system on the Dera Ismail Khan border of the north-west frontier of India. From the Gomal river southward commences the true Suliman system, presenting an impenetrable barrier between the plains of the Indus and Afghanistan. The Suliman Mountains finally merge into the hills of Baluchistan, which are inhabited by the Marri and Bugti tribes. The chief mass of the range is known as...
SULINA—SULLA

Takht-i-Suliman or Solomon's throne. It may be seen on the western horizon from Dena Ismail Khan, a grey, flat-looking rampart rising from the lower line of mountains north and south of it, slightly saddle-backed in the middle, but culminating in a very well-defined peak at its northern extremity. The legend of the mountain is that Solomon visited Hindostan to marry Balkis, and that as they were returning through the air, on a throne supported by genii, the bride imploring the brickdove to let her look back for a few moments on her beloved land. Solomon directed the genii to scoop out a hollow for the throne on the summit of the mountain. The hollow is a cavity some 30 ft. square cut out of the solid rock, at the southern extremity of the mountain and is a place of pilgrimage for both Hindus and Mahomedans. The actual shrine is about two m. south of the highest peak. The whole mountain was traversed and surveyed by the Takht-i-Suliman Survey Expedition of 1883 (see SHERKHAN) and was found to consist of two parallel ridges running roughly north and south, the southern end of the eastern ridge culminating in a point 11,070 ft. high, which is the Takht proper on which the shrine is situated, and the western ridge culminating at its northern end in a point 11,300 ft. high known as Kaisarghar. Between these two ridges is a connecting tableland about 9000 ft. high. This plateau and the interior slopes of the ridges are covered with chilghosa (edible pine) forests. The mass of the mountain is composed of nummulite limestone. No water is to be found on the summit.

SULINA, a town in Rumania, at the mouth of the Sulina branch of the Danube. Pop. (1900), 561 r. Sulina is the only free port on the Danube, and is much used for the transhipment into sea-going vessels of grain which is brought down the river in large lighters from Rumania, Russia, Bulgaria, Servia and Austria-Hungary. No agricultural produce is grown in its neighbour- hood, owing to the reed-covered swamps with which it is surrounded. Sulina is the headquarters of the technical department of the European Commission of the Danube (q.v.). Large steamers navigate up to Galatz and Braila. In 1901, 1411 steamers and sailing craft aggregating 1,350,000 tons register cleared from Sulina for European ports carrying, besides other merchandise, nearly 13,000,000 quarters of grain. Owing to the improvements effected by the European Commission, there is a depth of 24 ft. of water on the bar, and of 18 to 22 ft. in the fairway. A lighthouse overlooks the estuary. The town contains the only English church in Rumania.

SULITELMA, a mountain on the frontier between Norway and Sweden, forming a salient (615 ft.) of the Kjol or 'keel' of the Scandinavian peninsula. The mass, composed of three peaks, is situated in 63° 10' N., and covered with a snow-field from which many glaciers descend. In these rise feeders of the Swedish rivers Lilla Lule and Pite, flowing south-east. Westward, the foothills descend upon the Skjerstad Fjord, above which are two lakes, Nedre and Ovre Vand. From Sjöstaas steamers on the Langvand and a light railway give communication between the sea and Furulund, the headquarters of the Swedish Sulitelsa Mining Company. A mountain track descends from Sulitelsa to Kvikjok (or Kvikjok), a considerable village magnificently situated on the Tarrsjock, a head-stream of the Lule Litt. This is a departure from the line of the Furulund road.

SULLA, Lucius Cornelius (138-82 B.C.), surnamed Felix, Roman general, politician and dictator, belonged to a minor and impoverished branch of the famous patrician Cornelius gens. He received a careful education, and was a devoted student of literature and art. His political advancement was slow, and he did not obtain the quaestorship until 107, when he served in the Jugurthine war under Marius in Africa. In this he greatly distinguished himself, and claimed the credit of having terminated the war by capturing Jugurtha himself. In these African campaigns Sulla showed that he knew how to win the confidence of his soldiers, and throughout his career the secret of his success seems to have been the enthusiastic devotion of his troops, whom he continued to hold well in hand, while allowing them to indulge in plundering and all kinds of excess. From 104 to 101 he served again under Marius in the war with the Cimbri and Teutones and fought in the last great battle in the Raudian plains near Verona. It was at this time that Marius's jealousy of hislegate laid the foundations of their future rivalry and mutual hatred. When the war was over, Sulla, on his return to Rome, lived quietly for some years and took no part in politics. In 93 he was elected praetor after a lavish squandering of money, and he delighted the populace with an exhibition of a hundred lions from Africa. Not till an (82) he be went as praetor at Cilicia with special authority from the senate to make Mithra- dates VI. of Pontus restore Cappadocia to Ariobarzanes, one of Rome's dependants in Asia. Sulla with a small army soon won a victory over the general of Mithradates, and Rome's client-king was restored. An embassy from the Parthians now came to solicit alliance with Rome, and Sulla was the first Roman who held diplomatic intercourse with that remote people. In the year 91, which brought with it the imminent prospect of sweeping political change, with the enfranchisement of the Italian peoples, Sulla returned to Rome, and it was generally felt that he was the man to lead the conservative and aristocratic party.

Meanwhile Mithradates and the East were forgotten in the crisis of the Social or Italic War, which broke out in 91 and threatened Rome's very existence. The services of both Marius and Sulla were given; but Sulla was the more successful, or, at any rate, the more fortunate. Of the Italian peoples Rome's old foes the Sammites were the most formidable; these Sulla van- quished, and took their chief town, Bovianum. In recognition of this and other brilliant services, he was elected consul in 88, and the next year the republic was saved by the capture of Nola in Campania. The question of the conduct of the campaign to put Mithradates again came to the front. The senate had already chosen Sulla; but the tribune Publius Sulpicius Rufus moved that Marius should have the command. Rioting took place at Rome at the prompting of the popular leaders, Sulla narrowly escaping to his legions in Campania, whence he marched on Rome, being the first Roman who entered the city at the head of a Roman army. Sulpicius was put to death, and Marius fled; and he and his party were crushed for the time.

Sulla, leaving things quiet at Rome, quitted Italy in 87, and for the next four years he was waging victory after victory against the armies of Mithradates and accumulating boundless plunder. Athens, the headquarters of the Mithradatic cause, was taken and sacked in 86; and in the same year, at Chaeronea, the scene of Philip II. of Macedon's victory more than two and a half centuries before, and in the year following, at the neighbouring Orchomenus, he scattered immense hosts of the enemy with trifling loss to himself. Crossing the Hellespont in 84 into Asia, he was joined by the troops of C. Flavius Fimbria, who soon deserted their general, a man sent out by the Marian party, now again the ascendant in the Roman state. And the year was concluded with Mithradates on condition that he should be put back to the position he held before the war; but, as he raised objections, he had in the end to content himself with being simply a vassal of Rome.

Sulla returned to Italy in 83, landing at Brundisium, having previously informed the senate of the result of his campaigns in Greece and Asia, and announced his presence on Italian ground. He further complained of the ill-treatment to which his friends and partisans had been subjected during his absence. Marius had fled in 86, and the revolutionary party, specially represented by L. Cornelius Cinna, Cn. Papirius Carbo and the younger Marius, had massacred Sulla's supporters wholesale, confiscated his property, and declared him a public enemy. They felt they must resist him to the death, and with the troops scattered throughout Italy, and the newly enfranchised Italians, to whom it was understood that Sulla was bitterly hostile, they counted confidently on success. But on Sulla's advance at the head of his 40,000 veterans many of them lost heart and deserted their leaders, while the Italians themselves, whom he confirmed in their new privileges, were won over to his side. Only the Sam- nites, who were as yet not involved in the Roman war, remained his enemies, and it seemed as if the old war between Rome and Samnium had to be fought once again. Several Roman nobles,
among them Gnaeus Pompeius (Pompey the Great), Q. Caecilius Metellus Pius, Marcus Licinius Crassus, Marcus Licinius Lucullus, joined Sulla, and in the following year (82) he won a decisive victory over the younger Marius near Praeneste (mod. Palestrina) and then marched upon Rome, where again, just before his defeat of Marius, there had been a great massacre of his adherents, in which the learned jurist Q. Mucius Scaevola perished. Rome was at the same time in extreme peril from the advance of a Samnite army, and was barely saved by Sulla, who, after a hard-fought battle, routed the enemy under Pontius Tellenus at the Cella of Rome. With the death of the younger Marius, who killed himself after the surrender of Praeneate, the civil war was at an end, and Sulla was master of Rome and of the Roman world. Then came the memorable "proscription," when for the first time in Roman history a list of men declared to be outlaws and public enemies was exhibited in the forum, and a reign of terror began throughout Rome and Italy. The title of "dictator" was revived and Sulla was in fact emperor of Rome. After celebrating a splendid triumph for the Mithradatic War, and assuming the surname of "Felix" ('Epaphroditus," "Venus's favourite") he styled himself in a dittatory style, he carried in 80 and 79 his great political reforms (see Rome: History, II. "The Republic"). The main object of these was to invest the senate, which he recruited with a number of his own party, with full control over the state, over every magistrate and every province; and the mainstay of his political system was to be the military colonies which he had established with grants of land throughout every part of Italy, to the ruin of the old Italian freeholders and farmers, who from this time dwindled away, leaving whole districts waste and desolate.

In 79 Sulla resigned his dictatorship and retired to Puteoli (mod. Pozzuoli), where he died in the following year, probably from the bursting of a blood-vessel. The story that he fell a victim to a disease similar to that which cut off one of the Herods (Acts xii, 23) is probably an invention of his enemies. The "half lion, half fox," as his enemies called him, the "Don Juan of politics" (Mommsen), the man who carried out a policy of "blood and iron" with a grim humour, amused himself in his last days with actors and actresses, with dabbling in poetry, and completing the Memoirs (commentarii, οὐρανοφυσα) of his eventful life (see H. Peter, Historiae romanae veteres, 1870). Pericles had risen to a height above his countrymen, and his end is said to have been hastened by a fit of passion, brought on by a remark of the quaker Granius, who openly asserted that he would escape payment of a sum of money due to the Romans, since Sulla was on his death-bed. Sulla sent for him and had him strangled in his presence; in his excitement he broke a blood-vessel and died on the following day. He was accorded a magnificent public funeral, his body being removed to Rome and buried in the Campus Martius. His monument bore an inscription written by himself, to the effect that he had always fully repaid the kindnesses of his friends and the wrongs done him by his enemies. His military genius was displayed in the Social War and the campaigns against Mithradas; while his constitutional reforms, although doomed to failure from the lack of successors to carry them out, were a triumph of organization. But he massacred his enemies in cold blood, and exacted vengeance with pitiless and calculated cruelty; he sacrificed everything to his own ambition and the triumph of his party.

The ancient authorities for Sulla and his time are his Life by Plutarch (who made use of the Memoirs); Appian, Bell. civ.; for the references in Cicero see Orelli’s edition mentioned above. Modern studies by C. S. Zachariä, L. Cornelius S. als Ordner des römischen Freistaates (1834); T. Lau, Lucius Cornelius Sulla (1855); E. Linfen, De bello civili Sullano (1896); P. Cantalupi, La Guerra civile Sullan (1899); W. Mann, Seven Roman Statesmen (1902); F. D. Getlach, Marius und Sulla (1856); J. M. Sunden, "De tribunica potestate a Lucio Sulla inminiata" in Skrifter utgivna av k. humanistiska Väsendskapsamnet i Upsala, v. 1897, in which it is argued that the right of proposing rogations and the right of proposing rogations was not the right of proposing rogations. See also Mommsen’s History of Rome, vol. iii., bk. iv., ch. 8, 9; Drumm, Geschichte Roms.

1 A short epigram on Aphrodite in the Greek Anthology (Anth. Pal., A. append., i, 153) is ascribed to him.


His nephew (as some say, though the degree of relationship cannot be clearly established), PUBlius CORNELIUS SULLA was consul in 66 B.C. with P. Autronius Paetus. Both were convicted of bribery, and Paetus subsequently joined Catiline in his first conspiracy. There is little doubt that Sulla also was implicated; Sallust does not mention it, but other authorities definitely assert his guilt. After the second conspiracy he was accused of having taken part in both conspiracies. Sulla was defended by Cicero and Hortensius, and entered Mr. Helmore’s school that he might be saved, and with the conviction, Sulla remained very quiet, and, whatever his sympathies may have been, took no active part in the conspiracy. When the civil war broke out, Sulla took the side of Caesar, and commanded the right wing at the battle of Pharsalus. He died in 45.

See Cicero, Pro Sulla, passim (ed. J. S. Reid, 1882); Ad Fam. vi. 10, xv. 17; Dio Cassius xxxvi. 44, xxxvii. 95; Suetonius, Caesar, 9; Caesar, Bell. civ., iii. 51, 89; Appian, Bell. civ. ii. 76.

SULLIVAN, Sir Arthur Seymour (1842-1900), English musical composer, was born in London on the 13th of May 1842, being the younger of the two sons of Thomas Sullivan, a cultivated Irish musician who was bandmaster at the Royal Military College, Sandhurst, from 1845 to 1856, and taught at the Military School of Music at Kneller Hall from 1847 till his death in 1866. His mother, née Mary Coghlan (1811-1858), had Italian blood in her veins. Arthur Sullivan was brought up to music from boyhood, and he had learnt to play every wind instrument in his father's band by the age of eight. He was sent to school at Bayswater till he was twelve, and then, through Sir George Smart, he was, at his own persistent request, made a Chapel Royal chorister, and entered Mr. Helm’s school for Chapel Royal boys in Cheyne Walk. He had a fine treble voice, and sang with exceptional taste. In 1856 the Mendelssohn Scholarship at the Royal Academy of Music was thrown open for the first time for competition, and was won by Sullivan, his nearest rival being Joseph Barnby. At the Academy he studied under Sterndale Bennett, Arthur O'Leary and John Goss, and did so well that he was given an extension of his scholarship for two years in succession. In 1858, his voice having broken, he was enabled by means of his scholarship to go to study at the conservatorium of Leipzig. There he had for teachers Moscheles and Flidi for piano-forte, Hauptmann for counter-point, Rietz and Reinecke for composition, and F. David for orchestral playing and conducting. Among his fellow-students were Grieg, Carl Rosa, Walter Bache, J. F. Barnett and Edward Dannreuther. Instead of the Mendelssohn cultus which represented orthodoxy in London, German musical interest at this period centred in Schumann, Schubert and the growing reputation of Wagner, whilst Liszt and Von Bülow were the celebrities of the day. Sullivan thus became acquainted for the first time with masterpieces which were then practically ignored in England. He entered enthusiastically into the spirit of the place, and after two years' hard study returned to London in April 1861. Before doing so, however, he had composed his incidental music for The Tempest, which he had begun as a sort of diploma work. Sullivan set himself to find converts in London to the enthusiasm he had imbibed at Leipzig. He became acquainted with George Grove, then secretary of the Crystal Palace, and August Manns, the conductor there; and at his instigation Schumann's First Symphony was introduced at one of the winter concerts. Early in 1862 Sullivan showed Grove and Manns his Tempest music, and on the 4th of April it was performed at the Crystal Palace. The production was an unmixed triumph, and Sullivan's exceptional gifts as a composer were generally recognized from that moment. He had hitherto been occupying himself with teaching, and he continued for some years to act as organist at St Michael's, Chester Square, but henceforth he devoted most of his time to composition. By 1864 he had produced his "Kennworth" cantata (remembered chiefly for the lovely duet, "How sweet the Moonlight"), the "Sapphire Necklace" overture, and the five beautiful songs from Shakespeare, which include
"Orpheus with his Lute," "Oh Mistress Mine" and "The Willow Song." His attractive personality, combined with his undoubted genius and brilliant promise, brought him many friends. Costa, who was conductor at Covent Garden, gave him the post of organist, and in 1864 he produced there his L'Île Enchantée ballet. Some of his spare time was spent in Ireland, where in 1863 he began the composition of his ("Irish") Symphony in E, which was produced at the Crystal Palace in 1866. The most important event, however, at this period, as bearing upon his later successes, was his co-operation with F. C. Burnand in the musical extravaganza Cox and Box, which first showed his capacity for musical drollery. This was acted privately in 1866, and was completed for public performance in 1867, in which year Sullivan again co-operated with Burnand in Contrabandista. Meanwhile he was in request as a conductor, and was made professor of composition at the Academy. His father's sudden death in 1866 inspired him to write the fine "In Memoriam" overture, which was produced at the Norwich Festival. In 1867, besides producing his "Marmion" overture, he and Grove did a great service to their art by bringing to light in Vienna a number of lost Schubert MSS., including the Rossmanné music. About this time Sullivan induced Tennyson to write his song-cycle "The Window," to be illustrated by Millais, with music by himself. But Millais abandoned the task, and Tennyson was not happy about his share; and the series, published in 1871, never became popular, in spite of Sullivan's dainty setting. In 1869 he brought out his oratorio The Prodigal Son at Worcester, and in 1870 his overture "Di Ballo" at Birmingham. In 1871 Sullivan had become acquainted with W. S. Gilbert (q.v.), and in 1872 they collaborated in a piece for the Gaiety Theatre, called Thespis; or, The Gods Grow Old, which was a great success in spite of the limited vocal resources of the performers. In 1875 R. D'Oyly Carte, then acting as manager for Selina Dolaro at the Royalalty, approached Gilbert with a view to his collaborating with Sullivan in a piece for that theatre. Gilbert had already suggested to Sullivan an operaetta with its scene in a law court, and within three weeks of his completing the libretto of Trial by Jury the music was written. The piece succeeded beyond all expectation; and on the strength of its promise of further successes D'Oyly Carte formed his Comedy Opera Company and took the Opéra Comique Theatre. There in 1877 The Sorcerer was produced, George Grossmith and Rutland Barrington being in the cast. In 1878 H.M.S. Pinafore was brought out at the Opéra Comique. At first it did not attract large audiences, but eventually it became a popular success, and ran for 700 nights. In America it was enthusiastically received, and the two authors, with D'Oyly Carte, went over to the States in 1879, with a company of their own, in order to produce it in New York. To secure the American rights for their next opera, they brought out The Pirates of Penzance at New York in 1879. In 1880, in London, it ran for nearly 400 nights. In 1881 Patience was produced at the Opéra Comique, and was transferred later in the year to the Savoy Theatre. There all the later operas came out: Iolanthe (1882), Princess Ida (1884), The Mikado—perhaps the most charming of all—(1885), Ruddigore (1887), The Yeomen of the Guard (1888), The Gondoliers (1889). This succession of pieces by Gilbert and Sullivan had made their united names stand for a new type of light opera. Its vogue owed something to such admirable performers as George Grosssmith—famous for his "patter songs"—Rutland Barrington, Miss Jessie Bond, Miss Brandram, and later W. H. Davison and Walter Passmore; but these artists only took advantage of the opportunities provided by the two authors. In place of the old adaptations of French opéra bouffe they had substituted a genuinely English product, humorous and delightful, without a tinge of vulgarity or the commonplace. But disagreements now arose between them which caused a dissolution of partnership. Sullivan's next Savoy opera, Haddon Hall (1892), had a libretto by Sydney Grundy; and the resumption of Gilbert's copyright in Thespis, and again in 1896 in The Grand Duke, was not as successful as before. Sullivan's music, however, still showed its characteristic qualities in the Chieftain (1894)—largely an adaptation of Contrabandista; The Beauty Stone (1898), with a libretto by A. W. Pinero and J. Comyns Carr; and particularly in The Rose of Persia (1900), with Captain Basil Hood.

In the public mind Sir Arthur Sullivan (who was knighted in 1883) had during these years become principally associated with the enormous success of the Savoy operas; but these by no means exhausted his musical energies. In 1872 his Te Deum for the recovery of the prince of Wales was produced at the Crystal Palace. In 1873 he produced at the Birmingham Musical Festival his oratorio The Light of the World, in 1877 he wrote his incidental music to Henry VIII., in 1880 his sacred cantata The Martyr of Antioch, and in 1886 his masterpiece, The Golden Legend, was brought out at the Leeds Festival. The Golden Legend satisfied the most exacting critics that for originality of conception and grandeur of execution English music possessed in Sullivan a composer of the highest calibre. In 1891, for the opening of D'Oyly Carte's new English opera-house in Shaftesbury Avenue he wrote his "grand opera" Thaïs (1891). Try Julian Sturgis. The attempt to put an English opera on the stage for a long run was doomed to failure, but Ivanhoe was full of fine things. In 1892 he composed incidental music to Tennyson's Foresters. In 1897 he wrote a ballet for the Alhambra, called Victoria and Merrie England. Among his numerous songs, a conspicuous merit of which is their admirable vocal quality, the best known are "If Doughty Deeds" (1866), "The Sailor's Grave" (1872), "Thou'r Passage Hence" (1873), "I would I were a King" (1878), "King Henry's Song" (1878) and "The Last Chord" (1877). This last, hackneyed as it is, has become one of the most beautiful English songs of the 19th century. It was written in 1877, during the fatal illness of Sullivan's brother Frederic, who, originally an architect, had become an actor, and by means of his fine voice and powers as a comedian (best shown as the Judge in Trial by Jury) had won considerable success. Among Sullivan's many hymn tunes, the stirring "Onward, Christian Soldiers!" (1872) is a permanent addition to Church music. In 1876 he accepted the principalship of the National Training School of Music, which he held for six years; this was the germ of the subsequent Royal College. He received the honorary degree of Mus. Doc. from Cambridge (1876) and Oxford (1876). In 1878 he was a member of the royal commission for the Paris Exhibition. He was conductor of the Leeds Festivals from 1879 to 1898, besides being conductor of the Philharmonic Society in 1885. Apart from his broad sympathy and his practical knowledge of instruments, his work as a conductor must always be associated with his efforts to raise the standard of orchestral playing in England and his unwearying exertions on behalf of British music and British musicians. Sullivan liked to be associated in the public mind with patriotic objects, and his setting of Rudyard Kipling's "Absent-minded Beggar" song, at the opening of the Boer War in 1899, was, with the exception of The Rose of Persia, the last of his compositions brought out in his lifetime. He died suddenly on November 22nd, 1900, and his burial in St. Paul's Cathedral was the occasion of a remarkable demonstration of public sorrow. He left unpublished a Te Deum written for performance at the end of the Boer War, and an unfinished Savoy opera for a libretto by Captain Hood, which, completed by Edward German, was produced in 1901 as The Emerald Isle.

Sullivan was the one really popular English composer of any artistic standing in his time; and his celebrity as a public man has somewhat interfered with a definite judgment as to his place in the history of English music. In his own time, English musical taste developed in a very remarkable degree; and musical criticism in serious quarters was a little disinclined to do justice to what was "popular." One of the most agreeable companions, broad-minded, and free from all affectation, he was intensely admired and loved in all circles of society; and though his health was not robust, for he suffered during many years at intervals from a painful ailment, he was a man of the world who enjoyed the life which his success opened out to him without being spoilt.
SULLY, J. -- SULLY, JAMES

by it. He was always a devoted and an industrious musician, and from the day he left Leipzig his influence was powerfully exerted in favour of a wider and fuller recognition of musical culture. He was accused in some quarters of being unsympathetic towards Wagner and the post-Wagnerians, yet he had been one of the first to introduce Wagner’s music to English audiences. He was keenly appreciative of new talent, but his tastes were too eclectic to satisfy the enthusiasts for any particular school; he certainly had no liking for what he considered uninspired academic writing. Serious critics deplored, with more justification, that he should have devoted so much of his great natural gift not merely to libretti, but to the production of a number of songs which, though always musically, were really of the nature of “pot-boiling.” Sullivan was an extremely rapid worker, and his fertility in melody made it easy for him to produce what would please a large public. Moreover, it must be admitted that his great social success, so early achieved, was not calculated to nourish a rigidly artistic ideal. But when all is said, his genius remains undisputed; and it was a genius essentially English. His church music alone would entitle him to a high place among composers; and as the “Goldscheider Legend, Innaund and Invidia,” and the “Irish” symphony and the charming “incidental music” to The Tempest and to Henry VIII, form a splendid legacy of creative effort, characterized by the highest scholarly qualities in addition to those beauty which appeal to every ear. Whether his memory will be chiefly associated with these works, or rather with the world-wide popularity of some of his songs and comic operas, time alone can tell. The Savoy operas did not aim at intellectual or emotional grandeur, but at providing innocent and wholesome pleasure; and in giving musical form to Gilbert’s witty librettos Sullivan showed once for all what light opera may be when treated by the hand of a master. His scores are as his words, and fanciful qvd music as Gilbert’s verses are qvd dramatic literature. Bubbling melody, consummate orchestration, lovely songs and concerted pieces (notably the famous vocal quintets) flowed from his pen in unexhausted and inimitable profusion. If he had written nothing else, his unique success in this field would have been a solid title to fame. As it was, it is Sir Arthur Sullivan’s special distinction not only to have been prolific in music which went straight to the hearts of the people, but to have enriched the English répertoire with acknowledged masterpieces, which are no less remarkable for their technical accomplishment.

See also Sir Arthur Sullivan: Life, Letters, and Reminiscences, by Arthur Lawrence, 1899 (1st ed. 1896; 2nd ed. 1900). Besides largely autobiographical, this volume contains a complete list of Sullivan’s works, compiled by Mr Wilfrid Bendall, who for many years acted as Sir Arthur’s private secretary. (H. Ch.)

SULLIVAN, JOHN (1740-1793), American soldier and political leader, was born in Somersworth, New Hampshire, on the 18th of February 1740. He studied law in Portsmouth, N.H., and practised at Berwick, Maine, and at Durham, N.H. He was a member of the New Hampshire Provincial Assembly in 1774, and in 1774-1775 was a delegate to the Continental Congress. In 1777 he had been commissioned General of New Hampshire militia, and on the 13th of December 1774 he and John Langdon led an expedition which captured Fort William and Mary at New Castle. Sullivan was appointed a brigadier-general in the Continental army in June 1775 and a major-general in August 1776. He commanded a brigade in the siege of Boston. In June 1776 he took command of the American army in Canada and after an unsuccessful skirmish with the British at Three Rivers (June 8) retreated to Crown Point. Rejoining Washington’s army, he served under General Israel Putnam in the battle of Long Island (August 27) and was taken prisoner. Released on parole, he bore a verbal message from Lord Howe to the Continental Congress, which led to the fruitless conference on Staten Island. In December he was exchanged, succeeded General Charles Lee in command of the right wing of Washington’s army, in the battle of Trenton led an attack on the Hessians, and led a night attack against British and Loyalists on Staten Island, on the 22nd of August 1777. In the battle of Brandywine (Sept. 11, 1777) he again commanded the American right; he took part in the battle of Germantown (Oct. 4, 1777); in March 1778 he was placed in command in Rhode Island, and in the following summer plans were made for his co-operation with the French fleet under Count d’Estaing in an attack on Newport, which came to nothing. Sullivan after a brief engagement (Aug. 29) at Quaker Hill, at the N. end of the island of Rhode Island, was obliged to retreat. In 1779, Sullivan, with about 4,000 men, defeated the Iroquois and their Loyalist allies at Newburg (now Elmira), New York, on the 26th of August, burned their villages, and destroyed their orchards and crops. Although severely criticised for his conduct of the expedition, he received, in October 1779, the thanks of Congress. In November he resigned from the army. Sullivan was again a delegate to the Continental Congress in 1780-1781 and, having accepted a loan from the French minister, Chevalier de la Luzerne, he was charged with being influenced by the French in voting not to make the right to the north-east fisheries a condition of peace. From 1782 to 1785 he was attorney-general of New Hampshire. He was president of the state in 1786-1787 and in 1789, and in 1786 suppressed an insurrection at Exeter immediately preceding the Shays Rebellion in Massachusetts. He presided over the New Hampshire convention which ratified the Federal constitution in June 1788. From 1789 until his death at Durham, on the 23rd of January 1795, he was United States District Judge for New Hampshire.


SULLIVAN, THOMAS BARRY (1832-1891), Irish actor, was born at Birmingham, and made his first stage appearance at Cork about 1840. His earliest successes were in romantic drama, for which his graceful figure and youthful enthusiasm fitted him. His first London appearance was in 1852 in Hamlet, and he was also successful as Angiolo in Miss Vandenhoff’s Woman’s Heart, Evelyn in Money and Hardman in Lord Lytton’s Not So Bad as we Seem. Claude Melnotte—helen Faucit as Pauline—was also a notable performance. A tour of America in 1857 preceded a second tour, and in 1859 he took the management of the Globe in London. He completed a trip round the world in the year 1866. From 1869 to 1870 he managed the Holborn theatre, where Beverley in The Ganger was one of his most powerful impersonations. Afterwards he travelled over the United States, Canada, Australia and England. Among his later London performances were several Shakespearian parts, his best, perhaps, being Richard III. He was the Benedict of the cast of Much A do About Nothing with which the Shakespeare Memorial was opened at Stratford-on-Avon. He died on the 3rd of May 1891.

SULLY, JAMES (1843— ), English psychologist, was born on the 30th of March 1842 at Bridgewater, and was educated at the Independent College, Taunton, the Regent’s Park College, Göttingen and Berlin. He was originally destined for the Nonconformist ministry, but in 1871 adopted a literary and philosophic career. He was Grote professor of the philosophy of mind logic at University College, London, from 1892 to 1903, when he was succeeded by Carveth Read. An adherent of the associationist school of psychology, his views had great affinity with those of Alexander Bain. His monographs, as that on pessimism, are ably and readily readable, and his textbooks, of which The Human Mind (1893) is the most important, are models of sound exposition.

WORKS.—Sensation and Intuition (1824). Pessimism (1897), Illusions (1881; 4th ed., 1895), Outlines of Psychology (1884; many editions), Teacher’s Handbook of Psychology (1886), Studies of Childhood (1895), Children’s Ways (1897), and An Essay on Laughter (1902).
SULLY, DUC DE—SULLY, T.

SULLY, MAXIMILIEN DE BÉTHUNE, DUC DE (1560–1641). French statesman, was born at the château of Rosny near Montes, on the 13th of December 1560, of a noble family of Flemish descent. His father, François de Béthune, baron de Rosny, (1532–1575), was the son of Jean de Béthune, to whom in 1529 his wife Anne de Melun brought as part of her dowry a scigneure at Rosny-sur-Seine, which later (1601) was made a marquisate. Brought up in the Reformed faith, Maximilien was presented to Henry of Navarre in 1571 and was thenceforward attached to the future king of France. The young baron de Rosny was taken to Paris by his patron and was studying at the Collège de Bourgogne at the time of the massacre of St Bartholomew's Day, from which he escaped by discreetly carrying a book of hours under his arm. He then studied mathematics and history at the court of Henry of Navarre, and on the outbreak of civil war in 1573 he enlisted in the Protestant army. In 1576 he accompanied the duke of Anjou on an expedition into the Netherlands in order to regain the former Rosny estates, but being unsuccessful he attacked himself for a time to the prince of Orange. Later rejoining Henry of Navarre in Guise, he displayed bravery in the field and particular ability as an engineer. In 1583 he was Henry's special agent in Paris. In 1584 he married Anne de Courtenay, a wealthy heiress, who died, however, in 1589. On the renewal of civil war Rosny again joined Henry of Navarre, and at the battle of Ivry (1590) was seriously wounded. He counselled Henry IV.'s conversion to Roman Catholicism, but steadfastly refused himself to become a Roman Catholic. As soon as Henry's power was established, the faithful and trusted Rosny received his reward in the shape of numerous estates and dignities. On the death of D'O, the superintendent of finances, in 1594, the king had appointed a finance commission of nine members, to which he added Rosny in 1596. The latter at once made a tour of inspection through the generalties, and introduced some order into the country's affairs. He was probably made sole superintendent of finances in 1598, although this title does not appear in official documents until the close of 1601. He authorized the free exportation of grain and wine, reduced legal interest from 8% to 6½%, established a special court for the trial of cases of peculation, forbade provincial governors to raise money on their own authority, and otherwise removed many abuses of tax-collecting, abolished several offices, and by his honest, rigorous conduct of the country's finances was able to save between 1600 and 1610 an average of a million livres a year. His achievements were by no means solely financial. In 1596 he was appointed grand commissioner of highways and public works, superintendent of fortifications and grand master of artillery; in 1602 governor of Montes and of Jargeau, captain-general of the queen's gens d'armes and governor of the Bastille; in 1604 governor of Poitiers; and in 1606 duke and peer of Sully, ranking next to princes of the blood. He declined the office of constable because he would not become a Roman Catholic. Sully encouraged agriculture, urged the free circulation of produce, promoted stock-raising, forbade the destruction of forests, drained swamps, built roads and bridges, planned a vast system of canals and actually began the canal of Briare. He strengthened the French military establishment; under his direction Évrard began the construction of a great line of defences on the frontiers. Sully opposed the king's colonial policy as inconsistent with the French genius, and likewise showed little favour to industrial pursuits, although on the urgent solicitation of the king he established a few silk factories. He fought in company with Henry IV. in Savoy (1600–1601) and negotiated the treaty of peace in 1602; in 1603 he represented Henry at the court of James I. of England; and throughout the reign he helped the king to put down insurrections of the nobles, whether Roman Catholic or Protestant. It was Sully, too, who arranged the marriage between the king and Marie de Medicis in 1600.

The political rôle of Sully practically ended with the assassi- nation of Henry IV. on the 14th of May 1610. Although a member of the council of regency, his colleagues were not disposed to brook his domineering leadership, and after a stormy debate he resigned as superintendent of finances on the 26th of January 1611, and retired to private life. The queen-mother gave him 300,000 livres for his services and confirmed him in possession of his estates. He attended the estates-general in 1614, and on the whole was in sympathy with the policy and government of Richelieu. He disavowed the plots at La Rochelle, in 1621, but in the following year was arrested at Moulins, though soon released. The ban of marshal of France was conferred on him on the 18th of September 1634. The last years of his life were spent chiefly at the château of Rosny and Sully. He died at Villebon, on the 22nd of December 1641. By his first wife Sully had one son, Maximilien, marquis de Rosny (1587–1634), who led a life of dissipation and debauchery. By his second wife, Rachel de Cochefilet, widow of the lord of Châteaupers, whom he married in 1592 and who turned Protestant to please him, he had nine children, of whom six died young, and one daughter married in 1605 Henri de Rohan.

Sully was not popular. He was hated by most Roman Catholics because he was a Protestant, by most Protstants because he was faithful to the king, and by all because he was a favourite, and selfish, obstinate and rude. He amassed a large personal fortune, and his jealousy of all other ministers and favourites was extravagant. Nevertheless he was an excellent man of business, inexorable in punishing malversation and dishonesty on the part of others, and opposed to the ruinous court expenditure which was the bane of almost all European monarchies in his day. He was gifted with executive ability, with confidence and resolution, with fondness for work, and above all with an almost unexampled love of his country. He was implicitly trusted by Henry IV. and proved himself the most able assistant of the king in dispelling the chaos into which the religious and civil wars had plunged France. To Sully, next to Henry IV., belongs the credit for the happy transformation in France between 1598 and 1610 by which agriculture and commerce were benefited and foreign peace and internal order were maintained.

Sully left a curious collection of memoirs written in the second person and bearing the quaint title, Mémoires des sages et royales economies d'état, domestiques, politiques, et militaires de Hen-ry le Grand, l'exemple des roys, le prince des vertus, et des loix, et le père en effet de ses peuples francicois; et des ser- vitudes utiles, Economies des plus confidents, familiers, et utiles soldats et officiers des grands Mars des François: dédiées à la France, à tous bons soldats, et tous peuples français. The memoirs are very valuable as a record of the state of the French finances at the time of the fact that they contain many fictions, such as a mission undertaken by Sully to Queen Elizabeth in 1601, and the famous "Grand Design," a plan for a Christian republic, which some historians have taken seriously. Two volumes have been published, the third and fourth splendidly printed, nominally at Amsterdam, but really under Sully's own eye, at his château in 1638; two other volumes appeared posthumously in Paris in 1662. The abbé de l'Ecluse rewrote the memoirs in ordinary narrative form and edited them in 1743. The best edition of the original is that in J. F. Michaud and J. J. F. Poujoulat. Nouvelle collection des mémoires relatifs à l'histoire de France (1814). vols. xvi.-xvii. An English translation by Charlotte Lennox appeared in 1756 and was later revised and republished (4 vols., London, 1865).


SULLY, THOMAS (1753–1872), American artist, was born at Haverhill, New Hampshire, on the 8th of June 1753. His parents, who were both pious Quakers, took him to America when he was nine years old, settling at Charleston, South Carolina, and he was first instructed in art by a French miniature painter. Afterwards he was a
pupil of Gilbert Stuart in Boston, and in 1809 he went to London and entered the studio of Benjamin West. He returned in 1810, and made Philadelphia his home, but in 1837 again visited London, where he painted a full length portrait of Queen Victoria for the St George's Society of Philadelphia. Sully was one of the best of the early American painters. He died in Philadelphia on the 5th of November 1872. Among his portraits are those of Commodore Decatur (City Hall, New York); the actor George Frederick Cooke, as Richard III. (Pennsylvania Academy of the Fine Arts, Philadelphia); Lafayette (Independence Hall, Philadelphia; U.S. Military Academy, West Point, New York); Charles and Frances Anne Kemble, and Reverdy Johnson. His son Alfred Sully (1821–1879) an officer in the United States army, was a brigade-commander in the Army of the Potomac in 1862-63, and after 1863 commanded the department of Dakota and conducted several campaigns against hostile Indians in the north-west. In 1865 he was breveted brigadier-general in the regular army and major-general of volunteers.

SULLY-PRUDHOMME, RENÉ FRANÇOIS ARMAND PRUD- HOMME: French poet, was born in Paris on the 16th of March 1839. He was educated at the Lycée Bonaparte, where after a time he took his degree as Bachelier ès Sciences. An attack of ophthalmia then interrupted his studies and necessitated an entire change in the course of his career. The scientific habit of mind, however, which he had derived from these years of technical study never left him; and it is in the combination of this scientific bent, with a soul aspiring towards what lies above and beyond science, and a conscience perpetually in agitation, that the striking originality of Sully-Prudhomme's character is to be found. He found employment for a time in the Schneider factory at Creuzot, but he soon abandoned an occupation to which he was eminently unsuited. He subsequently decided to read law, and entered a notary's office at Paris. It was during this period that he composed those early poems which were not long in acquiring celebrity among an ever-widening circle of friends. In 1865 he published his first volume of poems, which had for sub-title Stances et poèmes. This volume was favourably reviewed by Sainte-Beuve, to whose notice it had been brought by Gaston Paris. It was at this moment that the small circle of which Leconte de Lisle was the centre were preparing the Pararnes, in which Sully-Prudhomme contributed several pieces. In 1866 Lemercier published a new edition of the Stances et poèmes and a collection of sonnets entitled Les Épreuves (1866). From this time forward Sully-Prudhomme devoted his life entirely to poetry. It was in the volume of Les Épreuves that the note of melancholy which was to dominate through the whole work of his life was first clearly discernible. In 1869 he published a translation of the first book of Lucretius with a preface, and Les Solitudes. In 1870 a series of domestic bereavements and a serious paralytic illness resulting from the strain and fatigue of the winter of 1870, during which he served in the Garde Mobile, shattered his health. In 1872 he published Les Écœurs d'angiés, Croquis italiens, Impressions de la guerre (1866-72) and Les Destins, La Résolte des héros in 1874, in 1875 Les Vaines tendresses, in 1878 L'Injustice, in 1886 Le Prisme, and in 1888 Le Bonheur. All these poems were collected and republished under the title of Poésies, occupying four volumes of his Œuvres (6 vols., 1883–1904). After the publication of Le Bonheur he practically ceased to produce verse, and devoted himself almost entirely to philosophy. He published two volumes of prose criticism L'expression dans les beaux arts (1884) and Réflexions sur l'art des vers (1882). Various monographs by him appeared from time to time in the philosophical reviews, and are among the remarkable series of essays (Revue des deux mondes, Oct. 15th, Nov. 15th, 1890) on Pascal, and a valuable study on the "Psychologie du libre arbitre" in the Revue de métaphysique et de morale (1906). He was elected to the Academy on the 8th of December 1881. On the 10th of December 1901 he was awarded the Nobel prize for literature, and devoted most of the money to the foundation of a prize for poetry to be awarded by the Société de gens de lettres. He was one of the earliest champions of Captain Dreyfus. In 1902 he wrote, in collaboration with Charles Richet, Le Problème des causes finales. During his later years he lived at Châtenay in great isolation, a victim of perpetual ill-health, and mainly occupied with his Vraie religion selon Pascal (1905). He had been partially paralysed for some time when he died suddenly on the 6th of September 1907. He left a volume of unpublished verse and a prose work, Le Lion social, which was a revision of an introduction which he had contributed to Michelet's La Bible de l'humanité.

What strikes the reader of Sully-Prudhomme's poetry first and foremost is the fact that he is a thinker; and moreover a poet who thinks, and not a thinker who turns to rhyme for recreation. The most strikingly original portion of his work is to be found in his philosophic and scientific poetry. If he has not the scientific genius of Pascal, he has at least the scientific habit of mind and a delight in mathematical certainties. In attempting to interpret the universe as science reveals it to us he has created a new form of poetry which is not lacking in a certain grandeur, of his most beautiful poems, "L'Idéal" (Stances et poèmes). His science is not due to scientific calculations, of stars so remote from our planet that their light has been on its way to us since thousands of centuries and will one day be visible to the eyes of a future generation. The second chief characteristic of Sully-Prudhomme's poetry is the extreme sensibility of soul, the profoundly melancholy note which we find in his love lyrics and his meditations. Sully-Prudhomme is above all things introspective; he penetrates into the hidden corners of his heart; he lays bare the subtle torments of his conscience, the shifting currents of his hopes and fears, belief and disbelief in face of the riddle of the universe to an extent so poignant as to be sometimes almost painful. And to render the fugitive phases and tremulous adventures of his spirit he finds incomparably delicate shades of expression, an exquisite and sensitive diction. We are struck in reading his poems by the nobility of his ideas, by a religious elevation like that of Pascal; for there is in his work something both of Lucretius and of Pascal. Yet he is far from being either an Epicurean or a Jansenist; he is rather a Stoic to whom the deceptions of life have brought pity instead of bitterness.

As an artist Sully-Prudhomme is remarkable for the entire absence of oratorical effect; for the extreme simplicity and fastidiously precise of his diction. Other poets have been endowed with a more glowing imagination; his poetry is neither exuberant in colour nor rich in sonorous harmonies of rhyme. The grace of his verse is a grace of outline and not of colour, his melody one of subtle rhythm; his verse is as if carved in ivory, his music like that of a perfect unison of stringed instruments. His imagination is inseparable from his ideas, and this is the reason of the extraordinary perspicuity of his poetic style. He extends poetry to two extreme limits; on the one hand to the borderland of the unreal and the dreamlike, as in a poem such as "Le Rêveur," (Vaines tendresses) in which he seems to express the inexpressible in precise language; on the other hand, in his scientific poems he encroaches on the province of prose. His poetry is plastic in the creation of forms which fittingly express his fugitive emotions and his elevated ideas. Both by the charm of his pure and perfect phrase, by his consummate art, and the dignity which informs all his work, Sully-Prudhomme deserves rank among the foremost of modern poets. (E. G.)

See C. Hémon, La Philosophie de Sully-Prudhomme (1907), Sully-Prudhomme by E. Zyromski (Paris 1907).

SULMONA, or Sulmona, a city and episcopal see of Abruzzi, Italy, in the province of Aquila, 40 m. by rail S.E. by E. of that town, and 107 m. E. by N. of Rome (75 m. direct). Pop. (1901), 13,372 (town), 18,247 (commune). Sulmona is situated at a height of 1322 ft. above the sea on the Giaio, a tributary of the Pescara, which supplies water-power to its paper-mills, fulling-mills and copper-works. Its cathedral of San Panfilo has a 14th-century portal. The interior has been modernized, but in the crypt are some medieval sculptures.
Sulmona has also in S. Maria della Tomba a good example of pure Gothic. S. Francesco d’Assisi occupies the site of an older and larger church, the Romanesque portal of which still stands at the end of the Corso Ovidio, and forms the entrance to the meat market. Opposite is a picturesque aqueduct of 1266 with pointed arches. S. Agostino has a good Gothic portal. The Ospedale Cívico, next to the church of the Annunziata, begun in the first half of the 15th century, shows an interesting mixture of Gothic and Renaissance styles. The window of the Palazzo Tabassi is similar, and both are due to Lombard masters. In the court of the grammar school is a fine 15th-century statue of Ovid, the most celebrated native of the town, whose memory is preserved among the peasants in songs and folk-lore. The Porta Napoli is an interesting gate of the early 14th century. Innocent VII. was a native of the town. In the vicinity of the town is Monte Mormore where Pietro di Morone lived (c. 1254) as a hermit and founded a monastery for his hermits, who after his elevation to the papacy as Celestine V. took the name of Celestines; the monastery (S. Spirito) remained till 1879, when it was transformed into a prison. There are some ruins of the imperial period, attributed, groundless, to the house of Ovid near it. The church contains a Gothic tomb of 1412 by a German master, in which Renaissance influence is, according to Burckhardt, traceable for the first time in Italy in the realistic characterization of the portrait figures.

Sulmo, a city of the Paeligni, is first mentioned during the Second Punic War (211 B.C.). It was the second town of the Paeligni in importance, Cornimontium was the Roman colony probably in the reign of Augustus, and as a municipium it continued to flourish throughout the empire. It was situated 7 m. south-east of Cornimontium on the road to Asseria, and was famous for its iron smelting. Hardly any remains of the ancient city exist above ground, owing to frequent earthquakes. A number of discoveries of tombs (both archaic and of the Roman period), &c., have however been made (cf. A. de Nino, in Notizie degli Scavi, passim). Charles V. erected it into a principality, which he bestowed on Charles Lannoy, who had captured Francis I. at the battle of Pavia. It ultimately passed to the Corono and Borghese families. The bishopric is known as that of Valva and Sulmona.

**Sulphonal**, or acetone diethyl sulphide (CH₃COCH₂CH₂SO₂NCH₂CH₂), a valuable hypnotic prepared by condensing acetone with ethyl mercaptan in the presence of hydrochloric acid, the mercaptol (CH₃COCH₂SH) formed being subsequently oxidized by potassium permanganate (E. Baumann, Ber., 1886, 19, p. 2868). It is also formed by the action of alcoholic potash and methyl iodide on ethylidene diethyl sulphide, CH₂=CH-CH₂SO₂NCH₂CH₂. (When heated to the oxygenation of dithiocarbamic acid with potassium permanganate.) It crystallizes in prisms melting at 125° C., which are practically insoluble in cold water, but dissolve in 15 parts of hot and also in alcohol and ether.

It is the *suiphonalium* of the B.P., and the *sulphonethanum* of the U.S.P. It produces lengthened sleep in functional nervous insomnia, and is also useful in insanity, being given with mucilage of acacia or in hot liquids, owing to its insolubility, or in large capsules. Its hypnotic power is not equal to that of chloral, but as it is not a depressant to the heart or respiration it can be used when morphine or chloral are contra-indicated. It is, however, a hypnotic of long action, often failing to produce sleep when taken at bedtime, but producing drowsiness and sleep the following day. The drowsiness the next day following a medicinal dose can be avoided by a saline laxative the morning after its administration. It is unwise to use it continuously for more than a few days at a time, as it tends to produce the sulphonal habit, which is attended by marked toxic effects, disturbances of digestion, giddiness, staggering gait and even paralysis of the lower extremities. These effects are accompanied by skin eruptions, and the urine becomes of a dark red colour (hematoonuria). Sulphonal is cumulative in its effects. Many fatal cases of sulphonal poisoning are on record, both from chronic poisoning and from a single large dose. Trional (CH₃)(CH₂)(CH₂)C(SO₂CH₃)₃, and tetronal, (CH₂)₃C(SO₂CH₃)₃, are also hypnotics. They are faster in action than sulphonal, and trional does not disorder the digestion.

**Sulphonic Acids**, in organic chemistry, a group of compounds of the type R-SO₂H, where R is an alkyl or an aryl group.

**Sulphonic Acid Salts.**—The members of this class may be prepared by the direct sulphonation of some paraflins (I. Worstall, Amer. Chem. Journ., 1898, 20, p. 664); by the oxidation of mercaptans with concentrated nitric acid (H. Kopp, Ann., 1840, 35, p. 346); in the form of their salts from the alkali halides and alkaline sulphites, and as esters from the alkali halides and silver sulphite. They are colourless oils or crystalline solids which are extremely hygroscopic, very soluble in water and have a strongly acid reaction. They are unaffected by heating with aqueous alkalins or acids and are stable towards concentrated nitric acid. Phosphorus pentachloride converts them into the corresponding acid chlorides, R-SO₂Cl, which are decomposed slowly by water. These chlorides, on reduction by zinc and sulphuric acid, pass readily into the mercaptans, whilst if zinc dust and alcohol be used they are converted into the sulphinic acids, R-SO₂.H.

**Methyl sulphonic acid, CH₃SO₂H,** was obtained by H. Kolbe (Ann., 1845, 54, p. 174) by reducing trichloromethyl sulphonic chloride uncertain in its action on bisulphide. Phosphorus was added to the presence of water: CS₂+3Cl₂+2H₂O = CC1₃SO₂Cl+4HCl+SCl₂, which yields a phosphorus amalgam. It is a colourless syrup which decomposes when heated above 130° C. The corresponding acid chloride is an extremely stable solid which melts at 135° C. It is formed by the action of carbon bisulphide on potassium bichromate in the presence of nitric and hydrochloric acids (Lecw, Zeit. f. Chem., 1869, p. 82).

When heated under pressure it decomposes with the final production of carbonyl and chlorine chlorides: Cl₂SO₂Cl = Cl₂SO₂Cl+CCl₃,

Ethyl sulphonic acid, CH₃CH₂SO₂H, is a crystalline deliquescent solid formed by oxidizing ethyl mercaptan or by reducing sulphonic acid chloride, CH₃CH₂SO₂H. (Kohler, Amer. Chem. Journ., 1898, 29, p. 687.)

Thiosulphonous salts of the type R-SO₂-SH are formed by the action of the thiochlorides on a concentrated solution of potassium sulphite: R-SO₂Cl + K₂S = R-SO₂K+K₂SO₂, or by the action of the salt of a sulphonic acid on an alkaline sulphite in the presence of iodine (Otto, Ber., 1891, 24, p. 144).

**Aromatic Sulphonic Acids.**—The acids of this group are very similar to the corresponding aliphatic sulphonic acids and are usually obtained by the direct heating of an aromatic hydrocarbon with concentrated sulphuric acid, fuming sulphuric acid or thionylchloride. After the action is completed they may frequently be "salted out" by adding common salt to the acid solution until no more dissolves. They are the salt of the acid separates (L. Gattermann, Ber., 1891, 24, p. 2121.) They are also formed by oxidizing thiophenols or by decomposing diazium salts with sulphurous acid. The free acids are usually hygroscopic, crystalline solids which are readily soluble in water. When heated under pressure with concentrated hydrochloric acid to about 150° C. they yield hydrocarbons and sulphuric acid. The salts usually crystallize well, and some of the alkali metals are employed in the preparation of phenols, into which they pass when fused with the caustic alkalis. When distilled with potash they yield the aromatic nitriles. The sulphonic acids with phosphorus pentachloride are converted into sulphonochlorides which are stable to cold water, but with ammonia they yield sulphonamidines, R-SO₂NH₂, and with alcohols esters of the sulphonic acids.

**Benzene sulphonate acid, C₆H₅SO₂H,** melts at 114° C. and is very deliquescent. Benzene sulphonochloride, C₆H₅SO₂Cl, is a fuming liquid which boils at 120° C. (10 mm.). The aminobenzene sulphonic acids, particularly the meta, and para compounds, are of importance owing to their employment in the colour industry. The direct sulphonation of aniline yields the para acid, C₆H₅SO₂(NH₂)H, which crystallizes in small plates and is sparingly soluble in cold water. When CO₂, Caustic potash, or alcohol is added, it yields aniline, whilst oxidation with chromic acid yields benzoquinone. In constitution it is probably to be regarded as a cyclic ammonium salt, C₆H₅(NH₂)SO₂H. When diazotized in acid solution and coupled with dimethyl aniline it yields helianthine.
the sodium salt of which is used as an indicator (g.v.). Metanitric acid C\(\text{H}_3\text{N}(\text{NH}_\text{2})\text{(SO}_2\text{H}) \) (I.3), which crystallizes in prisms, is formed by: the reduction of nitrobenzeno sulfonic acid and is used in the preparation of various azo dyes.

Sulphuric acid, R-SO₃H, are formed by reducing sulphochlorides with zinc dust; by the action of sulphur dioxide on the zinc alkyls (Hobson, Ann., 1857, 102, p. 72; 1858, 106, p. 287); by the action of sulphochlorides on mercaptans in alkaline solution; and by the action of the Grignard reagent on sulphur dioxide or thionyl chloride (Rosenheim, Ber., 1904, 37, p. 2125; Oddo, R. Acad. Lit., 1905 (5), 14 (1), p. 169). The free acids are unstable. They are readily oxidized to sulfonic acids and reduced to thioglycerols. Their alkali salts can be treated with the alkali halides yield sulphones, R-SO₂H. Ethyl sulphinic acid, C\(\text{H}_3\text{H}_2\text{SO}_2\text{H} \) is a colourless syrup. Benzene sulphinic acid, C\(\text{H}_6\text{H}_4\text{SO}_2\text{H} \) crystallizes in large prisms and acts as a reducing agent. It decomposes when heated with water under pressure: 3\(\text{C}_\text{H}_3\text{H}_2\text{SO}_2\text{H} \rightarrow \text{C}_\text{H}_3\text{H}_2\text{SO}_2\text{H} + \text{C}_\text{H}_6\text{H}_4\text{SO}_2\text{H} + \text{C}_\text{H}_2\text{H}_2\text{H} + \text{H}_2\text{O} \). The potassium salt when fused with caustic potash yields benzene and potassium sulphite.

SULPHUR [symbol S, atomic weight 32-07 (O = 16)], a non-metallic chemical element, known from very remote times and regarded by alchemists as the prime of its philosophical nature, as the principle of combustion; it is also known as brimstone (g.v.). The element occurs widely and abundantly in nature both in the free state and in combination. Free or native sulphur, known also as "virgin sulphur," occurs in connexion with volcanoes and in certain stratified rocks in several modes, viz. as crystals, and as stalactitic, encrusting, reniform, massive, earthy and occasionally pulverulent forms as "sulphur meal." It seems rather doubtful whether the unstable monoclinal modification of sulphur (\(\beta\)-sulphur) is ever found in a native state.

The crystals belong to the orthorhombic system, and have usually a pyramidal habit (fig. 1); they may be elliptical or tabular; they are rare. The cleavage is imperfect, but there is a well-marked conchoidal fracture. The hardness ranges from about 1 to 2, and the sp.gr. from 1.9 to 2.1. Crystals of sulphur are transparent or translucent and highly refractive with strong birefringence; they have a resinous or slightly adamantine lustre, and present the characteristic sulphur-yellow or orange-red peculiar to the element. Impurities render the mineral grey, greenish or reddish, bituminous matter being often present in the massive varieties. Sulphur containing selenium, for instance, is called fulvous sulphur. The isles of Vulcano and Lipari, in the Lipari islands, may be occasionally of a peculiar orange-red; and a similar colour is seen in sulphur which contains arsenic sulphide, such as that from La Souflatara near Naples. The presence of tellurium in native sulphur is rare, but is known in certain specimens from Quercettino.

Volcanic sulphur usually occurs as a sublimate around or on the walls of the vents, and has probably been formed in many cases by the interaction of sulphur dioxide and hydrogen sulphide. Sublimed sulphur also results from the spontaneous combustion of coal seams containing pyrites. Deposits of sulphur are frequently formed by the decomposition of hydroggen sulphide, on exposure to the atmosphere: hence natural sulphureous waters, especially hot springs, readily deposit sulphur. The reduction of sulphates to sulphides by means of organic matter, probably through the agency of sulphur-bacteria, may also indirectly furnish sulphur, and hence it is frequently found in deposits of gypsum. Free sulphur may also result from the decomposition of pyrites, as in pyritic shales and lignites, or from the alteration of galena: thus crystals of sulphur occur, with angles, in cavities in galena at Monteponi near Leghorn in Tuscany; while R. G. Herrick states that sulphur sometimes yields sulphur on weathering. It should be noted that the oxidation of sulphur itself by atmospheric influence may give rise to sulphurised in the presence of lime, to the formation of gypsum: thus Sulphur deposits of Sicily suffer alteration of this kind, and have their outcrop marked by a pale earthy rock called briscate.

Some of the most important deposits of sulphur in the world are situated in Sicily, especially in the provinces of Catania and Siracusa, as at Racalmuto and Cattolica; and to a less extent in the provinces of Catania, Palermo (Lercara) and Trapani (Gibellina). The sulphur occurs in Miocene marls and limestone, associated with gypsum, celestine, aragonite and calcite. It was formerly believed that the sulphur had a volcanic origin, but it is now generally held that it has either been reduced from gypsum by organic agencies, or more probably deposited from sulphur-bearing waters. Liquid occasionally enclosed in the sulphur and gypsum has been found by O. Silvestri and by C. A. H. Sjögren to contain salts like those of sulphur-springs. An important zone of sulphur-bearing Miocene rocks occurs on the east side of the Apennines, constituting a great part of the province of Forli and part of Pesaro, Cesena and Ferrara. It is a continuation of the deposits of Caltanisetta, but the latter yielding crystals coated with aspalth. Sulphur is occasionally found crystallized in Carrara marble; and the mineral occurs also in Calabria. Fine crystals occur at Conil near Cadiz; whilst in the province of Teruel in Aragon, sulphur in a compact form replaces fresh-water shells and plant-remains, suggesting its origin from sulphur-springs. nodular forms of sulphur occur in Miocene marls near Radoboj in Croatia, and near Swamowie, south of Cracow. Russia possesses large deposits of sulphur in Doghestan in Transcaucasia, and in the Transcaspian steppes. Important deposits of sulphur are worked at several localities in Japan, especially at the Kosaka mine in the province of Rikuchi, and at Yatsukoda-yama, in the province of Mutsu. Sulphur is worked in Chile and Peru. A complete list of localities for sulphur would include all the volcanic regions of the world. In the United States, sulphur occurs in the following states, in many of which the mineral has been worked: Louisiana (g.v.), Utah, Colorado, California, Nevada, Idaho, Texas and Wyoming. The Rabbit Hole sulphur-mines are in Nevada, and a great deposit in Utah occurs at Cove Creek, Beaver county. In the British Islands native sulphur is only worked in the Isle of Eigg, and is used for the manufacture of blacklead, and the production of lampblack. Carboniferous Limestone of Oughterard in Co. Galway, Ireland.

In combination the element chiefly occurs as metallic sulphides and sulphates. The former are of great commercial importance, being, in most cases, valuable ores, e.g. copper pyrites (copper), galena (lead), blende (zinc), cinnabar (mercury), &c. Of the sulphates we notice gypsum and anhydrite (calcium), barytes (barium) and kieserite (magnesium). Gasous compounds, e.g. sulphur dioxide and sulphurated hydrogen, are present in volcanic exhalations (see Volcano) and in many mineral waters. The element also occurs in the animal and vegetable kingdoms; it is present in hair and wool, and in alburnious bodies; and is also a constituent of certain vegetable oils, such as the oils of garlic and mustard. There is, in addition, a series of bacteria which decompose sulphur compounds and utilise the element thus liberated in their protoplasm (see Bacteriology).
by the combustion of the least sufficient quantity of sulphur, the rest is liquefied. The molten sulphur accumulates on the sole, whence it is by time to time run out into a square stone receptacle, from which it is again run into the interior, thus bringing itself into the shape of truncated cones weighing 110 to 130 lb each. These cakes are sent out into commerce. A calcareous with a capacity of 26,256 cub. ft. burns about two months and produces 90,000 lb of molten sulphur. The yield is in 40-50%. The immense volumes of sulphuric acid evolved give rise to much annoyance; all the minor pits suspend work during the summer to avoid destruction. In one pit of the type, the liquid, and all the material, must be at least 220 yds. from any inhabited place and 110 yds. from any field under cultivation.

More efficient is the Gilly kiln which uses coke as a fuel. The kiln consists of a series of interconnected cells which are both charged with the ore. The first cell is heated and the products of combustion are led into the second cell where they give up part of their heat to the charge. The sulphur, however, is left behind. The outer crust of the metal found in the second cell is at a sufficiently high temperature to ignite spontaneously when air is admitted. Other methods have been employed, but with varying commercial success. For example, in the Griti and Orlando processes the ore is charged into retorts and the fusion effected by superheated steam, the sulphur being run off as usual; or as was suggested by R. E. Bollman in 1867 the ore may be extracted by carbonization, the gas obtained from kilns, contains about 3% of earthy impurities, and consequently needs refining. The following apparatus (invented originally by Michel de Marseilleilles and improved since by Gill) consists essentially of a system of two forms of "refined" sulphur which command demands. It consists of a large stone chamber which communicates directly with two slightly slanting tubular retorts of iron. The retorts are charged with the metal and the volatile part is distilled off to the two crucibles by boiling off an average of 25 lbs of "refined" sulphur (50% C.). The condensed gas passes through a condenser and is caught in a vessel kept at the requisite temperature by means of the lost heat of the retort fires. The chamber has a safety valve at the top of its vault, which is closed by water in such manner that the gas will not be drawn through the chamber to the exterior.

The first puff of sulphur vapour which enters the chamber takes fire and converts the air of the chamber into a mixture of nitrogen and sulphur dioxide. The next following instamants of vapour, getting diffused throughout a large mass of relatively cold gas, condense in a kind of "snow," known in commerce and valued as "flowers of sulphur" (flores sulphuris). By conducting the distillation slowly, so that the temperature within the chamber remains not very great, it is possible to obtain the whole of the product in the form of "flowers." If compact ("roll") sulphur is wanted the distillation is made to go on at the quickest temperature. The temperature of the interior of the chamber soon rises to more than the freezing-point of sulphur (113°C), and the distillate accumulates at the bottom as a liquid, which is tapped off from time to time to be cast into the customary form of rods.

The Louisiana deposits are worked by a process devised by Herman Frasch in 1891. It consists in sinking a bore-hole, after the manner of a petroleum well, and letting in pipes centrally arranged, the outer pipe being 10 in. in diameter, the next 6 in., the next 3 in. and the innermost 1 in. In the superheated steam is forced down the outer pipe superheated steam at 330°F. to melt the sulphur. Compressed air is now driven down the 1-in. pipe and bubbles into the melted sulphur and set it in violent action with great heat, so that it rises to the surface through the outer pipes; it is then run off to settling tanks. The sulphur so obtained is 98% pure.

In some places sulphur is extracted from iron pyrites by one of two methods. The pyrites is subjected to dry distillation from out of iron or fire-clay tubular retorts at a bright red heat. One third of the sulphur is volatilized: 3FeS₂ = Fe₂S₃ + 2S and is obtained as a distillate. The second method is analogous to the calcareous method of liquefication; the ore is placed in a lime-kiln like furnace over a mass of kindled fuel to start a partial combustion of the mineral, and the process is so regulated that, by the heat generated in the interior, the mass is converted into a semi-solution which collects in the molten state on an inverted roof-shaped sole below the furnace and is then conducted into a cistern. Such pyrites sulphur is usually contaminated with arsenic, and consequently is known as Sicilian black sulphur. In Sicily, and elsewhere, it is almost free from this impurity.

Large quantities are also recovered from alkali waste (see ALKALI MANUFACTURE); another source is the spent oxide of gas manufacture (see GAS).

The substance known as "milk of sulphur" (lac sulphuris) is a very finely divided sulphur produced by the following, or some analogous, process. One part of sulphur is mixed with two parts of water, the paste produced diluted with 24 parts of water; 2-3 parts of sulphur are added; and the whole is boiled for about an hour or longer, when the sulphur dissolves. The mixed solution of the divalent and thiosulphate of sulphur is produced is clarified, diluted largely, and then mixed with enough of pure dilute hydrochloric acid to produce a feebly alkaline mixture which is then coagulated. The addition of more acid would produce an additional supply of sulphur (by the action of the H₂S₃O₄ on the dissolved H₂S); but this thiosulphate sulphur is yellow and compact, while the polysulphide part has the desired qualities, forming an extremely fine, almost white, powder. The precipitate is washed, collected, and dried at a very moderate heat.

Properties.—Sulphur exists in several allotropic modifications, but before considering these systematically we will deal with the properties of ordinary (or rhombic) sulphur. Commercial sulphur forms yellow crystals which melt at 113°C and boil at 444-53°C. The compound is under ordinary pressure (H. L. Callendar, Chem. News, 1891, 63, p. 1) just above the boiling point the vapour is orange-yellow, but on continued heating it darkens, being bluish-pink at 500°C. At temperatures below 650°C these yellow sulfur forms the compound with chlorine, forming a dissociation of the molecules. At 524°C Dumas deduced the structure S₂ from vapour-density determinations, whilst for the range 860 to 1040°C, Sainte-Claire Deville and Troost deduced the formula S₆. Blitz (Ber., 1888, 21, p. 1031, 1901, 34, p. 2490) showed that the vapour density decreased with the temperature, and also depended on the pressure. G. Preuner and W. Schupp (Zeit. phys. Chem., 1900, 69, p. 157), in a study of the dissociation isotherms over 300-850°C, detected molecules of S₂, S₃ and S₄, whilst S₅ appears to exist below pressures of 30 mm. Because of its freezing-point determinations of the molecular weight in solution indicate the formula S₆. The density of solid sulphur is 2.062 to 2.070, and the specific heat 0.172; it is a bad conductor of electricity and becomes negatively electrified on friction. It ignites in air at 363°C and in oxygen at 275-280°C (H. Moissan, Compt. rend., 1903, 137, p. 547), burning with a characteristic blue flame and forming much sulphur dioxide, recognized by its pungent odour. At the same time a little trioxide is formed, and, according to Hempel (Ber., 1890, 23, p. 1459), half the sulphur is converted into this oxide if the combustion be carried out in oxygen at a pressure of 40 to 90 atmospheres. Sulphur also combines directly with most of the elements to form sulphides. The atomic weight was determined by Berzelius, Ehrmann and Marchand, Dumas and Stan Thomsen (Zeit. phys. Chem., 1894, 13, p. 736) obtained the value 32-0660.

Allotropic Modifications.—Sulphur assumes crystalline, amorphous and (possibly) colloidal forms. Historically the most important are the rhombic (S₆) and monoclinic (S₈) forms, discussed by E. Mitscherlich in 1822 (see Ann. chim. phys., 1823, 24, p. 264). The transformations of these two forms are slow. In the presence of water, sulphur may be obtained artificially by slowly crystallizing a solution of sulphur in carbon bisulphide, or, better, by exposing pyridine saturated with sulphurhexed hydrogen to atmospheric oxidation (Ahrens, Ber., 1890, 23, p. 2708). It is insoluble in water, but readily soluble in carbon bisulphide, sulphur chloride and oil of turpentine. The common monoclinic variety is obtained by allowing a crust to form over molten sulphur by partially cooling it, and then breaking the crust and pouring off the still liquid portion, whereupon the interior of the vessel will be found coated with long needles of this variety. Like S₈ it is soluble in carbon bisulphide. Three other monoclinic forms have been described. By acting upon a solution of sodium hyposulphite with potassium bisulphate, Gernze (Compt. rend., 1884, 98, p. 144) obtained a form which he termed nacre (or pearly) sulphur; the same modification was obtained by Sabatier (ibid., 1885, 100, p. 1346) on shaking hydrogen persulphide with alcohol or ether. It is readily transformed into rhombic sulphur. Another form, mixed with the variety just described, is obtained by adding 3 to 4 volumes of alcohol to a solution of ammonium sulphide saturated with sulphur and exposing it to the air for a time. Engel's monoclinic form (Compt. rend., 1891, 112, p. 866) is obtained by mixing a solution of sodium hyposulphite with double its volume of hydrochloric acid, filtering and extracting with chloroform; the extract yielding the variety on evaporation. A triclinic form is claimed to be obtained by Friedel (Bull. soc. chim., 1879, 32, p. 14) on subliming ordinary sulphur.

1 It is a common practice of keepers of dogs to place a piece of roll sulphur in the animal's water but this serves no useful purpose owing to this property.
Amorphous sulphur or $S_n$ exists in two forms, one soluble in carbon bisulphide, the other insoluble. Milk of sulphur (see above), obtained by decomposing a polysulphide with an acid, contains both forms. The insoluble variety may also be obtained by decomposing sulphur chloride with water and other reactions. Crystallisation takes place between 200° and 250° C.

The colloidal sulphur, $S_n$, described by Debus as a product of the interaction of sulphuretted hydrogen and sulphur dioxide in aqueous solution, is regarded by Spring (Rec. trav. chim., 1906, 25, p. 253) as a hydrate of the formula $S_nH_2O$. The "blue sulphur," described by Orloff, has been investigated by Paternò and Mazzucchelli (Abs. Journ. Chem. Soc., 1907, ii. 451).

**SULPHUR**

Molten Sulphur—Several interesting phenomena are witnessed when sulphur is heated above its melting point. The solid melts to a pale yellow liquid which on cooling and heating gradually darkens and becomes more viscous, the maximum viscosity occurring at 180° C, the product being dark red in colour. This change is associated with a change in the spectrum (N. Lockyer). On continuing the heating, the viscosity diminishes while the colour remains the same. If the viscous variety be rapidly cooled, or the more highly heated mass be poured into water, an elastic substance is obtained, termed plastic sulphur. This substance, however, on standing becomes brittle. The character of molten sulphur has been mainly elucidated by the researches of A. Smith and his collaborators. Smith (Abs. Journ. Chem. Soc., 1907, ii. 20, 454, 757) forms sulphur as a mixture of two fluids, the primary of which in dynamic equilibrium, $S_n$ being light in colour and mobile, and $S_n$ dark and viscous. At low temperatures $S_n$ predominates, but as the temperature is raised $S_n$ increases; the transformation, however, is retarded by some gases, e.g. sulphur dioxide and hydrochloric acid, and accelerated by others, e.g. ammonia. The solid derived from $S_n$ is crystalline and soluble in carbon bisulphide, but that from $S_n$ is amorphous and insoluble. As to the formation of precipitated sulphur, Smith considers that the element first separates in the liquid $S_n$ condition, which is transformed into $S_n$ and finally $S_n$; the insoluble (or carbon bisulphide) forms arise when little of the $S_n$ has been transformed; whilst the soluble consist mainly of $S_n$. Similar views are adopted by H. Erdmann (Ann., 19-8, 362, p. 133), but he regards $S_n$ as the polymer $S_n$, analogous to ozone $O_3$; Smith, however, regards $S_n$ as $S_n$.

**Compounds**

Sulphuretted hydrogen, $H_2S$, a compound first examined by C. Scheele, may be obtained by heating sulphur in a current of hydrogen, or by the action of an oxidising agent on a solution of sulphur or its compounds, and being at complete at the latter temperature, dissociation taking place above this temperature (M. Bodenstein, Zeit. phys. Chem., 1899, 29, p. 315); by heating some metallic sulphides in a current of form sulphide; and also by decomposing many metallic salts with (ferrous sulphide and dilute sulphuric acid being most generally employed); by the action of sulphur on heated paraffin wax or vaseline, or by heating a solution of magnesium sulphide. It is also produced during the putrefaction of organic substances containing sulphur and is found among the products obtained in the destructive distillation of coal. To obtain pure sulphuretted hydrogen the method generally adopted consists in decomposing precipitated antimony sulphide with concentrated hydrochloric acid. As an alternative, H. Moissan (Comp. rend., 1903, 137, p. 363) condenses the gas by means of liquid air and fractionates the product.

$H_2S$ is a colourless, odourless, and offensive gas. It acts as a strong poison. It burns with a pale blue flame, forming sulphur dioxide and water. It is moderately soluble in water, the solution possessing a faintly acid reaction. This solution is not very stable, since on exposure to air it slowly oxidizes and becomes turbid owing to the gradual precipitation of sulphur. The gas is much more soluble in alcohol. It forms a hydrate of composition $H_2S.H_2O$. (De Foreman, Comp. rend., 1888, 106, p. 1357.) The gas may be liquefied by a pressure of about 17 atmospheres, the liquid so obtained boiling at –61°.8 C.; and by further cooling it yields a solid, the melting point of which is given by various observers as –82° to –86° C. (see Ladenburg, Ber., 1900, 33, p. 337). It is decomposed by the halogenes, with liberation of sulphur. Concentrated sulphuric acid also decomposes it: $H_2SO_4 + H_2S = 2H_2O + SO_2 + S$. It combines with many metals to form metallic sulphides, and also decomposes many metallic salts with consequent production of sulphides, a property which it extremely useful in chemical analysis. It is frequently used as a reducing agent; in reducing arsenates to arsenites, permanganates to manganous salts, etc., whilst in alkaline solution it converts many organic nitro compounds into the corresponding amino-derivatives. Oxidising agents rapidly unite with sulphuretted hydrogen, the primary products of the reaction being water and sulphur.

By the action of dilute hydrochloric acid on metallic polysulphides, and other products, which are obtained by a more thorough or incomplete oxidation of $S_n$ is usually considered to be $H_2S$. Thiogallate, on the other hand, is a form of $S_n$ or $S_n$. It was also examined by W. Ramsay (Journ. Chem. Soc., 1874, 12, p. 857). Hofmann, who obtained it by saturating an alcoholic solution of thioacetamide with a solution of hydrochloric acid, with an alcoholic solution of styrchmy, considered the resulting product to be $H_2S$; while P. Sabatier by fractionating the crude product in vacuo obtained an oil which boiled between 60° and 80° C. and possessed a musky odour.

Several halogen compounds of sulphur are known, the most stable of which is sulphur fluoride, $SF_6$, which was first prepared by H. Moissan and Lebeau (Comp. rend., 1900, 130, p. 866) by fractionally distilling the vitreous mass formed by the reaction of hydrogen fluoride on sulphur. It is Tasteless, colourless, and odourless gas, which is exceedingly stable and inert. It may be condensed and yields a red mass at –55° C. Sulphur hexafluoride decomposes it with formation of hydrofluoric acid and liberation of sulphur. Sulphur chloride, $SCl_2$, is obtained as a by-product in the manufacture of carbon tetrachloride from carbon bisulphide and chlorine, and on exposure to air it readily decomposes to sulphur, chlorine gas, or by the action of sulphur on sulphuryl chloride in the presence of aluminium chloride (O. Ruff). It is an amber-coloured, fuming liquid possessing a very unpleasant irritating smell. It is liquefied at –90° C. the liquid of which has a yellowish-brown tinge, is soluble in benzene and ether, and in benzine. It is decomposed by water: $2SCl_2 + 3H_2O = 4HCl + 2S + H_2SO_4$, the thiosulphuric acid produced, on gradual decomposing into water, sulphur and sulphur dioxide. Sulphur chloride is a gas with great readiness and is consequently used largely for vulcanising rubber; it also dissolves chlorine. The chloride $SCl_3$ according to the reactions $S + 3Cl_2 = SCl_3$ and $3SCl_2 + Cl_2 = 2SCl_4$ did not appear to exist, but E. Beckmann (Zeti. phys. Chem., 1899, 42, p. 1839) obtained it by distilling the product of the interaction of chlorine and $SCl_2$ at low pressures. The tetrachloride, $SCl_4$, is formed by the action of chlorine on carbon bisulphide (App. Ann., 1873, 70, p. 191), it is a yellowish-brown liquid which dissolves rapidly with rise of temperature. On cooling it solidifies to a crystalline mass which fuses at –72° C. (Ruff, ibid.).

Water dissolves it violently with formation of hydrochloric and sulphuric acids. Sulphur bromide, $SBr_2$, is a dark red liquid which boils with decomposition at about 200° C. The products obtained by the action of iodine on sulphur are probably mixtures, although E. McIlvorp (Chem. News, 1902, 86, p. 5) obtained a substance of composition $SIF_4$ (which in all probability is a chemical individual) as a reddish-coloured powder by the action of sulphuretted hydrogen on solutions of iodine.

Four oxides of sulphur are known, namely sulphur dioxide, $SO_2$, sulphur trioxide, $SO_3$, sulphur sesquisioxide, $SO_3$, and persulphuric anhydride, $SO_3$. The dioxide has been known since the earliest times, and is obtained by burning sulphur, especially in the exhalations of volcanoes and in solution in some volcanic springs. It was first collected in the pure condition by J. Priestley in 1775 (Phil. Trans., 1775, pp. 354, 361), and was adopted by A. L. Lavoisier in 1789 (Zeti. phys. Chem., 1789, 2, p. 1). It is formed when sulphur is burned in air or in oxygen, or when many metallic sulphides are roasted. It may also be obtained by heating carbon, sulphur and many metals with concentrated sulphuric acid: $C + 2H_2SO_4 = 2SO_2 + CO_2 + 2H_2O; S + 2H_2SO_4 = 2SO_2 + 2H_2O; Cu + 2H_2SO_4 = SO_2 + CuSO_4 + 2H_2O$; and by decomposing a sulphite, a thiosulphate or a thionite acid with a dilute mineral acid. It is a colourless gas which possesses a characteristic suffocating odour. It does not burn, neither does it support combustion. It is readily soluble in alcohol and in water, the solution in water characterising with increasing strength a strongly acid reaction. It is easily liquefied, the liquid boiling at –18 C., and it becomes crystalline at –72 C. (Ruff, ibid.).

It is shown by the action of chlorine or carbon tetrachloride upon a solution of potassium sulphite, $K_2SO_3$ and $KCl$, that the latter is a compound of $SO_2$ and $SO_3$, and that $S_2=Cl$. In the presence of water it frequently acts as a bleaching agent, the bleaching process in this case being one of reduction. It is frequently used as an antichlor, since in presence of water it has a strong alkaline action: $2SO_2 + 2H_2O = 2H_2SO_3$.

In many cases it acts as a reducing agent (when used in the presence of acids); thus, permanganates are reduced to manganous salts, iodates are reduced with liberation of iodine, etc., $2KMnO_4 + 3SO_2 = K_2SO_4 + 2MnSO_4 + 2H_2O; 2KIO_3 + 5SO_2 + 4H_2O = 2KI + 2H_2SO_4 + 3H_2O$.
It is prepared on the industrial scale for the manufacture of sulphuric acid, for the preparation of sodium sulphate by the Bredig point, and for use as a fuming agent and as a preservative. When compressed it is also used largely as a refrigerating agent, and in virtue of its property of neither burning nor supporting combustion it is also used as a fire extinguisher. The free acid is not readily decomposed by water, but it is readily decomposed by water with liberation of sulphur, sulphuric acid, and thiocarbonyl sulphide. It forms a hydrate with water and is used as a fuming agent. The gas is also inserted into the form of a salt, and is used as a smoke-producing agent.

There are various methods of preparing sulphuric acid, but the most important is the Voltaic process, in which the free acid is inserted into the gas in a tube at 180°C. It is then inserted into sulphuric acid, with liberation of sulphur. Numerous salts, termed sulphates, are known. Since the free acid would be diatomic, two such acids would be formed, the neutral and acid acid. They are not truly alicyclic compounds, however, but the free acid is considered to be the isomer of the oxides, hydroxides or carbones of the metals, or by processes of precipitation. Sulphuric acid may have either of the constitutions OH₂SO₃OH or OH₂SO₃O⁻, or be an equilibrium mixture of these two substances. Although the correct formula for the acid is not known, sulphates are known of both types. Sodium sulphate is almost certainly the second and the unsymmetrical type. Two ethyl sulphates are known, the first or symmetrical type being derived from ethyl sulphuric chloride and alcohol, and the second and unsymmetrical type being derived from sodium ethyl sulphate and alcohol.

Sulphur dioxide, SO₂, has been obtained as a fuming gas by decomposing the sulphur dichloride, SO₂Cl₂, with a catalytic mixture of concentrated sulphuric acid and potassium dichromate. The resulting gas is a mixture of SO₂ and SO₃, with SO₂ being the principal component. SO₂Cl₂ can be obtained by the reaction of chlorine and sulphur dioxide at high temperatures and pressures. It is also obtained by the action of chlorine on a mixture of sulphur trioxide and water. SO₂Cl₂ is a powerful oxidizing agent and is used in the preparation of a wide range of compounds, including sulphones and sulfoxides. It is a colorless gas with a pungent odor. It is also used as a bleaching and disinfecting agent.

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in the form of its barium salt by suspending freshly precipitated hydrated manganese dioxide in water and passing sulphur dioxide into the mixture until all is dissolved; the barium salt is then precipitated by the careful addition of barium hydroxide. Much manganese dioxide is used during the process.

Barium tetrathionates, prepared by Long (Journ. Chem. Soc., 1901, 80, p. 1) and by Davis and Ewart (Journ. Chem. Soc., 1901, 80, p. 227), have also been prepared. The tetrathionates are only sparingly soluble in water. The crystals, which are easily obtained, are about 0.01 millimetre in diameter, and are of a yellowish-green colour.

Sulphuric acid, H₂SO₄, is a colourless, odourless, liquid, or an oily liquid, having the specific gravity of 1-834 at 15°. It boils at 338°, and at about 400° the vapour dissociates into sulphur trioxide and water; at a red heat further decomposition ensues, the sulphur trioxide dissociating into the dioxide and water. It freezes to a colourless crystalline mass, melting at 10-5°. The acid is extremely hygroscopic, absorbing moisture from the atmosphere with great rapidity; hence it finds considerable application as a desiccating agent. The behaviour of aqueous solutions of sulphuric acid is very interesting. The pure acid (100% H₂SO₄) cannot be prepared by boiling down a weaker acid under any pressure (at least between 3 and 300 centimetre of mercury) an acid of the composition H₂SO₄.3H₂O or 1250SO₃H₂O being invariably obtained. Neither is there any advantage gained by mixing this hydrate with sulphur trioxide; for when such a mixture is concentrated by evaporation, sulphur trioxide is vaporized until the same hydrate is left. The pure acid, however, may be obtained by strongly cooling this hydrate.
SULPHURIC ACID

when it separates in the form of white crystals, which melt at 105°, and on gentle heating evolve sulphur trioxide and again form the same hydrate. When strong sulphuric acid is mixed with water there is a great development of heat; the heat evolved when four times its weight of water is added to one of concentrated sulphuric acid raises the temperature from 0° to 100° C. (Hence the laboratory precaution of always adding the acid to the water and not the water to the acid.) In addition to the heat evolution there is also a diminution in volume, the maximum occurrence when the components are present in the ratio \( \text{H}_2\text{SO}_4:2\text{H}_2\text{O} \), thus pointing to the existence of a hydrate \( \text{H}_2\text{SO}_4\cdot2\text{H}_2\text{O} \). A second hydrate, \( \text{H}_2\text{SO}_4\cdot\text{H}_2\text{O} \), may be obtained as rhomblic crystals, which melt at 7° and boil at 208°, by diluting the strong acid until it has a specific gravity of 1.78, and cooling the mixture; this compound is sometimes known as glacial sulphuric acid. Lead and dihydrates form freezing mixtures with snow. Other hydrates have also been described.

Reactions. — Sulphuric acid has the widest commercial application of all chemical reagents. Here only reactions of commercial utility will be considered, and reference should be made to the article SULPHUR for reactions which are more of a purely scientific interest. In its reactions Sulphuric acid exhibits the properties of a strong oxidizing and dehydrating agent, and its power of expelling other acids from their salts.

In the first group we have to notice the use of iron or zinc and dilute sulphuric acid for the manufacture of hydrogen gas. Hydrogen is used directly for the purposes of combustion, or in the nascent condition, for reduction purposes, as generally is the case in organic chemistry (see ANILINE). It is worthy of notice that while many valuable processes depend upon dilute sulphuric acid for their success, the use of the concentrated acid has been of considerable number of commercial processes. Hydrochloric, hydrobromic, hydriodic, hydrofluoric, nitric, phosphoric and many other acids are manufactured by the action of sulphuric acid on their salts: the alkali and chlorine industries, and also the manufacture of bromine and iodine, employ immense quantities of this acid.

In organic chemistry sulphuric acid is extensively employed. Its immense affinity for the elements of water makes it a valuable dehydrating and condensation agent. It extracts the elements of water from formic acid, giving carbon monoxide; from oxalic acid, forming carbon and carbon monoxide; from acetic acid, it is able to give ether or ethylene according to the conditions of the experiment; and from many oxygenated compounds (e.g. sugar, tartaric acid, &c.), with the production of charcoal masses. The formation of glyceric aldehydes and ketones by the action of sulphuric acid on glyceric alcohols is of considerable scientific interest and of the utmost importance in the history of organic chemistry.

It also acts in an opposite manner in certain cases, adding the elements of water to compounds; thus, nitriles are converted into acid-amides, and various acetylene derivatives may be caused to yield ketonic derivatives. As an oxidizing agent its application is limited. The transformation of pipetidine into pyridine by W. König, and the observation that antraquinone yields oxy-antraquinones when treated in the cold with strong sulphuric acid, and the recent introduction of fuming sulphuric acid for the oxidation of naphthalene to phthalic acid, a process of great value in the manufacture of artificial indigo, may be noted. But its chief employment is inorganic and has no resemblance to the properties of other acids when it reacts with aromatic hydrocarbon residues; these compounds being important either as a step towards the preparation of hydroxy-compounds, e.g. resorcin, the naphthols, alizarin, &c., or for which many of them do not possess a convenient soluble form.

Sulphates. — Sulphuric acid, being a dibasic acid, forms two series of salts with monovalent metals; an acid salt, MHSO\(_4\), and a basic salt, MSO\(_4\), the hydronio acid being employed in the manufacture of sulphur trioxide. When heated it loses water to form sodium pyrosulphate, NaHSO\(_4\), which on treatment with sulphuric acid yields normal sodium sulphate and sulphur trioxide. The normal sodium sulphate is the more important, and occur widely and abundantly distributed in the mineral kingdom; anhydrite, gypsum, angleseyite, barytes, celestite and kieserite (of the commonest occurrence in the United States). As the sulphates are soluble in water, and exhibit well crystallized forms. Of the most insoluble we may notice the salts of the metals of the alkaline earths, barium, strontium and calcium, barium sulphate, both the hydroxy and calcium sulphate sparingly but quite appreciably soluble. Lead sulphate is very slightly soluble in water, soluble in strong sulphuric acid, and almost insoluble in alcohol.

Sulphates may be detected by heating the salt with carbonate on charcoal in the reducing flame of the blowpipe; the black stain produced if the mass be transferred to a silver coin and then moistened. In solution, sulphates are always detected and estimated by the formation of a white precipitate of barium sulphate on treatment with barium chloride solution; the whole being made to react together in the presence of excess of barium chloride. This is the BaCI\(_2\) method. When the precipitation of barium chloride is slight, and the white precipitate is not formed, the BaO method is used. In this case the precipitate is not allowed to separate, but the excess of barium chloride is added until a white precipitate is formed, and the excess of BaO is determined by the reduction of barium chloride to sulphate. The precipitate is then washed, dried, and the barium in the precipitate estimated as sulphate.

Manufacture. — The first step in its manufacture is the combustion of sulphur. Formerly this was employed exclusively in the free state as brimstone, and was still employed in some countries, notably in the United States, but the great bulk of sulphuric acid is now made from metallic sulphides, especially those of iron and zinc. Most of the brimstone of trade at the present day comes from Sicily, Spain, and the United States, but in the United Kingdom, as playing an important part, and seems likely to oust the Sicilian sulphur. Free sulphur is also contained as "gas sulphur" in the "spontex" of gasworks, which are actually utilized for the manufacture of phytic acid by burning off the pure state from the "alkali waste" of the Leblanc process, but this "recovered sulphur" is too expensive to be burned for the purpose in quantity. In the United Kingdom much gas sulphur is used for the manufacture of sulphuric acid, together with a limited quantity of Sicilian sulphur for the production of sulphuric acid free from arsenic.

The largest single percentage of the sulphuric acid is made from pyrites, i.e. more or less pure disulphide of iron which occurs in large quantities in many countries. Great Britain produces very little of it, Ireland a little more, but of poor quality. Most of the pyrites of the United States, which can be made to yield a large proportion of pure iron pyrites for the production of sulphuric acid, is imported from Spain. Pyrites generally (not always) contains enough copper (say 3 or 4 %) to make its extraction from the residues ("cinders") worth while. The annual production of pyrites in the United States is nearly 15,000,000 tons, of which 7,000,000 tons are utilized for the production of sulphuric acid by the pyrites-burner method. Germany also contains large quantities of pyrites, and most of it is utilized for the production of sulphuric acid.

A very important source of sulphuric acid is the并不完全的句子，可能与实际内容相关且可能需要进一步的上下文才能完全理解。
The gas produced in the burning of sulphur ores, when issuing from the burner, holds in mechanical suspension a considerable quantity of "flue-dust," which must be removed as far as is practicable before the gas is subjected to further treatment. "Flue-dust" consists essentially of the salts of the respective sulphuric acids, and small quantities of the various metals occurring in the raw ore. All the thallium and selenium on the market is obtained from this source. Sometimes the burner-gas is employed directly for the distillation of the oxygen in the air to form "sulphite cellulose" from wood. When the gas is to be utilized for the manufacture of sulphuric acid the SO₃ must be combined with more oxygen to form SO₃ gas. This SO₃ gas is then connected. Until recently the only agent practically used for this purpose was furnished by the oxides of nitrogen; more recently other oxygen carriers, acting by "contact processes," have also been employed.

The production of sulphuric acid by the assistance of the oxides of the nitrogen of the nitrogenous carburettor gases is carried out in the "vitriol chambers." These are immense receptacles, mostly from 100 to 200 ft long, 20 to 30 ft wide, and 15 to 25 ft high, constructed of sheet-lead, the joints of the sheets being made by "burning" or autogenous soldering. Fusing them together by a blow-pipe without the aid of solder (which would be quickly destroyed by the reaction) the chambers must be supported on all sides by suitable wooden or iron framework, and they are always erected at a certain height over the ground, so that any leaks occurring can be easily detected. In practically all the chambers a single burner-gas line forms a set of a cubic capacity of from 100,000 to 200,000 cub. ft. The burner gas is introduced at one end, the waste gases issue from the other, and the movement of the gases is impelled partly by their own pressure, partly by the height of the chimney (or tower), or by mechanical means.

At the same time water is introduced in a number of places in the shape of steam or in the shape of liquid water. In consequence the SO₂ + H₂O = H₂SO₃. As this reaction of its own accord takes place only to a very small extent, an "oxygen carrier" is always introduced in the shape of the vapours of nitric acid or the lower oxides of nitrogen or both. This is used practically the whole of the SO₂ is ultimately converted into sulphuric acid, and at the same time the nitrogen oxides are always recovered with comparatively very slight losses and made to serve other purposes.

The reactions taking place in the vitriol chambers are very complicated, and have been explained in many different ways. The view hitherto accepted by most chemists is that developed by G. Lunge, according to which there are two principal reactions, succeeding each other, it may be in quite contiguous places, but under different conditions. Where the nitrous fumes prevail and there is less water present, sulphur dioxide combines with nitric acid and oxygen to form nitro-sulphuric acid, a crystalline substance of the formula SO₃(OH)(ONO). The reaction is therefore: SO₂ + O + HNO₃ = SO₃(OH)(ONO). The solid substance is, however, only formed in every fourth or fifth chamber of the apparatus consisting of sulphuric acid floating in the chamber and forming "nitrous vitriol." Wherever this nitrous vitriol comes into contact with liquid water, it is immediately converted into sulphuric acid, the mixture of mist, and practically as dilute sulphuric acid, it is decomposed into sulphuric and nitrous acid, thus: SO₃(OH)(ONO) + H₂O = H₂SO₄ + HONO₂. The re-formed nitric acid, although not so strong as nitric acid, is used to the same extent as nitric acid, and is used as an "oxygen carrier" in question, as the products of its spontaneous decomposition, when meeting with other compounds, always react like nitric acid itself and thus may transfer an indefinite quantity of oxygen to the corresponding quantities of SO₃ and H₂O, with the corresponding formation of H₂SO₄. This theory at once explains among other things, why the acid formed in the vitriol chambers always contains an excess of water (the second of the above-quoted reactions requiring the "mass action" of this excess), and why the external cooling produced by the contact of the chamber sides with the air is of great importance (liquid water in the shape of air-cooled "vitriol"").

In 1906 (in a paper published with Bert) to some extent modified his views, by introducing an intermediate compound, phosphotungstic acid, SO₄H₂O, which had been noticed by various chemists by its action on the phosphoric acid gas emitted in the formation of the blue colour to sulphuric acid. It is evident that the "nitrous gases" present in the vitriol chamber consist essentially of a mixture of SO₃ and SO₂. This SO₃ gas is further oxidized by NO from the excess of oxygen present. The NO (or (NO + O)NO) reacts with the SO₃, forming SO₃NH₂, which, being extremely unstable, is at once oxidized to SO₃NH₃ (nitro-sulphuric acid). The latter is now either converted into nitrogen by the gas issuing from the bottom of the tower, or it reacts with more SO₃ forming again sulphonitric acid: 2SO₃NH₂ + SO₃ = 2SO₃NH₃ + SO₃NH₂. The latter can also be converted into the nitric acid by the aid of NO and SO₃.

Whatever is the true theory of the vitriol-chamber process, there is no doubt about the way in which the reactions have to be carried out in practice. Since the reactions occur among gases and liquids in the nebulous state, vast spaces have to be provided in which the process may be carried out as completely as possible before the waste gases are allowed to escape into the outer air. These spaces cannot be constructed in any way other than is actually done; that is, by means of chimney-shaped chambers, together with about a third, or at least a fourth, of the oxygen originally present therein, such excess of oxygen being required to drive off to the outer air the nitrogen, which is obtained, rather than iron oxide, in a way that would be quickly destroyed by the acid liquids and gases.

When issuing from the chambers, the gases still contain the whole of the nitrous acid and a mixture of sulphuric acid and nitric acid. It is necessary to employ much more water than is required to form H₂SO₄; and this is the more necessary as strong sulphuric acid could not be formed in the absence of nitric acid, and thus withdraws these oxygen carriers from the gas-space of the chambers where the necessary reactions take place. It follows from this that the acid collecting at the bottom of the chambers must never exceed a certain concentration, say 70% of H₂SO₄, having a specific gravity of 1.615, but it is preferable to make it only 66 to 67% having a specific gravity of 1.57 to 1.58. On the steam required for the working of the chambers; and the acid issues from the apparatus in a "denitrated" and sufficiently concentrated state (78 to 80% H₂SO₄) to be used over again for absorbing nitrous vapours or any other purpose desired.

The process is, therefore, a continuous one, with the aid of the following cycle of operations is carried out. To begin with, in the burners pyrites (or, as the case may be, brimstone or blende) is partially oxidized to yield SO₂, and this is conveyed to the chambers; in the bottom of the tower, the SO₂ is absorbed with water, and the remaining gases containing the odour of SO₂ are conveyed back to the top of the tower and the recovery process begins again. The SO₂ is forced out of the acid by the steam, thereby liberating the SO₃ with which it is combined, and the acid which resembles the Glover tower, but is usually filled with coke, over which sulphuric acid of about 80% H₂SO₄ trickles down in sufficient quantity to retain the nitrous vapours. Ultimately the gas is drawn off by a chimney, or sometimes by mechanical means.
SULPHURIC ACID

with the nitrous vitriol. Although this method appears more troublesome, it allows the amount of nitre to be more easily and more accurately regulated. The size of the Glover towers, and more especially that of the Gay-Lussac towers, has been progressively increased, and thereby the cube of the lead chambers themselves has diminished to a much greater extent. By improved process the Faure and Kessler apparatus, which consists of a platinum pan, surmounted by a double-walled leaden hood, in such a manner that, while the hood is constantly cooled from the outside by water, the inner plate is heated sufficiently to cause the fumes thus produced to be carried away by a stream of air which is allowed to flow back into the pan. The majority of acid makers, however, prefer retorts made entirely of platinum, preferably provided with the Heraeus perforation with a dense, closely-woven covering of gold, including the top or "dome." The new Kessler furnace is a very ingenious apparatus, in which the fire from a gas-producer travels over the sulphuric acid contained in a trough made of Voltaic iron, and is employed by a number of perforated plates, over which fresh acid is constantly running down; the temperature is kept down by the production of a partial vacuum, which greatly promotes the volatilization of the water, whilst retarding that of the acid. This furnace is suitable for most acids, and, being unsuitable for platinum or platinum-gold stills on account of the crusts forming at the bottom of the retorts; and it is more and more coming into use both in Great Britain and on the Continent. A third consideration is the condensation of the vapours formed in the concentrating process; the further the concentration proceeds the more sulphuric acid they contain. Condensation is a comparatively easy task with the case of platinum apparatus, but with glass or porcelain beakers or retorts it presents great difficulties. In this respect the Kessler furnace has also proved to be very efficacious, so that it is at the present time considered the best apparatus for the concentration of sulphuric acid found in the trade.

The highest strength of sulphuric acid practically attainable by boiling down is 98% H₂SO₄, and this is only exceptionally reached, and then only by a method which involves the need for and the provision of a vacuum apparatus. The usual strength of the O.V. of commerce, mostly designated by its specific gravity as 168° Twaddell, is from 93 to 95, or at most 96% H₂SO₄. When attempts are made to push this higher, either through the medium of the vacuum apparatus, or simply by reducing the size of the tower is as strong as that which remains behind. Real "monohydrate" or acid approaching 100% can be made by Lunge's process of cooling strong O.V. down to 0° C. when H₂SO₄ crystallizes out, or by the addition of anhydrous SO₃ in the shape of fuming acids or a mixture of it.

Since the development of the contact processes the fuming acid has become so cheap that it is now exclusively used for the preparation of the acids applied to practical use.

Fuming or Nordhausen Oil or Vitriol, a mixture or chemical compound of H₂SO₄, with more or less SO₃, has been made for centuries by exposing pyritic ash to the influence of atmospheric agents, collecting the solution of ferrous and ferric sulphates, and then boiling it down into a hard mass ("vitriolite") and heating this to a low red heat in small earthenware retorts. Since about 1800 this industry had been confined to the north-west of Bohemia, and it survived until 1890, when it was entirely abandoned — not because its product had become any less necessary, but, quite on the contrary, because the enormously increasing demand for fuming sulphuric acid, which was then discovered to be useful in the manufacture of a variety of articles and alloys, and in the extraction of boric acid from the ore, made it absolutely necessary to supply the world with the original product from the vineyard of the Bohemian. Other sources of supply had accordingly to be sought, and they were found by going back to a reaction known long before, but the first time in which it was discovered by which the combination of SO₂ and O into SO₃ by means of spongy platinum. This reaction, now known by the name of the catalytic or contact process, was made the subject of a patent by Peregrine Phillips in 1831, and was tried later in many ways but had been always considered as useless for practical purposes until 1875, when it was simultaneously and independently taken up by Clemens Winkler in Freiberg, and by W. S. Squire and R. Messel in London. Both these inventors began in the same way, viz. by decomposing ordinary sulphuric acid by a high temperature into SO₃, O₂, and H₂O (the last of course being in the shape of steam), absorbing the water by sulphuric acid, and combining SO₂ and O to combine to SO₃ by means of moderately heated platinum in a fine state of division. Winkler showed that this division was best obtained by soaking asbestos with a solution of platinum chloride and then forming the asbestos into a kind of "pulverizer" or rather a specially active kind of "contact substance," prepared from platinum chloride at a low temperature. This revival of the synthetical production of SO₃, at a period when this article had suddenly become of great importance, caused the greatest excitement among chemists and led to numerous attempts in the same direction, some of which were at once sufficiently successful to enable them to work with the division. Progressive addition to the production of a mixture of SO₃ and O from sulphuric acid, as above described, was both too troublesome and costly, and after a number of experiments in other directions inventors went back to the use of the fuming acid. In the case of Winkler's apparatus, for a good many years the further development of this industry was surrounded by great mystery, but it is now known that a satisfactory process of manufacture of the acid was attained in several places, for instance, at Freiberg and in London, by the labours of the original inventors, Professor Winkler and Dr. Messel. These difficulties were mostly caused by the solid impurities.
SULPICIA—SULPICIUS RUFUS, PUBLIUS

contain in the burner-gases in the shape of flue-dust, especially the arsenic, which after a short time rendered the contact substance inapplicable. It is not certain how the difficulty arose from the fact that the reaction \( \text{SO}_4^2- + \text{O} = \text{SO}_3 \) is irreversible, the reverse reaction, \( \text{SO}_3 + \text{O} = \text{SO}_4^2- \) setting in but little above room temperature. This was due to the fact that the arsenic, though far from being so toxic as is known (so much secrecy having been observed), the best results obtained in various places, save one, did not exceed 67% of the theoretical quantity, the remaining 33% of \( \text{SO}_3 \) having to be considered as lost. The case was discussed in the first volume of the Journal of United States Geologists (1), and there is now known, the exception (undoubtedly the only one 1899, was the process discovered as early as 1889 by Dr R. T. J. N. Kietisch, of the Badische Anilin- und Soda-Fabrik at Ludwigshafen, but kept strictly secret until it was published in 1899. The principal features of this invention are, first, a much more thorough purification of the burner-gas than had been practised up to that time, both as to the increase of a million per annum of pyrites per annum. It is therefore not too much to say that, in all probability, the contact process will ultimately be employed generally for concentrated acids. Still, for the reasons given in the beginning of this article, this process is not likely to influence the ostrich trade, to a great extent. Since the Badische process has become known, several other new contact processes have come into the field, in some of which ferric oxide is employed as contact substance, but we must refrain from describing these in detail.

Medicine.—Sulphuric acid or oil of vitriol is a colourless oily-looking liquid incompatible with alkalis and their carbonates, lead and calcium. There are two medicinal preparations: (1) \( \text{HCl} \) acidum diutium dilutum, containing 13.5% of hydrogen sulphate, (2) \( \text{HCl} \) acidum sulphuricum aromaticum (elixir of vitriol), containing alcohol, spirit of cinnamon and ginger and 13.5% of hydrogen sulphate. When used in medicines the acid is rendered less powerful and irritating and caustic, acting by its powerful affinity for water and therefore dehydrating the tissues and causing them to turn black. It coagulates the albumen. Strong sulphuric acid is occasionally used as a medicinal article, and by surgeons in the treatment of malignant growths. It is difficult, however, to limit its action, and glacial acetic and nitric acids are preferable for this purpose. Considerable burns on the face or body may result from the application of sulphuric acid in the preparation olivewax. It is possible it may be of use in the distillation of any purifying or distilling apparatus. It is used in dilute form to distinguish the burns produced by this acid from those of other corrosive fluids. Intimately, dilute sulphuric acid is used in poisoning by alkalis as a neutralizing agent. Both it and the acetic or nitric acids are therefore intended by the last-named constituents, and would be useful in diarhoea of a serious type, being strongly recommended both as a prophylactic and as a treatment during epidemics of Asiatic cholera. Small doses of the acidic acid also serve as a prophylactic to those artisans who work in lead and as a treatment in lead poisoning in order to form an insoluble sulphate of lead. Sponging the body with very dilute solutions of sulphuric acid is useful to diminish the night-sweats of phthisis.

Toxicology.—Given in toxic doses or in strong solution, sulphuric acid is a severe gastro-intestinal irritant, causing intense burning pain, extending from the mouth to the stomach, and vomiting of matter. When taken internally, the onset of all its effects may be so rapid that death may take place in a couple of hours, owing to collapse, consequent on perforation of the walls of the oesophagus or stomach, or from asphyxia due to swelling of the glottis consequent on some of the acid having entered the larynx. Should the patient survive the first twenty-four hours death generally results later from stricture of the oesophagus or intestine, from destruction of the glands of the stomach or from excessive destruction of the stomach wall. Death is usually attended with an extreme thirst and the patient often requests half a teaspoonful of the strong acid, but recovery is recorded after half an hour having been swallowed. The poison consists in the presence of the irritating sulphuric acid, which in the eyes, skin, whiting, plaster, or any alkaline substance at hand, emetic. The stomach pump should not be used. Morphine may be given hypodermically to mitigate the pain. Should the patient survive have been made rapidly by him. The symptoms of sulphuric acid poisoning is bad, 60 to 70% of the cases proving fatal. The post-mortem appearances will be those of corrosive poisoning. The bucal mucous membrane will be greyish, brown or black in colour, due to the corrosive effects of the acid. SULPICIA, the name of two Roman poets. The earlier lived in the reign of Augustus, and was a niece of Messana, the patron of literature. Her verses, which were preserved with those of Tibullus and were for long attributed to him, are elegiac poems addressed to a lover called Cерinthus, possibly the Cornutus but very probably Th. Els. in two of his Elegies (bk. ii., 2 and 3; see Schanz, Gesch. d. röm. Litt., § 284; F. Pleaes, La Poésie lat., pp. 376–377 and references there given). The younger Sulpicia lived during the reign of Domitian. She is praised by Martial (x. 35, 38), who compares her to Sappho, as a model of wifely devotion, and wrote a volume of poems, describing with considerable freedom of language the methods adopted to retain her husband Calenus's affection. An extant poem (70 hexameters) also bears her name. It is in the form of a dialogue between Sulpicia and the muse Calliope, and is chiefly a protest against the banishment of the philosophers by the edict of Domitian (A.D. 94), as likely to throw Rome back into a state of barbarism. At the same time Sulpicia expresses the hope that no harm will befall Calenus. The muse reassures her, and prophesies the downfall of the tyrant. It is now generally agreed that the poem (the MS. of which was discovered in the monastery of Bobbio in 1493, but has long been lost) is not by Sulpicia, but is of much later date, probably the 4th century; according to some it is a 15th-century production, and not identical with the Bobbio poem.

Editions by O. Jahn (with Juvenal and Persius, revised by F. Bücheler, 1863) and in E. Bährn, De Sulpicio quaerat satura (1873), and in Bohn's Classical Library (Dec. 11, 1869) and Journal of Philology (1874), vol. v.; O. Ribbeck, Geschichte der römischen Dichtung (1892, vol. iii.; H. E. Butler, Persius, Augustus Poems (1900), p. 174; J. S. and Planck, Geschichte der römischen Litteratur (1900), p. 216); F. Jahn, Geschichte der röm. Literatur (Eng. trans., 1900), p. 233, 6. There are English translations by L. Evans in Bohn's Classical Library (prose, with Juvenal and Persius) and by J. Grainger (verse, 1759).

SULPICIUS RUFUS, PUBLIUS (c. 121–58 B.C.), Roman orator and statesman, legate in 89 to Cn. Pompeius Strabo in the eastern war, and in 88 tribune of the plebs. Soon afterwards Sulpicius, hitherto the orator, declared in favour of Marius and the popular party. He was deeply in debt, and it seems that Marius had promised him financial assistance in the event of his being appointed to the command in the Mithradatic War. To secure the appointment for Marius, Sulpicius brought in a franchise bill by which the newly enfranchised Italian allies and freedmen would have swapped the old electors (see further Rome, History, II. The Republic). The majority of the senate were strongly opposed to the proposals; a justitium (cession of public business) was proclaimed by the consuls, and Marius and Sulpicius got up a riot, and the consuls, in fear of their lives, withdrew the justitium. The proposals of Sulpicius became law, and, with the assistance of the new voters, the command was bestowed upon Marius, then a mere privatus. Sulpicius, who was then at Nola, immediately marched upon Rome. Marius and Sulpicius, unable to resist him, fled from the city. Marius managed to escape to Africa, but Sulpicius was discovered in a villa at Laurentum and put to death; his head was sent to Sulla and exposed in the forum. Sulpicius appears to have been originally a moderate reformer, who by force of circumstances became one of the leaders of a democratic revolt. Although he had impeached the turbulent tribune C. Norbanus (60 B.C.), he resisted the proposal of a second impeachment, and by popular decree, he did not hesitate to incur the displeasure of the Julian family by opposing the candidature for the consulship of C. Julius Caesar (Strabo Vopiscus), who had never been praetor and was consequently ineligible. His franchise proposals, as far as the Italians were concerned, were a necessary measure of justice; but they had been carried by violence. Of Sulpicius as an orator, Cicero says (Brutus, 53): "He was by far the most dignified of all the orators I have heard, and, so to speak, the most tragic; his voice was loud, but at the same time sweet and clear; his gestures were full of grace; his language was rapid and voluble, but not redundant or diffuse; he tried to imitate Crassus, but lacked his harm." Sulpicius left no written
speeches, those that bore his name being written by a certain P. Canutius (or Cannutius). He is one of the interlocutors in Cicero's *De oratore*.


**Sulpicius Rufus, Servius** (c. 106-43 B.C.), surnamed *Lemovia* from the tribe to which he belonged, Roman orator and jurist. He studied rhetoric with Cicero, and accompanied him to Rhodes in 78 B.C. Finding that he would never be able to rival his teacher he gave up rhetoric for law (Cic. *Brut.* 41). In 63 he was a candidate for the consulship, but was defeated by L. Licinius Murena (q.v.), whom he subsequently accused of bribery; in 51 he was successful. In the Civil War, after considerable hesitation, he threw in his lot with Caesar, who made him proconsul of Achaea in 46. He died in 43 while on a mission from the senate to Antony at Mutina. He was accorded a public funeral, and a statue was erected to his memory in front of the Rostra. Two excellent specimens of Sulpicius's style are preserved in Cicero (*Ad. Fam.* iv. 5 and 12). Quintilian (Instit. x. 1, 116) speaks of three orations by Sulpicius as still in existence; one of these was the speech against Murena, another *Pro or Contra Auidium*, of whom nothing is known. He is also said to have been a writer of erotic poems. It is as a jurist, however, that Sulpicius was chiefly distinguished. He left behind him a large number of treatises, and he is often quoted in theDigest, although the direct source is not named (fortified see Teuffel-Schwabe, *Hist. of Roman Lit.* 174, 4). His chief characteristics were lucidity, an intimate acquaintance with the principles of civil and natural law, and an unrivalled power of expression.

See R. Schneider, *De Servio Sulpicio Rufo* (Leipzig, 1834); O. Karlowa, *Römische Rechtgeschichte*, vol. i. (Leipzig, 1888); the chief ancient authority is Cicero.

**Sultan** (an Arabic word meaning "victorious" or "a ruler", *sultān*, dominion), a title of honour borne by a great variety of rulers of and varying powers and importance in Mahomedan Africa and the East. The word has thus no exact equivalent in English, and was early imported into the language in the Middle English form of *soudan* (from old Fr. *soudan*, *soudan*). This title is that conventionally applied by foreigners to the ruler of the Ottoman Empire, the sultan *par excellence*, whose proper style is, however, *padishah* (emperor) and "commander of the faithful" (see Amīr). The feminine form "*sultana*" is derived from the Italian fem. of *sultano*.

**Sultanpur**, a town and district of British India, in the Fyzabad division of the United Provinces. The town is on the right bank of the river Gumti, midway between Bareilly and Lucknow, on the Oudh & Rohilkhand railway. Pop. (1901), 9550.

The District of Sultanpur has an area of 1713 sq. m. The surface is generally level, being broken only by ravines in the neighbourhood of the rivers. The central portion is highly cultivated, while in the south are widespread arid plains and swampy *jhils* or marshes. The principal river is the Gumti, which passes through the centre of the district and affords a valuable highway for commerce. Minor streams are the Kandu, Pili, Tonsa, and Nandha, the last two being of some importance, as their channels form the outlet for the superfluous water of the *jhils*, draining into the Sai. There are no forests in the district, only stunted *dhak* woodlands used for fuel. In 1901 the population was 1,083,904, showing an increase of less than 1% in the decade. Sultanpur is a purely agricultural district with a very dense population. The principal crops are rice, pulses, wheat, barley, sugar-cane and a little poppy. The main line of the Oudh & Rohilkhand railway from Lucknow to Rae Bareli and Mogul Serai serves the south-western portion.

The most incident worthy of note in the history of the district since the British annexation of Oudo; one of the main functions of the native troops stationed at Sultanpur during the Mutiny. The troops rose in rebellion on the 9th of June 1857, and, after murdering two of their officers, sacked the station. Upon the restoration of order Sultanpur cantonment was strengthened by a detachment of British troops; but in 1861 it was entirely abandoned as a military station.

See *Sultanpur District Gazetteer* (Allahabad, 1903).

**Sumach**. The Sumach of commerce is the finely ground leaves of *Rhus coriaria*, a native of the North Mediterranean region from Portugal to Asia Minor; it is a shrub or low tree with hairy leaves composed of 11 to 15 elliptical leaflets with large blunt teeth, and large loose panicles of whitish-green flowers. Another species, *Rhus cotinus*, known as Venetian Sumach, also a native of southern Europe and Asia Minor, yields the yellow dye-wood known as young fustic; it is also known as the Smoke-plant or Wig-tree, from the feathery or hairy appearance of the leaf-stalks, which become elongated and hairy after the flowering. The genus *Rhus* is a member of the natural order Anacardiaceae and contains about 120 species of trees or shrubs mostly native in the temperature regions of both hemispheres. The leaves are alternate and simple or compound, with few to many entire-margined or serrated leaflets, and terminal or axillary panicles of small flowers with parts in fours or fives. The species are mostly poisonous, some being especially noxious. Such are *Rhus toxicodendron*, the North American poison ivy, a shrub climbing on rocks and trees by means of rootlets, and poisonous to the touch. *R. senecana*, the North American poison elder sumach or dogwood, also contains an extremely irritating poison. *R. vernicifera* is the Japan lacquer or varnish-tree. Several species are cultivated in the British Isles as store, greenhouse or hardy trees.

**Sumatra**, the westernmost and, next to Borneo, the largest of the Great Sunda Islands in the Malay Archipelago. It stretches N.W. to S.E. from Malacca Passage to Sunda Strait, between 5° 40' N. and 5° 59' S., and 95° 10' and 106° 3' 45' E. Its length is about 1100 m., its extreme breadth 250 m., and its area, including the neighbouring islands, except Banca and Biloton, is 178,338 sq. m. The northern half runs roughly parallel to the Malay Peninsula, from which it is separated by the Strait of Malacca, and the southern end is separated by the
narrow Sunda Strait from Java. Unlike Java, Sumatra has a series of considerable islands (Nias Islands, Mentawai Islands, &c.) arranged like outliers in front of the west coast, which faces the open Indian Ocean. The general physical features of the island are simple: a chain of lofty mountain ranges extends throughout the western part of the island, its western slopes descending rapidly towards the sea and the eastern part is a plain. Owing to this configuration of the island the rivers of the western side are comparatively short; only very few of them are large enough to be navigable. Those of the eastern slope, on the other hand, such as the Musi, Jambi, Indragiri, Kampar, Slak, Rokan, Panel, Bila, and Asahan, are longer, and with many of their affluents are navigable in their middle and lower courses over considerable stretches for craft drawing 6 to 10 ft. The Musi and Jambi are navigable for 577 and 497 m. respectively. As waterways all the rivers labour under the drawbacks of rapids, mud-banks at their mouths, banks overgrown with forest, sparse population, and currents liable to serious variations due to irregularity of supply from the mountains and sudden falls in their lower courses some of them form enormous intercommunicating deltas. The mountainous regions contain numerous lakes, many evidently occupying the craters of extinct volcanoes. When, as sometimes happens, two or three of these craters have merged into one, the lake attains a great size. Among the larger lakes may be mentioned Toba; Maninjau, west of Fort de Kock; Singkara, south-east of Fort de Kock; Korinchi, inland from Indrapura; and Ranus, in the south-west.

Orography.—In order to appreciate the orography of the island the following sections of Sumatra should be discriminated one from another: (1) The valley of the Achin or Aijieh River. (2) The plains around the lake of Toba, which are of varied level and physical character. Those on the north and north-east at an elevation of 4000 ft., having the character of steps, with scanty forest-cover, and, save in the narrow valleys and river-courses, are suitable for cattle-rearing. The plains on the east and west lie at a lower level and are eroded by larger rivers and swamps. The valleys are overgrown by sawahs and ladangs, or dry ricefields, and, near the rivers, planted with jagong (maize), coffee and fruits. Except on the south-east, where the elevation falls away to the east coast, Toba Lake is surrounded by steep shores. According to R. D. M. Verbeek, P. van Dyk, B. Hagen and W. Volz, the lake had its origin in the collapse of a volcano. (3) The valley of the Batang Toru, with the plateau of Sipirok in the east and the mountain chain three miles inland. On the south and south-east the valley is bounded by two volcanoes, Lubuk Raja and Si Buwali; whence were derived the volcanic tuffs of the valley and of the plateau of Sipirok, with the mafic lavas, which are drained by the Batang Toru and its affluents. The valley varies in breadth from 51 ft. to half a mile and less. Flowing in a deep bed cut in the tuff strata, the river is not navigable. (4) The longitudinal valley of the Batang Gadis, with its affluent the Angkola, and, in the south the valley of the Sipar, the upper course of the Rokan, between Lubuk Raja in the north and Mt Merapi in the south. This valley is 64 m. long, with a mean breadth of 5 to 6 ft. All the rivers of this valley, flowing in deep beds of eroded diluvial tuffs, with a fall as much as foundations of 5 to 660 ft., are more or less un navigable. The valley is bounded east and west by chains of plateau and Palaeozoic rocks. The bottom is in many parts the diluvial lake bottom or the river. (5) The section of middle Sumatra between the line of the three volcanoes, Singalang-Tandikat, Merapi, and Sago on the north, and that of the Dred Sondang, Batuah Selimbah, Korinchi and Tujuh on the south. This section is divided by the Medendi-bergen or middle chain into a northern half watered by the Ombilin or upper Indragiri with its affluents, and a southern half traversed by the Batang Hari or upper Jambi. Between these two volcanoes, which rise to 9500 ft. or more, there is a high plateau of volcanic formation, whose elevation declines in a direction from west to east from 2500 to 1650 ft., with the lake of Maninjau (about 40 sq. m.) filling the hollow of an old volcano, and with rivers which have eroded their beds in the tuffs to a depth of 300 ft. and more. South of the volcanoes the northern affluents of the Ombilin—the Sumpur, Sello and Sinarum—flow into one another in a north-west to south-east direction. Here, too, are found fertile tuffs, and the valleys are densely populated. The rivers, like those already characterized, are not available as waterways. Singkara Lake (44 sq. m.) is of origin similar to that of Maninjau. The Ombilin, issuing out of the lake on the east side and flowing through a plateau of Eocene sandstone, has on its banks the coalfields of Surie Durian, &c., but is not serviceable as a waterway for that part of Sumatra. The coal has to be transported by railway via Solok to Padang (Empuhaman), a port on the west coast. Solok lies on the Sumani, which, flowing from the south to the lake of Singkara, prolongs the valley of the Sumpur to the Medendi-bergen. Unlike the northern, the southern affluents of the Ombilin do not follow longitudinal valleys, the river lying in broad valleys and ranges of slate, limestone and sandstone. Here prevailing granite and diabase give rise to a complicated mountain system through which the rivers change their way in a curved and irregular course. South of the Medendi-bergen the southern affluents of the Batang Hari, the Seliti, Gumanti, Si Potar, Mamun and Pangang, at least these in the west, again run in longitudinal valleys. These affluents and the Batang Hari itself (except the part of it north of Mamun) are navigable for not more than 12 ft. (6) South Sumatra, so far as known, presents everywhere in its valleys the same character as that of the Batang Toru, Batang Gadis, and the valleys of the Rokan, Sumpur, and Maninjau. These valleys are divided into north and south by volcanoes which have here produced similar masses of tuff, with lakes and rivers of the same formation as in the north. Such are the valley of Korinchi, with the river of the same name, between the peaks of Korinchi and Mt Raja; the valleys of Serampe and Sungkai Tenang (as imperfectly known as that of the Korinchi), in which are to be sought the sources of the Tambesi and Aesi, both affluents of the Jambi; the longitudinal valley of

SUMATRA

Scale: 1:12,000,000

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Y

Z

English Scale: 1 in. = 200,000 ft.

Radial

Distances:

1st.

Rafflesia

2nd.

Indonesia

3rd.

Java

4th.

China

5th.

Ocean

6th.

India

7th.

Europe

8th.

North America

9th.

South America

10th.

Africa

11th.

Australia

12th.

Antarctica

13th.

North Pole

14th.

South Pole

15th.

East Indies

16th.

China

17th.

India

18th.

Europe

19th.

North America

20th.

South America

21st.

Australia

22nd.

Antarctica

23rd.

North Pole

24th.

South Pole

25th.

Rafflesia

26th.

Indonesia

27th.

Java

28th.

China

29th.

Ocean

30th.

India

31st.

Europe

32nd.

North America

33rd.

South America

34th.

Australia

35th.

Antarctica

36th.

North Pole

37th.

South Pole

38th.

East Indies

39th.

China

40th.

India

41st.

Europe

42nd.

North America

43rd.

South America

44th.

Australia

45th.

Antarctica

46th.

North Pole

47th.

South Pole

48th.

Rafflesia

49th.

Indonesia

50th.

Java

51st.

China

52nd.

Ocean

53rd.

India

54th.

Europe

55th.

North America

56th.

South America

57th.

Australia

58th.

Antarctica

59th.

North Pole

60th.

South Pole
Ketua, in Lebong, flowing to the west coast, and of the upper Meunane. To the south of the Makaluk and the upper Komering, an affluent of the Musi, between Sebelat and Kabia. The Makaluk and Selabung drain into Lake Ranau, which on the south side is dammed by the volcano Seminung. The south side of the hinterland valley of the Meunane, which flows into the bay of the same name. Generally the lower valleys of the rivers lie at elevations of 500 to 1000 feet; higher up they rise to 2500 or 3000 feet; the mountain chains rise to 5500 feet; the highest point, 7000 feet from 6600 meters. The section of south Sumatra between the eastern chain of old rocks and the west coast with its numerous river mouths is formed of the alluvial deposits of the rivers. In the distance from the sea, older strata and eroding rocks underlie the alluvium. The strata near the mountain chains and volcanoes consist of diilluvial tuffs.

Older rocks are gneiss, schist and quartzite, the schist often containing gold. They probably belong to several geological periods, but all were folded and denuded before the Carboniferous beds were deposited. There are the back-arc basin, and the ocean flows at the levels of the old rocks. It lies unconformably upon the older rocks; and the limestone contains Fossilina, Philippias and Productus, indicating that it belongs to the Upper Carboniferous. These beds are found only in the eastern part of Sumatra. They consist mainly of sandstone, diabase and gabbro, and are sometimes folded, sometimes but little disturbed. No Permian beds are known, and for many years there were rocks which resembled Triassic clays and sandstones with Daonella have been found in the upper part of the basin of the Kwalu (East Sumatra). They rest unconformably upon the Carboniferous beds, and have themselves been tilted. A strong angle, and a strong bed, was recorded by Bücking. Tertiary deposits are very widely spread over the plains and low-lying country. They consist of breccias, conglomerates, sandstones, marls, and limestones, with seams of coal, the most valuable coal occurred in the Oecome beds. At the close of the Eocene period great eruptions of augite-anidesite took place from two fissures which ran along the west coast. The Melaye and Geurung are the oldest of the strata, and are old volcanic beds. The limestone of the east coast it sometimes yields petroleum. The Plioceene occurs chiefly in the low-lying land and is generally covered by drift and alluvium. Sometimes it contains thick seams of lignite or brown coal.

The present volcanoes lie along a line (with offshoots) which runs parallel to the west coast, but some distance to the east of the fissures from which the early Tertiary lavas were poured. Lava streams are seldom emitted from these volcanoes, the material erupted consisting chiefly of ash and scoriae, which are spread over a very wide extent of country. Augite-anidesite predominates, but basalt and rhyolite also occur.

Climate.—As throughout the whole of the Malay Archipelago, so in Sumatra, which lies about equally balanced on both sides of the equator, the temperature stands at a high level subject to but slight variations. The mean monthly temperature mounts only from 77 ° F. in January to 80-6 ° F. in May and August and October. In the distribution of the rainfall, as dependent on the direction of the winds, the following parts of Sumatra must be distinguished: (1) Punti—The Sumatra, on which, as on Banka and Billiton, the heaviest rainfall occurs during the north-west monsoon, the annual volume of rainfall increasing from 98-4 in. in the east to 139 in. in the west. Of the 139 in. of yearly rainfall, 91-7 in. are brought by the north-west and 47-3 in. by the south-east monsoon. (2) The west coast. Here the rainfall for the year increases from the southern and northern extremities towards the middle. Bengkulu, e.g. gets 126 in.; Singkawang (2°5' N.), 172 in.; and Padang 184 in. in the year. Here, too, the prevailing rainfall is brought by the north-west monsoon, but in this belt its prevalence is not so pronounced. Padang getting 94 in. of rain during the north-west monsoon. The west coast, in the middle of the rainy season, is washed by the withdrawal from the north-east monsoon towards the west coast. The higher stations of middle Sumatra, on the lee side of the western mountain chain, have a yearly rainfall of only 78-9 in. and 80-7 in. in the western parts. Sumatra is swept by a variety of winds. The south-east wind, which predominates. Blowing over land and in the direction of the longitudinal valleys, the south-east wind is comparatively dry, and thus helps the ripening of strawberries on the lowlands, but extends to some 6500 ft. above sea-level. The north-east wind does not extend above 9000 ft. The willows, Bos sundanus does not appear to find the least comfort in the forests in the lowlands, but extends to some 6500 ft. above sea-level. The range of the elephant does not extend above 9000 ft. The wild elephant is not abundant in Sumatra, but the elephant, altogether absent from Java, is represented in Sumatra by a species somewhat larger than the common Malayan deer is widely distributed, Cerus muntiacus less so. The orang-utan occurs, rarely, in the north-east. The siamang (Siamang, *Siamang* maculatus *Siamang* maculatus) is a small ape peculiar to the forests in the height of the Boxa-bolobes agilis is not so common. A fairly familiar form is the simipie (Simipius pongolus). The chigai (*Cercocerus cynomolus*) is the only ape found in central Sumatra in a tame state. The piglet (*Sus* domesticus) in the north of the island. The *Sus* domesticus is the only hare, the little hare found in the Malay Archipelago. The *Manis javanica* is the only representative of the Edentata. Some 350 species of birds are known, and the avifauna closely resembles that of the Malay Peninsula and Borneo, including few peculiar species.

Flora.—Rank grasses (*kalang, gloga*), which cover great areas in Java, have an even wider range in Sumatra, descending to within 50 ft. of sea-level; wherever a space is found in the forest, these aggressive grasses begin to take possession of the soil, and if once they are firmly rooted the woodland has great difficulty in reestablishing itself. Among the orders more strongly represented are Saururacae in the Diterandra section; *Bauhinia* section; *Hymenodendron* section; *Myrtaceae* in the *Myrtus* section; *Dipterocarpaceae*, *Nyctaginaceae*, *Begoniaceae*, *Acanthaceae*, *Annonaceae*, *Cucurbitaceae*, *Malvaceae*, *Gentianaceae*, *Combretaceae*, *Amaryllidaceae*, *Cyrtandraeae*, *Epiprionidae* and *Epiprionidae*. Many of the Sumatran forms which do not occur in Java are found in the Malay Peninsula. In the north the pine tree (*Pinus merkusii*) has advanced almost to the equator, and in the south a variety of species characteristic of the Australian region. The distribution of species does not depend on elevation to the same extent as in Java, where the horizontal zones are clearly marked; and there appears to be a tendency of all forms to grow at lower altitudes than in that island. A remarkable feature of the Sumatran flora is the great variety of trees that vie with each other in stature and beauty, and as a timber-producing country the Sumatran flora holds a position which is second to none in the archipelago. Forest products—gums and resins of various sorts, such as gutta-percha—are valuable articles of export. The process of reckless deforestation is perceptible in certain districts, the natives often destroying a whole tree for a plank of inferior quality. The principal cultivated plants, apart from sugar-cane and coffee, are rice (in great variety of kinds), the cocoonut palm, the areca palm, the sago palms, maize, yam, and sweet potatoes; and among the fruit trees the Indian tamarind, pomegranate, guava, papaw, orange and lemon. Even before the arrival of Europeans Sumatra was known for its pepper plantations; and these still form the most conspicuous feature of the south of the island. For the foreign market coffee is the most important of all the crops, the Padang districts being the chief seat of its cultivation. Benzoin was formerly obtained almost exclusively from Sumatra from the *Styrax benzoin*.}

**Population.**—The following tables give the area and estimated population of the several political divisions of Sumatra and of the island as a whole (excluding the small part belonging to the RIoow-Lingga residency):

<table>
<thead>
<tr>
<th>Area in sq. m.</th>
<th>Population</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sumatra, West Coast</td>
<td>31,649</td>
<td>1,577,270</td>
</tr>
<tr>
<td>Sumatra, East Coast</td>
<td>32,824</td>
<td>412,970</td>
</tr>
<tr>
<td>Bengkulu</td>
<td>9,299</td>
<td>162,926</td>
</tr>
<tr>
<td>Lampung Districts</td>
<td>11,284</td>
<td>1,426,240</td>
</tr>
<tr>
<td>Palembang</td>
<td>55,497</td>
<td>804,299</td>
</tr>
<tr>
<td>Achin</td>
<td>20,471</td>
<td>110,504</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>161,612</strong></td>
<td><strong>3,168,312</strong></td>
</tr>
</tbody>
</table>
SUMATRA

Of the total population, about 5000 are Europeans, 93,000 Chinese, 2500 Arabs, 7000 foreigners of other nations, and the rest natives. In 1905 the total population was given as 4,920,505.

The natives of the mainland of Sumatra are all of Malay stock (those of the north being the most hybrid), but it is doubtful to what extent Malay has here absorbed pre-Malay blood. The different tribes vary in language, customs and civilization. No race of true Negrito type has been found. The Kubus (q.v.), a savage forest people of the highlands, were believed by some to be Negrito owing to the frizzled character of their hair, but it appears certain that they are Malayan. The north of Sumatra is occupied by the Acehnese (q.v.), who have an extensive language, and the west of Lake Toba is the country of the Batass (q.v.) or Battaks. In the hill-country south of the lake are two forest tribes, Orang-ulu and Orang-lubu, pure savages of whom practically nothing is known, affiliated by most authorities to the Battaks. The plains east of this territory are occupied by the Siaks, and farther south on the east coast are the Jambis, both Malays. Above Padang are the several tribes of the prosperous and comparatively civilized Menangkobs (q.v.). The Korinchis live among the mountains south of Padang, and farther south on the east coast are the tribes called the Tiku, who are a peculiar tribe who employ a distinctive written character which they cut with a kris on bamboo or lontar. The same character is employed by their immediate neighbours to the south, the Pasumas, who bear traces of Javanese influence. In the extreme south are the Lampong people, who claim descent from the Menangkobs, but have also an admixture of Javanese blood. The inhabitants of the islands west of Sumatra are of mixed origin. Simalu is peopled partly by Achinese and partly by Menangkob settlers. They profess Mahomedanism but are practically savages. Nias (q.v.) has an interesting native population, apparently of pre-Malayan origin; and the Mortu and islands (q.v.) are inhabited by a race generally held to be a Polynesian settlement which has escaped fusion with Malay stock. As regards education and the spread of Christianity among the natives, the west coast division is far in advance of the rest of the island. Here about 32,000 natives profess Christianity and there are about 300 schools; elsewhere schools are comparatively few and the adhesion to Christianity very slight.

Administrative Divisions and Towns.—In the west coast lands East Sumatra is divided into 14 districts, each under a resident of the Dutch Government. Agriculture, timber, and coalfields have created populous settlements on the coast at Padang (the capital of the west coast, with 35,158 inhabitants in 1897, of whom 16,460 were Europeans), Prijam, Natau, Agung Puger, and Sinubong. Southwards are the towns of Perai Kock, Payokombo, &c. In the east coast land it is only at the mouths of rivers—Palembang at the mouth of the Musi, with 53,000 inhabitants, and Medan in Deli, the residence of the highest civil and military officials of the east coast, in which a fine government house has been erected—that considerable centres of population are to be found. Nine-tenths of the natives of Sumatra live by agriculture, the rest by cattle-rearing, fishing, navigation, and, last but not least, from the products of the forests; they are therefore little concentrated in towns.

The Dutch government of the west coast, extending along the shore of the Indian Ocean from the north of Acheh to the Siam frontier, has the principal offices and residences of the Padang lowlands, Tapanuli and the Padang highland. The governor has his residence at Padang, which is also the capital of the lowlands residency. Padang Sidempuan, the chief town of Tapanuli, lies inland, south of Mt Luba Raja. The town of Siboga has considerable commercial importance, the bay on which it stands being one of the finest in all Sumatra. Bukit Tianni, or, as it is commonly called, Fort de Kock, is the capital of the residency of the Padang highlands. To the government of the west coast belong the following islands: Simalu; Banjak Islands, a small limestone group, well wooded and sparsely peopled; Nias, formerly called Acheh; Bintuhan, a small island near Pulu Tiku, or Rat Island, in a low and swampy locality, and on an open roadstead. This was the chief establishment possessed by the Dutch in the island, but other noteworthy places are Moko-Moko, with the old British fort; Anna; Pasar Bintuhan, and Lais (Laye), the former seat of the British resident.

The residency of the Langkong districts is the southernmost in the island, being separated from Palembang by the Masui River. It is partly mountainous, partly so flat as to be under water in the rainy season. The most important places are Telok Betong, chief town of the residency; Mengkabang, with a Dutch trade, Lunung Sugki, Sukadana, Tanjung Karang, and Kota Agung.

The residency of Palembang consists of the former kingdom of Tapanuli, and various island districts, together forming a distinct monarchy. Between the mainland dependency of the Riau-Lingga residency and the residency of Palembang lies Jambi, an extensive sultanate, of which a portion belongs to the residency of Padang (called Jambi) a Dutch "comptroller," who represents the resident of Palembang; another portion is claimed by a quasi-independent native sultanate in the interior. Of this interior very little was known until the small outlying settlements of the Dutch Exploring and Royal Geographical Societies towards the end of the seventies, but in 1901 an armed Dutch expedition, necessitated by frequent disturbances, explored and surveyed the districts, and awarded the governor, however, another 50,000 inhabitants (2500 Chinese), extensive barracks, hospitals, &c., a mosque (1740), connected the forest in the Dutch Indies, and a traditional tomb of Alexander the Great. The residency of Riau, which embraces many hundreds of islands, great and small, also includes a portion of the Sumatra mainland, between the residencies of Palembang to the east and of Tapanuli to the west. It comprises the old kingdom of Indragiri, and lies on either hand of the river of that name.

The residency of the east coast was formed in 1873 of the territory of Siak and its dependencies and the state of Kampar. In includes perhaps the richest and best-developed districts of northern Sumatra, namely, Deli (with an assistant-resident), Langkat, Serdang, &c.—districts not so well known by the outside world, but practically the best 19th century famous among the chief tobacco-producing countries in the world. Belawan is the harbour to Deli, but the capital is Medan, where the sultan and the Dutch resident reside. Belawan is connected with Medan by a good, well-tarred road, and is connected with Singapore by a private company, almost entirely dependent for its earnings upon the numerous tobacco plantations, several of which belong to British and American interests, and are occupied by Japanese coolies, largely Chinese, and the Malays are comparatively few in number. The tobacco plantations of British North Borneo were nearly all started by planters from Deli.

The residency of Siau occupies the northern part of the island. No little progress has been made by the Dutch even in this war-ridden territory. There is a railway in the lower valley of the Achin River, connecting the capital, Kotaraja, and neighbourhood with Bintuhan, a good, free port, with Ian act trade, carried on by numerous steamers, both Dutch and foreign. Edi on the north-east coast, with another harbour, is capital of a sultanate which formerly owed allegiance to the sultan of Acheh, but was formed a political division of the government of Acheh since 1888, and the expedition restored order. Edi is a centre of the still extensive pepper trade, carried on mainly with the Chinese at Singapore and Palembang.

Products and Industry.—Forests and natural vegetation cover a much larger part of Sumatra than of Java. Whereas in Java tall timber on the mountains keeps to altitudes of not less than 3000 ft., the tall timber on the mountains of Sumatra commonly descends below 1500 ft., and in men and now a political division, is similarly managed. Tin is known, especially in Siak. Copper has been worked in the Padang highlands (most largely in the district of Lake Singkara) and also in Tin特区. Tin is produced in large quantities, and the export of this field increased from 1730 tons in 1892 to 78,500 metric tons in 1899. The profit on the working, which is carried on by the state, is large. Lignite of good quality is found in several localities. The production of vegetable oil, which was formerly carried on by great extent in the close of the 19th century: on the Lepan River in Langkat it mounted from 352,880 gallons in 1891 to 20,143,000 gallons in 1900. The oil of the palm oil is sent to Batavia, the capital, for refining, and has an extensive market, but the Achin government, has become one of the chief centres of the petroleum industry. The crude oil is conveyed in pipes to Aube Bay,
on the east coast, and refined in the island of Sumbanese, Arseneic, saltpetre, alum, naphtha and sulphur may be collected in the volcanic districts. A systematic mineralogical survey has been undertaken in central Sumbatra.

History.—As far as is known, Sumbatran civilization and culture are of Hindu origin; and it is not improbable that the island was the first of all the archipelago to receive the Indian immigrants who played so important a part in the history of the region. Certain inscriptions discovered in the Padang highlands seem to certify the existence in the 7th century of a powerful Hindu kingdom in Tanah Datar, not far from the site of the later capital of Menangkabo. In these inscriptions Sumatra is called the "S," and the individual inscriptions Sumatrenia is called the "W." The southern India influence still to be found in the island are extremely numerous, though far from being so important as those of Java. There are ruins of Hindu temples at Butar in Dili, near Pertibi, on the Panbij river at Jambi, in the interior of Palembang above Lahat, and in numerous other localities. One of the principal Hindu ruins is at Muara Takus on the Kampar river. The buildings (including a stupa 40 ft. high) may possibly date from the 11th century. At Pagar Rujung are several stones with inscriptions in Sanskrit and Menangkabo Malay. Sanskrit words occur in the various languages spoken in the island; and the Ficus religiosa, the sacred tree of the Hindu, is also the sacred tree of the Battas. At a later period the Hindu influence in Sumatra was strengthened by an influx of Hindus from Java, who settled in Palembang, Jambi and Indragiri, but their attachment to Sivaism prevented them from coalescing with their Buddhist brethren in the north. In the 13th century Mahomedanization began to make itself felt, and in course of time took a firm hold upon some of the most important states. In Menangkabo, for instance, the Arabic alphabet displaced the Kavi (ancient Javanese) character previously employed. Native chronicles describe Siva as the Great: and the Chinese dynasties boast its origin from a missionary of Islam. The town of Sumaderab was at that period the seat of an important principality in the north of the island, whose current name is probably a corruption of this word. There is a village called Suma near Pasi which possibly indicates the site.

Sumatra first became known to Europeans through the Portuguese, Diogo Lopes de Sequeira, in 1508. The Portuguese were the first to establish trading posts on the island, but at the end of the century they were driven out by the Dutch. At this time the most powerful native state in the island was Acheh (q.v.). Elsewhere Dutch sovereignty was gradually extended,—in 1664 over Indrapura; in 1666 over Padang, until by 1830 it was established over much of the southern part of the eastern lands, including Palembang. Meanwhile, in 1868 the British had acquired a footing in Benkulen, and between them and the Dutch there was always much jealousy and friction until in 1824 a treaty was made under which the British vacated Sumatra in favour of the Dutch, who reciprocated by giving up Malacca. In May 1825 Benkulen was taken over from the British. In the second half of the century the Dutch found a succession of armed expeditions necessary to consolidate their power. Thus in 1831 a revolt was suppressed in Palembang, and an expedition was sent to the Lampong districts. In 1833 Raja Rama of Lampang, ringleader of the revolt in Palembang, surrendered. In 1838 an expedition was sent against Sambal; the sultan was dethroned and a treaty made with his successor. In 1869 the British were invited to the Palembang residency. In 1863 there was an expedition against Nias, and in 1863 another against Ashan and Serdang (east coast). In 1873 war was declared against Achin. In 1876 there was an expedition against Kota Julo (east coast) and the emancipation of slaves was carried out on the west coast. In 1878 Benkulen was made a residency, and the civil administration of Achin and dependencies was entrusted to a governor. From 1883 to 1894 the government, with the help of missionaries, extended its authority over the south-east and south-west of the island, and also over some of the lands to the east and north of Toba lake, including the districts of Toba, Silindong and Tanah Jawa, and in 1895 over the southern part of the peninsula of Sumatra in Toba lake. Its jurisdiction was also extended over Tanjung Priok, where the frontier of the Dutch east coast of Sumatra. By military expeditions (1890-95) the Dutch influence on the Batang Hari, or Upper Jambi, was increased; and as also in 1899 in the Lima Kota in central Sumatra, included within the territory of Siak. The war in Achin did not materially retard the development of Sumatra, and although the titular sultan of Achin continued a desultory guerrilla warfare against the Dutch in the mountainous woodlands of the interior, the almost inaccessible Pasei country, really active warfare has long ceased. All along the main coasts of the former domains of Palembang, Sumatra, and north Sumatra have been established and military roads constructed; even in Pedir, on the north coast, until 1899 the most actively turbulent centre of resistance of the sultans' party, and still later only pacified in parts, Dutch engineers were able to build a highway to connect the west with the east coast, and other works have been successfully carried out. Practically the whole of the island is now more or less explored and under control.

The literature dealing with Sumatra is very extensive. Of the older works the best known is W. Marsden, History of Sumatra London, 1841. A full list of other authorities will be found in P. J. Veth's Aardrijkskundig Woordenboek van Nederl. Indië (1886). Among later works one of great importance is Midden-Sumatra; Reizen en Onderzoekingen door de Tanaband, 1829-1837; ed. by P. J. Veth. See also Brau de Saint-Pol Lias, I.d. de Sumatra (Paris, 1884); E. B. Kielstra, Beschrijving van de Afol van de Oost (1885-1886), and "Sumatra West-Kust van 1819-1825," in Bijdr. tot Land., etc., Kunde (1887); on the history of Palembang, west coast and the war in Achin, in Indisch militair Tijdschrift (1886-1889); Tijdschr. bat. Gen. (1887-1892). For topography and geography, see K. Fennema, Topographische en geologische Beschrijving van het Noordelijk gedeelte ... Westkust, etc.; J. van het Mijnwezen (1887); R. D. M. Verbeek, Topographische en geologische Beschrijving van een Deel van Sumatra's Westkust, with atlas (Batavia, 1883); similar work by Villers, of which the French edition (1892); D. Van der Stok, De Oost-Kust van Sumatra in de tijd van de Nederlanders, 1819-1825, in Batav. Tijdschr. Westkust, etc.; Volz, "Beiträge zur Geographie von Nord-Sumatra," Zeitschr. deutsch. geol. Gesell, (1899), vol. ii.; H. Büsing, "Zur Geologie der Sumatra-Inseln und der Inseln vor der Westküste," in Fortschritte d. Geol. 1899, vol. vii., with map and five plates (Leiden, 1904); D. J. Erb, "Beiträge zur Geologie und Morphologie der südlichen West-Küste von Sumatra," Z. Ges. Berlin (1907); J. F. Hooz, Die Oro- und Homogenität der Sumatra-Inseln, 1902; Ed. van den Berghen, Dwars door Sumatra, Tocht van Padang naar Siak (Haarlem, 1895); A. Maas, Quer durch Sumatra (Berlin, 1904); E. Otto, Pfannenste- und Jügerlen auf Sumatra (Berlin, 1899); B. Hagen, "Die Gajo-Länder," Jahresb. Frankfurt v. G., etc., (1907); Climate: J. P. van der Stok, Regenmaeunungen und Atlas von Wind und Weather (Batavia, 1897). Consult further Tijd. Aardr. Gen., Tijd. Batav. Gen., Jaarb. van het Mijnwezen, and Koloniale Verslagen, passim. (See also MALAY ARCHIPELAGO).

Sumba (Tjendana, or Sandalwood), one of the Lesser Sunda Islands in the Dutch East Indies, lying south of Flores, from which it is separated by Sumba strait, about 10° S., 120° E. It has an area of about 4600 sq. m., consists of a plateau with an extreme elevation of about 3300 ft., and appears to be composed mainly of sedimentary rocks. It has a large Malay population (estimated at 200,000). Some trade is carried on in cotton, ponies, edible birds' nests, tortoiseshell, and various drugs and articles, among which is Waiangapu or Nangamessi on the north-east coast. Sumba is included in the Dutch residency of Timor, together with the lesser island of Savu, to the east. From this last island the sea is enclosed by Timor, Sumba and the islands between them, and Flores and the chain of islands east of it is called the Savu Sea.

1 Koto means the number of settlement or township, and a great many districts have been named from the number of kotaks they contain; e.g. the VII. Kotas, the VIII. Kotas, &c.
SUMBABA—SUMER AND SUMERIAN

SUMBABA (Dutch Soemba wa), one of the Little Sunda islands in the Dutch East Indies, east of Lombok, from which it is separated by the narrow Alas Strait. It has an area of 4300 sq. m., or, including the neighbouring islands, 5240 sq. m. The deep bay of Salé or Sumbawa on the north divides the island into two peninsulas, and the isthmus is further reduced by the narrower Bay of Chempi on the south. The eastern peninsula is deeply indented on the north by the Bay of Bima. Four mountain chains cross the island in a west to east direction. The northern, as in Bali and Lombok, is of volcanic origin. Tambora, forming a minor peninsula east of Sumbawa Bay, is said to have lost a third of its elevation in the eruption of 1815, but is still 9035 ft. high. In the southern chain is found a limestone formation analogous to that in Bali, Lombok and Java. Between these two chains are round hills consisting of lavas or sometimes of volcanic tuffs, covered with the long silvery grass which also clothes vast prairies in Java and Sumatra. There are no navigable streams. The climate and productions are not unlike those of Java, though the rains are heavier, the drought more severe, and the fertility less. Sulphur, arsenic, asphalt and petroleum exist. The natives live solely by agriculture. But out of a total population of about 75,000 there are 11,000 foreigners, living mostly by trade and navigation. The natives consist of Sumbawans proper, a people of Malay stock; of Buginese and Macassar immigrants, and of wild tribes of the mountains of whom nothing is known. Mahommedanism prevails throughout the island except among the mountain tribes.

Historically Sumbawa, with its four independent states, belongs to the confederated states of the government of Celebes and its dependencies, a situation to be explained by the fact of the old supremacy of the Macassaresi over Sumbawa, Flores and Sumba. The independent states are Sumbawa proper, Dompo, Sangar and Bima. Two other states on the northern part of the island were so far devastated by the Tambora eruption of 1815 that their territory, after lying for so long uninhabited, was in 1866 divided between the Sumbawa and Bima, the former lying in the south-western peninsula. The residence of the sultan is Sumbawa on the north coast. It is surrounded with a palisade and ditches. The inhabitants of this state employ sometimes the Malay and sometimes the Macassar character in writing. A considerable trade is carried on in the export of horses, buffaloes, goats, dinding (dried flesh), skins, birds’ nests, wax, rice, kattyang, sappanwood, &c. Sumbawa entered into treaty relations with the Dutch East India Company in 1674. Dompo is the western half of the eastern peninsula. The capital of the state, Dompo, lies in the heart of the country, on a stream that falls into Chempi Bay. Bada, the sultan’s residence, is situated on the south-western promontory of the island, and Bima the extreme east. Bima or Bodja, the chief town of the latter state, lies on the east side of the Bay of Bima; it has a stone-walled palace and a mosque, as well as a Dutch fort.

Sumbawang (p. 76), or Sumbawang, is a promontory on the northern coast of the island, now, however, considered a part of the town of Bima. Genoetsch, xxii.; Liggoet, “Anteekeningen betreffende den economischen Toestand en de Ethnographie van Sumbawang,” in Tijdschr. Bat. Gen. xxiii.

SUMBAL, or SUMBAL, also called Musk Root, a drug occasionally employed in European medical practice. It consists of the root of Perula sambul, Hook., a tall Umbelliferous plant found in the north of Bokhara, its range apparently extending beyond the Amur. It was first brought to Russia in 1833 as a substitute for musk; and in 1867 was introduced into the British pharmacopoeia. The root found in commerce consists of transverse sections an inch or more in thickness and from 1 to 3 or more inches in diameter. It has a dark thin papery bark, a spongy texture, and the cut surface is marbled with white and blackish or pale brown; it has a musky odour and a bitter aromatic taste. The action and uses of the drug are the same as those of asafoetida (q.v.) It owes its medicinal properties to a resin and an essential oil. Of the latter, it contains about 9% and of the latter 4%. The resin is soluble in water, and has a very smelly, but not fully developed until after contact with water.

Under the name of East Indian sambul, the root of Dorema ammonicum, Don., has occasionally been offered in English commerce. It is of a browner hue, has the taste of ammoniacum, and gives a much darker tincture than the genuine drug; it is thus easily detected. The name "sambal" (a word of Arabic origin, signifying a spike or ear) is applied to several fragrant roots in the East, the principal being Nardostachy shalalarnasi, D.C. (see SPIKE- NARD). West African sambul is the root of a species of Cyperus.

SUMER and SUMERIAN. The Babylonian name Shumer was used in the cuneiform inscriptions together with Akkad, for "mat Shumeri u Akkadi, "land of S. and A.," to denote Babylonian in general (see AKAAD). In the semi-Semitic ideographic documents the equivalent for Shumer is Ké-nu, which seems to be a combination of kén, "land," + gi, "reed," i.e. "land of reeds," and appropriate designation for Babylonia, which is essentially a district of reedy marshes formed by the Tigris and Euphrates. It was formerly thought that Shumer was employed especially to denote the south of Babylonia, while Akkad was used only of the north, but this view is no longer regarded as tenable. It is more probable that the expression Shumer designated the whole of Babylonia in much the same manner as did Akkad, and that the two words "Shumer and Akkad" were used together as a comprehensive term. That Shumer actually did mean all Babylonia appears evident from the biblical use of Shinar=Shumer to describe the district which contained the four chief Babylonian cities, viz. Babel, Erech, Accad and Calneh (Gen. x. 10), which, according to the Old Testament account, constituted the beginnings of Nimrod’s kingdom. The identity of Shinar and Shumer is also demonstrated by the Septuagint rendering of Shinar in Isaiah xi. 11 by "Babylonia." In short, there can be no doubt that the biblical name Shumer was practically equivalent to the mat Shumeri u Akkadi=non-Semitic form, Shemher, just as the non-Semitic word dimaru, "god," is equivalent to another form, dimir. Others have seen in the ancient Babylonian place-name Girsu an inversion of Su-gir=Su-Qir, which has also been identified with Shumer. In this connexion Hommel’s theory2 should be mentioned, that the word Shumer was a later palatalization of Ki-imir, "land of Imirr" = Shi-imirr, subsequently Shingi with palatalized k=s and elision of the final r. The form imir (imgar), however, as a place-name for Babylonia is uncertain. All that can be said at present about this difficult etymology is that in the non-Semitic Babylonian the name is represented by an ideographically indeterminate name which could also be indicated by the combination ng. Here we find Shumer, probably pronounced Shuwar, with a sound similar to that heard to-day in the Scottish Gaelic word lamh, “hand”; v. a sort of nasalized w. This gave rise to the later inaccurate forms: Greek, Senaar; Syriac, Sen’ar; and biblical Hebrew, Shinar=Shi’gar.

The so-called “Sumerian problem,” which has perplexed Assyriologists for many years, may be briefly stated as follows. In a great number of Babylonian inscriptions an idiom has long been recognized which is clearly not ordinary Semitic in character. This non-Semitic system, which is found in many instances, on alternate lines with a regular Semitic translation, in other cases in opposite columns to a Semitic rendering, and again without any Semitic equivalent at all, has been held by one school, founded and still vigorously defended by the distinguished French Assyriologist, Joseph Halevy, to be nothing more than a priestly system of cryptography based, of course, on the then current Semitic speech. This cryptography, according to some of the Halevyans, was read aloud in Semitic, but, according to other expositors, the system was read as an “ideophonic,” secret, and purely artificial language.

The opposing school (the Sumerists) insists that these

1 Hastings’s Dict. Bibb., iv. 503.
2 Ibid. i. 2240.
non-Semitic documents were evidently in an agglutinative language, naturally not uninfluenced by Semitic elements, but none the less essentially non-Semitic in origin and fundamental character. Scholars of this opinion believe that this language, which has been arbitrarily called "Akkaadin" in England and "Sumerian" on the European continent and in America, was primitively the speech of the pre-Semitic inhabitants of the Euphrates region who were conquered by the invading Semites. These invaders, according to this latter view, adopted the religious and cultural practices of the conquered Sumerians; and, consequently, the Sumerian idiom at a comparatively early date began to be used exclusively in the Semitic temples as the written vehicles of religious thought in much the same way as was the medieval Latin of the Roman Church. The solution of this problem is of vital importance in connexion with the early history of man's development in the Babylonian region.

The study of the Sumerian vocabulary falls logically into three divisions. These are (1) the origin of the cuneiform signs, (2) the etymology of the phonetic values, and (3) the elucidation of the many and varied primitive sign-meanings.

Previous to Professor Friedrich Delitzsch's masterly work, on the origin of the most ancient Babylonian system of writing, no one had correctly understood the facts regarding the beginnings of the cuneiform system, which is now generally recognized as having been originally a pure picture writing which later developed into a conventionalized ideographic and syllabic sign-list. In order to comprehend the mysteries of the Sumerian problem a thorough examination of the beginning of every one of these signs is, of course, imperative, but it is equally necessary that every phonetic Sumerian value and word-combination be also studied, both in connexion with the equivalent signs and with other allied phonetic values. This etymological study of Sumerian is attended with incalculable difficulties, because nearly all the Sumerian texts which we possess are written in an idiom which is quite evidently under the influence of Semitic. With the exception of some very ancient texts, the Sumerian literature, consisting largely of religious material such as hymns and incantations, shows a number of Semitic loanwords and grammatical Semitisms, and in many cases, although not always, is quite patent a translation of Semitic ideas by Semitic priests into the formal religious Sumerian language. Professor Paul Haupt may be termed the father of Sumerian etymology, as he was really the first to place this study on a scientific basis in his Sumerian Family Laws and Akkadian and Sumerian Cuneiform Texts. It is significant that all phonetic and grammatical work in Sumerian tends to confirm nearly every one of Haupt's views. Professors Peter Jensen and Zimmer have also done excellent work in the same field and, together with Haupt, have established the correct method of interpreting the Sumerian vocables, which should be studied only in relation to the Sumerian literature. Sumerian words should be compared with words in the idioms of more recent peoples, such as Turkish, in spite of many tempting resemblances. Until further light has been thrown on the nature of Sumerian, this language should be regarded as standing quite alone, a prehistoric philological remnant, and its etymology should be studied only with reference to the Sumerian inscriptions themselves. On the other hand, grammatical and constructional examination from outside the more modern agglutinative idioms, in order to establish the truly linguistic character of the Sumerian peculiarities and to dispel the Halévyan contentions that Sumerian is really not a language at all.

It is not surprising that Halévy's view as to the crypticographic nature of Sumerian should have arisen. In fact, the first impression given by the bewildering labyrinth of the Sumerian word-list is the conclusion that such a vocabulary could never have arisen in a regularly developed language. For example, anyone studying Brünnow's List will find the same sign denoting pages of meanings, many of which have apparently no connexion with any other meaning belonging to the sign in question. A great multiplicity of meanings is also attributed, apparently quite arbitrarily, to the same sign, sound-value or word. In these instances, however, we can explain the difficulty away by applying that great fundamental principle followed by the Semitic priests and scribes who played with and on the Sumerian idiom, and in the course of many centuries turned what was originally an agglutinative language into what has almost justified Halévy and his followers in calling Sumerian a cryptography. This principle is that of popular etymology, i.e., of sound-association and idea-association which has brought together in the word-lists many apparently quite distinct meanings, probably primarily for purposes of mnemonical aid. The present writer in his Materials for a Sumerian Lexicon has mentioned this ruling phenomenon again and again. A very few examples, however, will suffice here. Thus the word ag = the sign RAM = rámû, "love" (proper meaning) is associated with rōmmû, "to roar," for phonetic reasons only. The word a = the sign A = "water" (original meaning) can indicate anything whatever connected with the idea moisture. Thus, a = "water, moisture, weep, tears, inundate, irrigate," &c. The word a can also mean "shining, glistening," an idea evidently developed from the shining rippling of water. Note that in Turkish as means both "water" and "the lustre of a jewel," &c. The word a might possibly be "gems of the first water." The combination a-má-tu, literally "water enter ship," means abbâbû, "deluge," ordinarily, but in one passage a-má-tu is made the equivalent of šabbâbû, "flame," a pure pun on abbâbû, "deluge." Examples of this, the leading principle which was followed by the framers of the Sumerian system, might be cited almost ad infinitum.

Facts of this character taken by themselves would perhaps be sufficient to convince most philologists that in Sumerian we have an arbitrarily compounded cryptography just as Halévy believes, but these facts cannot be taken by themselves, as the evidences of the purely linguistic basis of Sumerian are stronger than these apparent proofs of its artificial character.

Briefly considered there are six most striking proofs that the Sumerian was based on a primitive agglutinative language. These may be tabulated concisely as follows:-

1. Sumerian presents a significant list of internal phonetic variations which would not have been possible in an arbitrarily invented language. Thus, taking the vowels alone; e =a by the principle of umlaut. Hence, we find the words ga and ge, as "for" for the same idea respectively. The vowel i could become e as de=di, &c. Consonantal variation is least common. Thus, b=m as bar=barn. Compare the modern Arabic pronunciation Maalbek for Baalbek. Perhaps the most interesting of these consonantal interchanges is that occurring between n and the sibilants sh and z; ner=sher; na=sa, which by some scholars has been declared to be phonetically impossible, but its existence is well established between the modern Chinese colloquial idioms. For example, Pekingese zhen, Hakka nziin, Fuchow ning, Ningpo zhein, and ying, Wonchoong song and nong all = "man." This demonstrates beyond a doubt the possibility of a strongly palatalized n becoming a palatal sibilant or vice versa, between which utterances there is but a very slight tongue movement.

The discussion of these phenomena brings us to another point which precludes the possibility of Sumerian having been merely an artificial system, and that is the undoubted existence in this language of at least two dialects, which have been named, following the inscriptions, the Eme-kû, "the noble or male speech," and the Eme-sal, "the woman's language." The existence and general phonetic character of the "woman's language" were first pointed out by Professor Paul Haupt,

2. Die Entstehung des ältesten Schriftsystems oder der Ursprung der Keilschrift in der Statthallie Mesopotamien (1897).
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cited as being the basis of many of the Sumerian combinations. Deliberate inversion certainly occurs in the Sumerian documents, and it is highly probable that this was a priestly mode of writing, but never of speaking; at any rate, not when the language was in common use. It is not necessary to imagine, however, that these devices originated with the Semitic priesthood. It is quite conceivable that the still earlier Sumerian priesthood invented the method of orthographic inversion, which after all is merely an extreme development of the normal Sunnian inversion. The fact is, it is the sort of thing in people's minds when endeavouring to express itself in a manner out of the ordinary. For example, evident Sumerian inversions are Gibbi, "the fire god," for Bil-gi; ushar for Sem. sharru, "king," &c.

It is, moreover, highly probable that Sumerian had primitively a system of voice-tones similar to that now extant in Chinese. Thus, we find Sumerian ab, "dwelling," &c.; ab, "road," and -ab, a grammatical suffix, which words, with many others of a similar character, were perhaps originally uttered with different voice-tones. In Sumerian, the number of conjectural voice-tones never exceeds the possible number even... 

It is also clear that Sumerian was actually read aloud, probably as a ritual language, until a very late period, because we have a number of pure Sumerian words reproduced in Greek transliteration; for example, Delephai = Dilbat, "the Venus-star"; Illinos = the god Illi = Bél; iddi = itu, "month," &c.

In view of the many evidences of the linguistic character of Sumerian as opposed to the one fact that the language had engrailed upon it a great number of evident Semitisms, the opinion of the present writer is that the Sumerian, as we have it, is fundamentally an agglutinative, almost polythetic, language upon which a. m. j. j. h. was subsequently constructed pot-pourri of Semitic inventions was superimposed in the many centuries of accretion under Semitic influences. This view stands as a connecting link between the extreme idea of the Halévy school and the extreme idea of the opposing Sumerist school.


SUMMANUS, according to some, an old Sabine or Etruscan deity; the name, however, is Latin, formed by assimilation from sub-manus (cf. manu, Matuta), signifying the god of the time "before the morning." His sphere of influence was the nocturnal heavens, thunderstorms at night being attributed to him, those by day to Jupiter. Summanus had a temple at Rome near the Circus Maximus, dedicated at the time of the invasion of Italy by Pyrrhus, king of Epirus (278), when a terracotta image of the god (or of Jupiter himself) on the pediment of the Capitoline temple was struck by lightning and hurled into the river Tiber. Here sacrifice was offered every year to Summanus on the 20th of June, together with cakes called summanae. The name is often prefixed to a first wheel, supposed to be the bolical of the car of the god of the thunderbolt. In Plautus (Bacchides iv, 8, 54) Summanus and the verb summonare are used for the god of thieves and the act of stealing, with obvious reference to Summanus as a god of night, a time favourable to thieves and their business. The later explanation that Summanus is a contraction from Summus Manius (the highest of the Muses), and that he is to be identified with Dis Pater, is now generally rejected.

See Augustine, De civitate dei, iv, 23; Ovid, Fasti, vii, 729; Festus,
SUMMARY JURISDICTION

s.e. Provostum fulger; G. Wissowa, Religion und Kultur der Römer (1902); W. W. Fowler, The Roman Festivals (1899).

SUMMARY JURISDICTION. In the widest sense this phrase in English law includes the power asserted by courts of record to deal at
brevis manu with contempt of court without the intervention of a jury. Probably the power was originally exercisable only when the fact was notorious, i.e. done in presence of the court. But it has long been exercised as to extra curial contempt (see CONTEMPT or COURT). The term is also applied to the special powers given by statute or rules to the High Court of Justice and to county courts for dealing with certain classes of causes or matters by methods more simple and expeditious than the ordinary procedure of an action (see SUMMONS). But the phrase in modern times is applied almost exclusively to certain forms of jurisdiction exercised by justices of the peace out of general or quarter sessions, and without the assistance of a jury.

Ever since the creation of the office of justice of the peace (q.v.) the tendency of English legislation has been to enable them to deal with minor offences without trial. This was necessary, as Blackstone says, except in the case of contempt the common law is a stranger to trial without a jury, and because even when an offence is created by statute the procedure for trying must be by indictment and trial before a jury, unless by statute creating the offence or some other statute another mode of trial is provided. In one remarkable instance power is given by an act of 1725 (12 Geo. I. c. 29, s. 4) to judges of the superior courts summarily to sentence to transportation (penal servitude) a solicitor practising after conviction of barratry, forgery or perjury (Steph. Crim. 6th ed., 113). In other words all the summary jurisdiction of justices of the peace is the creation of statute. The history of the gradual development of the summary jurisdiction of justices of the peace is stated in Stephen's Hist. Crim. Law, vol. i. ch. 4. The result of legislation is that summary jurisdiction has been conferred by statutes and by-laws as to innumerable petty offences of a criminal or quasi-criminal character (most of which in French law would be described as contraventions), ranging through every letter of the alphabet. The most important perhaps are those under the Army, Game, Highway, Licensing, Merchant Shipping, Post Office, Public Health, Revenue, Acts.

A court of summary jurisdiction is defined in the Interpretation Act 1889 as "any justice or justices of the peace or other magistrate, by whatever name called, to whom jurisdiction is given by, or who is authorized to act under, the Summary Jurisdiction Acts, whether in England, Wales or Ireland, and whether acting under the Summary Jurisdiction Acts or any of them or any other act or by virtue of his commission or under the common law" (52 & 53 Vict. c. 63, s. 13 [11]). This definition does not apply to justices of the peace sitting to hold a preliminary inquiry as to indictable offences, or in the discharge of their quasi-administrative functions as licensing authority. The expression "Summary Jurisdiction Acts" means as to England and Wales the Summary Jurisdiction Acts of 1848 (11 & 12 Vict. c. 42) and 1870 (42 & 43 Vict. c. 49) and any act amending these acts or either of them. These acts define the procedure to be followed by justices in those cases in which they are empowered by statute to hear and determine civil or criminal cases without the intervention of a jury or the forms of an action or indictment at law or a suit in equity. Besides these two acts the procedure of the exercise of summary jurisdiction is also regulated by acts of 1857 (28 & 29 Vict. c. 1, c. 43), 1884 (47 & 48 Vict. c. 43) and 1899 (62 & 63 Vict. c. 22), and by the Summary Jurisdiction Process Act 1881 (44 & 45 Vict. c. 24). The act of 1848 repealed and consolidated the provisions of a large number of earlier acts. The act of 1857 provided a mode of appeal to the High Court by case stated as to questions of law raised in summary proceedings. The act of 1870 amended the procedure in many details with the view of uniformity, and enlarged the powers of justices to deal summarily with certain classes of offences ordinarily punishable on indictment. The act gives power to make rules regulating details of procedure.

The rules now in force were made in 1886, but have since been amended in certain details. The act of 1884 swept away special forms of procedure contained in a large number of statutes, and substituted the procedure of the Summary Jurisdiction Acts. The act of 1899 added the obtaining of property by false pretences to the list of indictable offences which could sub modo be summarily dealt with. The statutes above mentioned form a kind of code as to procedure and to some extent also as to jurisdiction.

As already stated, to enable a justice to deal summarily with an offence, whether created by statute or by-law, some statutory authority must be shown. A very large number of petty offences (contraventions) have been created (e.g. poaching, minor forms of vagrancy, nuisances of various descriptions, highway offences), and are not all being created (1) by legislation, or (2) by the by-laws of corporations made under statutory authority, or (3) by departments of state acting under such authority.

The two latter classes differ from the first in the necessity of proving by evidence the existence of the by-law or statutory rule, and if need be it is inutra vires.

In the case of offences which are primarily made punishable only on indictment, power to convict summarily is given in the following cases:

1. All indictable offences (except homicide) committed by children under seven and under twelve, if convicted before a summary court and not by parliamentary or delinquent act (1879, s. 10).

2. All indictable offences (except homicide) committed by young persons of twelve and under sixteen, if the young person consents to being told of his right to be tried by a jury (1879, s. 11; 1899, s. 2).

3. The indictable offences specified in sch. 1, col. 2 of the act of 1879 and in the act of 1899, if committed by adults, if they consent to being tried after being told of their right to be tried by a jury (1879, s. 12).

4. The indictable offences specified in sch. 1, col. 1 of the act of 1879 and the act of 1899, if committed by an adult who pleads guilty on due consideration that if he does so he will be summarily convicted (1879, s. 13).

5. Adults cannot be summarily dealt with under 3 or if the offence is punishable by law with penal servitude or imprisonment for two years or more, unless it is of a kind specified in the Schedule to the Summary Jurisdiction Act 1879, and they may be dealt with summarily only on the consent of the accused or the person having authority over him (1899, s. 14).

It will be observed that as to all the indictable offences falling under heads 1 to 4, the summary jurisdiction depends on the consent of the accused or person having authority over him, whereas in the case of summary conviction or indictment of the accused (1879, s. 14),

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Occasionally a warrant is issued in place of a summons in the first instance, in which case the information is likely to be more fully stated. The proceedings must be begun, i.e. by laying the information, not later than six months after the commission of the offence, unless by some particular statute another period is prescribed for the commencement of the action.

In a certain number of summary cases the accused is arrested under statutory authority without application to a justice, e.g. in the case of rogues and vagabonds and certain classes of offences committed on board a ship. In other cases the accused may be lawfully arrested without a warrant, or brought before the court in arrest, where he may be cross-examined. He may lawfully be arrested for a longer period of time, e.g. those of lunatics, if he is found in the jurisdiction of the court, i.e. before two or more justices, or in the regular place of meeting or some place temporarily appointed as the substitute for the regular court-house, or before a stipendiary magistrate. A summary conviction is a conviction in a lower court than the assize court, and the accused is brought before the court on arrest, and the court will not answer questions lawfully put to him by an inspector of the prison without endorsement, in the rest of England and Wales, and in Scotland, the Channel Islands and Isle of Man, after endorsement by a competent magistrate. The conviction is usually summarily, in the same court, by a justice of the peace or an inspector of the prison.

A warrant of arrest is executed by the constable or person to whom it is directed, and wherever or from whom the local jurisdiction of the issuing court; or a fresh pursuancy within the court may extend, summarily, where there is no without endorsement, in the rest of England and Wales, and in Scotland, the Channel Islands and Isle of Man after endorsement by a competent magistrate. The warrant may be issued in the summary court in a fresh jurisdiction, by a justice of the peace or an inspector of the prison.

The summons is obtained by writ of habeas corpus or by a writ of summons to the court by warrant, and a summary civil jurisdiction, e.g. as to certain civil debts recoverable summarily, or to make orders to do or to abstain from doing certain acts, e.g. with reference to nuisances and buildings, the procedure differs in certain details from that in criminal actions.

1. The summons is issued on a complaint which need not be in writing nor on oath, and not on an information, and warrants of arrest cannot be issued.

2. The evidence of the defendant and his or her spouse are the same as in civil actions.

3. The court's decision is by order and not by conviction. The order varies in form, but in the case of a conviction therewith is enforceable by distress and sale of the defendant's effects or by imprisonment, but only on proof that the defendant has had since the order means of paying and has refused or neglected to do so

4. Proceedings for the enforcement of local rates are not affected by the Summary Jurisdiction Acts except as to the power of summing to the High Court questions of law arising on a summons to enforce local rates. But all other points in the law as to such rates are sometimes but not quite accurately described as ministerial, for their powers of inquiry though limited are judicial and not ministerial.

Appeal.—The orders and convictions of a court of summary jurisdiction are in many cases appealable to quarter sessions. The right to appeal is always dependent on the specific provisions of a statute or rule of court. Some statutes or rules provide for appeal against an action on conviction (but not on plea of guilty) to imprisonment without the option of a fine, whether as punishment for an offence or for failure to do or abstain from doing any act, or for failure to pay money or find security or enter into recognizances or even to assert the appeals (1879, s. 19). The procedure on the appeals is regulated and made uniform by the acts of 1879, ss. 31, 32; and 1884. These provisions are supplementary of the particular provisions of many statutes authorizing an appeal.

The decisions of courts of summary jurisdiction on points of law arising in connexion with the proceedings are reviewable by the High Court under the acts of 1857 and 1879, but are occasionally corrected by the common law remedies of mandamus, prohibition, or certiorari. The application of the last-named remedy is restricted by the same statute to proceedings under the admiralty or police laws and orders of the High Court dealing with appeals, &c., from the decisions of justices in the exercise of their civil jurisdiction; but not when the subject-matter is a criminal cause or matter.

In proceedings between husband and wife for separation orders there is a special form of appeal on facts as well as to law to the probate, divorce and admiralty division of the High Court (Summary Jurisdiction [Married Women] Act 1895; Licensing Act 1902, s. 5).

SCOTLAND. Civil.—In the Court of Session there are certain forms of proceedings in summary cases, e.g. with reference to entails, custody of children, guardians and factors of minors and lunatics, which are applications for exercise of the nobile officium or extraordinary jurisdiction of the court (see Mackay, Court of Session Practice, 1914, p. 163). The appointment of such a person is given to justices of the peace as to the recovery of small debts.

Criminal and Quasi-criminal.—The only act relating to summary jurisdiction procedure common to England and Scotland is the Summary Jurisdiction (Scotland) Act 1881. Summary jurisdiction in Scotland depends chiefly upon the Summary Jurisdiction (Scotland) Acts 1864 and 1881. The acts follow, to some extent, the lines of the English statutes, but there are certain important differences, and some of the exceptions to the application of the summary jurisdiction are included in the definition of the court, as are stipendiary magistrates (1897, c. 48). The acts also apply to proceedings before church courts, or before burgesses, and to justices of the peace where they have by statute or by common law the power to try offenses or fines penalties. All proceedings for summary conviction or for recovery of a penalty must be by way of complaint according to one of the forms in the schedule to the act of 1864. The English summons and warrant are represented in Scotland by the warrant of citation and the warrant of apprehension. Where no punishment is fixed for a
statutory offence, the court cannot sentence more than a fine of £5 or sixty days' imprisonment, in addition to ordering caution to keep the peace. The jurisdiction of the ... English law called "libellus conventions." The antiquity and importance of the summons as a legal form in England is shown by the presence of the "summoner," or summoner of the ecclesiastical court, as one of the characters in the Assize Rolls, and in The History of Sir John Oldcastle, where the summoner was the substitute of the plaintiff issued from the bishop of Rochester's court. The term is used with reference to a demand for the attendance of a person in the high court of parliament. As regards English courts of justice it is equivalent to what in the civil and canon law and in Scots law, in which courts deriving their procedure from those sources, is known as "citation." That term is still preserved in English ecclesiastical courts and in matrimonial causes.

It is an essential principle of justice that a court should not adjudicate upon any question without giving the parties the opportunity of being heard and of bringing their witnesses before the court. The most usual term in English law for the process by which attendance is commanded or required is the "summons."  

Civil Proceedings.—In the High Court of Justice, civil actions are begun by obtaining from the officers of the court a document known as a writ of summons. In this document are stated the questions in controversy and the jurisdiction of the court to decide the question in the case; the matters in controversy must be of an amount exceeding £20. There is a short form of application to the Attorney General in England for a certificate as to the admissibility of the case for the purpose of obtaining a High Court summons, and the High Court summons is given as usual in the case of liquidated sums of money must be precise and particular. It is sealed and issued to the party suing it out, and served on the defendant by the officer of the court. It is a process by which the court instructs the defendant to appear and answer the claim, and to indicate the consequences of non-attendance, viz., adjudication in default.  

The procedure in the High Court and in some of the county courts is initiated by forms of summons different from the writ of summons. Of those issued in the High Court three classes merit mention: (1) the summons for determining interlocutory matters of practice and procedure arising in "a pending case or matter." These are now limited as far as possible to a general summons for directions, introduced in England by Lord Halsbury Lord Chief Justice, 1875, so as to discourage frequent and expensive applications to the masters or judges of the High Court on questions of detail. These summonses are sealed and issued on application at the offices of the High Court. The matters raised are dealt with by a master or judge in chambers summarily. In matters of practice and procedure there is no appeal from a judge at chambers without leave from him or from the court of appeal.

2. For determining certain classes of questions with more decision and less delay than is possible by the forms already mentioned. This kind of summons is known as an "originating summons," because under it proceedings may be begun without writ for certain classes of cases. The Law Reform Act, 1851, 2 & 3 Victorian (3), 3. The originating summons may be used in all divisions of the High Court, but is chiefly employed in the chancery division, where it is a great extent supersedes actions for the administration of trusts or of the title of property of the parties. It is a miscellaneous procedure similar to the action of origin in the chancery division. The evidence is usually written. In the chancery division where the questions raised are important the summons is adjourned into chambers after the evidence to the court of appeal from decisions on originating summonses.

The forms of summonses and the procedure thereon in civil cases in the High Court are regulated by the Rules of the Supreme Court 1883, 12 & 13 Vict. c. 86.  

3. Certain proceedings on the crown side of the king's bench division are begun by summons, e.g., applications for bail; and in certain of the actions of habeas corpus, prohibition and certiorari are asked for by summons as the full court is not in session. (See Crown Office Rules, 1906).

In the county courts an action is begun by plaint and summons. The power of summoning the defendant is limited to giving every form of county court action, and the default summons, which is an optional remedy of the plaintiff in actions for debts or liquidated demands exceeding £5, and in all actions for the price or hire of goods

1 A similar practice existed before 1853 under the powers given by 13 & 14 Vict. c. 86, but was very limited in its operation, as it applied only to the personal estate of a deceased person.
SUMMUM BONUM—SUMNER, C.

He graduated in 1830 at Harvard College, and in 1834 graduated at the Harvard Law School. Here, in closest intimacy with Joseph Story, he became an enthusiast in the study of jurisprudence: at the age of twenty-three he was admitted to the bar, and was contributing to the American Jurist, and editing law texts and Story's court decisions. What he saw of Congress during Lincoln's visit to Washington in 1864 filled him with loathing for politics as a career, and he returned to Boston resolved to devote himself to the practice of law. The three years (1837–1840) spent in Europe were years of fruitful study and experience. He secured a ready command of French, German and Italian, equalled by no American then in public life. He formed the acquaintance of many of the leading statesmen and publicists, and secured a deep insight into continental systems of government and of jurisprudence. In England (1838) his omnivorous reading in literature, history and jurisprudence made him persona grata to leaders of thought. Lord Brougham declared that he "had never met with any man of Sumner's age of such extensive legal knowledge and natural legal intellect." Not till many years after Sumner's death was any other American received so intimately into the best English circles, social, political and intellectual.

In his thirtieth year, a broadly cultured cosmopolitan, Sumner returned to Boston, resolved to settle down to the practice of his profession. But gradually he devoted less of his time to practice and more to lecturing in the Harvard Law School, to editing court reports and to contributions to law journals, especially historical and geographical lines, in which his erudition was unsurpassed. In his opinion the trial of the future would be conducted by himself and his friends, and he became despondent as to his future. It was in a 4th of July oration on "The True Grandeur of Nations," delivered in Boston in 1845, that he first found himself. His oration was a tremendous arrangement of war, and an impassioned appeal for freedom and for peace, and proved him an orator of the first rank. He immediately became one of the most eagerly sought orators for the lyceum and college platform. His lofty themes and stately eloquence made a profound impression, especially upon young men; his platform preachment imposing, for he was six feet and four inches in height and of massive frame; his voice was clear and of great power; his gestures unconventional and individual, but vigorous and impressive. His literary style was somewhat florid. Many of his speeches were monuments of erudition, but the wealth of detail, of allusion, and of quotation, often from the Greek and Latin, sometimes detracted from their effect.

Sumner co-operated effectively with Horace Mann for the improvement of the system of public education in Massachusetts. Prison reform and peace were other causes to which he gave ardent support. In 1847 the vigour with which Sumner denounced a Boston congressman's vote in favour of the Mexican War Bill made him the logical leader of the "Conscience Whigs," but he declined to accept their nomination for Congress. He took an active part in the organizing of the Free Soil party, in revolt at the Whigs' nomination of a slave-holding southerner for the presidency; and in 1848 was defeated as a candidate for the national House of Representatives. In 1851 control of the Massachusetts legislature was secured by the Democrats in coalition with the Free Soilers, but after filling the state offices with their own men, the Democrats refused to vote for Sumner, the Free Soilers' choice for United States senator, and urged the selection of some less radical candidate. A deadlock of more than three months ensued, finally resulting in the election (April 24) of Sumner by a majority of a single vote.

Sumner thus stepped from the lecture platform to the Senate, with no preliminary training. At first he prudently abstained from trying to force the issues in which he was interested, while he studied the temper and procedure of the Senate. In the closing hours of his first session, in spite of strenuous efforts to prevent it, Sumner delivered (Aug. 26, 1852) a speech, "Freedom national; Slavery sectional," which it was immediately felt marked a new era in American history. The conventions

sold or let to the defendant to be used in the way of his calling. It may also issue by leave of the judge or registrar in other cases, with the same effect. If no leave be had, the summons is not given even in cases where the claim is not for the price or hire of goods sold or let as above, if the affidavit of debt discloses that the defendant is a servant or partner of the plaintiff. The advantage of the written summons is that judgment is entered for the plaintiff without hearing unless the defendant gives notice of defence within a limited time. A default summons must as a rule be served personally on the defendant by a person of good character, but may be served by a bailli of the court and not by the party suing them out.

Justices of the peace have power to cause issue summons to persons accused of indictable offences, or of offences summarily punishable, for their attendance, for preliminary inquiry or summary trial according to the nature of the charge, and also to persons against whom a complaint of a civil nature within the justices' jurisdiction is made. On failure to attend on summons, attendance may be enforced by warrant; and in the case of indictable offences this is the course always adopted. The forms in use for indictable offences are scheduled to the Indictable Offences Act 1848, and those for other purposes to the Summons Act 1868. The summons is a writ of Summum Jurisdiction.) The attendance of witnesses before justices of the peace may be required by witness summons, enforced in the event of disobedience by arrest under warrant (see Witness).

The summons in civil proceedings, and the writ of subpoena, are usually served by a bailiff of the court and not by the party suing them out. In courts for the trial of indictable offences the attendance of the accused and of the witnesses is not secured by summons. Both officer and party can make an ex parte application, and the summons must be served with the writ of subpœna issued from the crown office of the High Court. Disobedience to the writ is punished as contempt of court.

Scotland.—Summons is a term confined in strictness to the books. The writ is called a summons. The summons is written in the sovereign's name, signed by a writer to the signet, citing the defendant to appear and answer the claim. The "will of the summons" is the conclusion of a writ, containing the will of the sovereign officer, accusing the defendant of some act or omission whose attendance is required. It is regulated by several acts, e.g. The Debtors (Scotland) Act 1838 (1 & 2 Vict. c. 114) and the Court of Session (Scotland) Act 1825, s. 53. Defects in the summons are cured by amendment or rectification of the summons by the Court of Session.

A privileged summons is one where the inducæ are shortened to six days against defenders within Scotland (Court of Session [Scotland] Act 1825, s. 53). Defects in the summons are cured by amendment or rectification of the summons by the Court of Session. The summonses go to the judge of the court, and are not like the English writ of summons, though it no longer states, as it once did, the grounds of action, now stated in the condescension and pursuer's pleas in law annexed to the summons. The form of the summons is given by the Court of Session (Scotland) Act 1850, s. 1 and schedule A. After the action has been set on foot by summons, the attendance of the parties and witnesses is obtained by citation. The Citation Amendment Acts 1871 and 1882 give additional facilities for the execution of citations in civil cases by means of registered letters, instead of by the old process known as "lock hole citation." In the act of 1871 the term "summons" is used to denote part of the process of inferior civil courts. In the sheriff court an action is now begun by writ (Sheriff Courts [Scotland] Act 1897), and not as formerly by petition or summons.

Ireland.—In Ireland summonses are used substantially for the same purposes and in the same manner as in England, but generally speaking under statutes and rules applying only to the parties. (W. F. C.)

SUMMUM BONUM (Lat. for "highest good"), in ethics, the ideal of human attainment. The significance of the term depends upon the character of the ethical system in which it occurs. It may be viewed as a perfect moral state: as pleasure or happiness (see Hedonism; Eudaemonism); as physical perfection; as wealth, and so forth. If, however, we abandon intuitional ethics, it is reasonable to argue that the term summum bonum ceases to have any real significance inasmuch as actions are not intrinsically good or bad, while the complete sceptic strives after no systematic ideal.

SUMNER, CHARLES (1811–1874), American statesman, was born in Boston, Massachusetts, on the 6th of January 1811.
of both the great parties had just affirmed the finality of every provision of the Compromise of 1850. Reckless of political expediency, Sumner moved that the Fugitive Slave Act be forthwith repealed; and for more than three hours he denounced it as a violation of the constitution, an affront to the public conscience, and an offence against the divine law. The speech provoked a storm of anger in the South, but the North was heartened to find at last a leader whose courage matched his conscience. In 1856, at the very time when "border ruffians" were drawing their lines closer about the doomed town of Lawrence, Kansas, Sumner in the Senate (May 19-20) laid bare the "Crime against Kansas." He denounced the Kansas-Nebraska Bill as in every respect a swindle, and held its authors, Stephen A. Douglas and Andrew P. Butler, up to the scorn of the world as the Don Quixote and Sancho Panza of the "harlot, Slavery." Two days later (May 22) Preston S. Brooks (1819-1857), a congressman from South Carolina, suddenly confronted Sumner as he sat writing at his desk in the Senate chamber, denounced his speech as a libel upon his state and upon Butler, his relative, and before Sumner, pinned on his desk, could make the slightest resistance, raised blow after blow upon his head, till his victim sank bleeding and unconscious upon the floor. That brutal assault cost Sumner three years of heroic struggle to restore his shattered health—years during which Massachusetts loyally re-elected him, in the belief that in the Senate chamber his vacant chair was the most eloquent pleader for free speech and free resistance to slavery. Upon his return, in 1859, the approaching presidential campaign of 1860 did not deter him from delivering a speech, entirely free from personal rancour, on "The Barbarism of Slavery"—to this day one of the most comprehensive and scathing indictments of American slavery ever presented.

In the critical months following Lincoln's election Sumner was an unyielding foe to every scheme of compromise. After the withdrawal of the Southern senators, Sumner was made chairman of the committee on foreign relations (March 8, 1861), a position for which he was pre-eminently fitted by his years of intimate acquaintance with European politics and statesmen. While the war was in progress his letters from Cobden and Bright, from Gladstone and the duke of Argyll, at Lincoln's request were read by Sumner to the cabinet, and formed a chief source of light as to political thought in England. In the turmoil over the "Trent" affair, it was Sumner's word that convinced Lincoln that Mason and Slidell must be given up, and that reconciled the public to that inevitable step. Again and again Sumner used the power incident to his chairmanship to block action which threatened to return the Union to war with England and France. Sumner openly and boldly advocated the policy of emancipation. Lincoln described Sumner as "my idea of a bishop," and used to consult him as an embodiment of the conscience of the American people.

The war had hardly begun when Sumner put forward his theory of reconstruction: that the seceded states by their own act had "become feto de se," had "committed state suicide," and that their status and the conditions of their readmission to membership in the Union lay absolutely at the determination of the government. There were two states which had never been states. He presented the initiative in Reconstruction to the Senate, and Lincoln, and later by Johnson, as an encroachment upon the powers of Congress. Throughout the war Sumner had constituted himself the special champion of the negro, being the most vigorous advocate of emancipation, of enlisting the blacks in the Union army, and of the establishment of the Freedmen's Bureau. The credit or the blame for imposing equal suffrage rights for negroes upon the Southern states as a condition of Reconstruction must rest with Charles Sumner more than with any other man. Needless of the teachings of science as to the slow evolution of any race's capacity for self-government, he insisted on putting the ballot forthwith into the hands of even the most ignorant blacks, lest their rights be taken from them by their former masters and the fruits of the war be lost. But it must be remembered that in Sumner's plan equal suffrage was to be accompanied by free homesteads and free schools for negroes.

In the impeachment proceedings against Johnson, Sumner was one of the president's most implacable assailants. Sumner's opposition to Grant's pet scheme for the annexation of San Domingo (1870), after the president mistakenly supposed that he had secured a pledge of support, brought upon him the president's bitter resentment. Sumner had always prized highly his popularity in England, but he unhesitatingly sacrificed it in taking his stand as to the adjustment of claims against England for breaches of neutrality during the war. Sumner laid great stress upon "national claims." He held that England's according the rights of belligerents to the Confederate states had doubled the duration of the war, entailing inestimable loss. He therefore insisted that England should be required not merely to pay damages for the havoc wrought by the "Alabama" and other cruisers fitted out for Confederate service in her ports, but that, for "that other damage, immense and infinite, caused by the prolongation of the war," the withdrawal of the British flag from this hemisphere could "not be abandoned as a condition or preliminary of such a settlement as is now proposed." (At the Geneva arbitration conference these "national claims" were abandoned.) Under pressure from the president, on the ground that Sumner was no longer on speaking terms with the secretary of state, he was deposed on the 10th of March 1871 from the chairmanship of the committee on foreign relations, in which he had served with great distinction and effectiveness throughout the critical years since 1861. Whether the chief cause of this humiliation was Grant's vindictiveness at Sumner's opposition to his San Domingo project or a genuine fear that the impossible demand, which he insisted should be made upon England, would wreck the prospect of a speedy and honourable adjustment with that country, cannot be determined. In any case it was a cruel blow to a man already broken by racking illness and domestic sorrows. Sumner's last years were further saddened by the misconstruction put upon one of his most magnanimous acts. In 1872 he introduced in the Senate a resolution providing that the names of battles with fellow citizens should not be placed on the regimental colours of the United States. The Massachusetts legislature denounced this battle-flag resolution as "an insult to the loyal soldiery of the nation" and as "meeting the unqualified condemnation of the people of the Commonwealth." For more than a year all efforts—headed by the poet Whittier—to rescind that censure were without avail, but early in 1874 it was annulled. On the 10th of March, against the advice of his physician, Sumner went to the Senate—it was the day on which his colleague was to propose the rescission resolution. He left for Kenilworth in the next day's mail. With these grateful words of vindication from Massachusetts in his ears Charles Sumner left the Senate chamber for the last time. That night he was stricken with an acute attack of angina pectoris, and on the following day he died.

Sumner was the scholar in politics. He could never be induced to suit his action to the political expediency of the moment. "The slave of principles, I call no party master," was the proud avowal with which he began his service in the Senate. For the tasks of Reconstruction he showed little aptitude. He was less a builder than a prophet. His was the first clear programme proposed in Congress for the reform of the civil service. It was his dauntless courage in denouncing compromise, in demanding the repeal of the Fugitive Slave Act, and in insisting upon emancipation, that made him the chief initiating force in the struggle that put an end to slavery.

See Sumner's Works (15 vols., Boston, 1870-1883), and Edward L. Pierce's Memoir and Letters of Charles Sumner (4 vols., Boston, 1877-1882). Brief biographies have been written by Anna L. Dawes (New York, 1892); Moorfield Storey (Boston, 1900); and George H. Haynes (Philadelphia, 1909).

SUMNER, CHARLES RICHARD (1790-1874), English bishop, was born at Kenilworth on the 22d of November 1790, and was educated at Eton and at Trinity College, Cambridge. He graduated B.A. in 1814, M.A. in 1817, and was ordained deacon
SUMNER, E. V.—SUMPTUARY LAWS

and priest. In the two winters of 1814-1816 he ministered to the English congregation at Geneva, and from 1816 to 1821 was curate of Highclere, Hampshire. In 1820 George IV. wished to appoint him canon of Windsor, but the prime minister, Lord Liverpool, objected; Sumner received instead a royal chaplaincy and librarianship, and other preferments quickly followed, till in 1826 he was consecrated bishop of Llandaff and in 1827 bishop of Winchester. In his long administration of his latter diocese he was most energetic, tactful and munificent. Though evangelical in his views he by no means confined his patronage to that school. In 1869 he resigned his see, but continued to live at the official residence at Farnham until his death on the 15th of August 1874. He published a number of charges and sermons, and The Ministerial Character of Christ Practically Considered (London, 1824). He also edited and translated John Milton's De doctrina christiana, which was found in the State Paper office in 1823, and formed the text of Macaulay's famous essay on Milton.

See the Life, by his son, G. H. Sumner (1876).

SUMNER, EDWIN VOSE (1707-1865), American soldier, was born at Boston, Massachusetts, and entered the United States army in 1819. He served in the Black Hawk War and in various Indian campaigns. In 1838 he commanded the cavalry instructional establishment at Carlisle, Pennsylvania. He took part in the Mexican War as a major, and for his bravery at Molino del Rey he received the brevet rank of colonel. In 1857 he commanded an expedition against the Cheyenne Indians. At the outbreak of the Civil War, four years later, Sumner had just been promoted brigadier-general U.S.A. and sent to replace Sidney Johnston in command on the Pacific coast. He thus took no part in the first campaign of the Civil War. But in the autumn he was brought back to the East to command a division, and soon afterwards, as a major-general U.S.V., a corps in the army that was being organized by McClellan. This corps, numbered II., retained its independent existence throughout the war, and under the command of Sumner, Couch, Hancock and Humphreys it had the deserved reputation of being the best in the Union army. Sumner, who was by far the oldest of the generals in the army of the Potomac, led his corps through out the peninsular campaign, was wounded during the Seven Days' Battle, and received the brevet of major-general U.S.A., and was again wounded in the battle of Antietam. When Burnside succeeded to the command of the army of the Potomac he grouped the corps in "grand divisions," and appointed Sumner to command the right grand division. In this capacity the old cavalry soldier took part in the disastrous battle of Fredericksburg, in which the II. corps suffered most severely. Soon afterwards, on Hooker's appointment to command the army, Sumner was relieved at his own request. He died suddenly, on the 21st of March 1869, while on his way to assume supreme command in Missouri.

SUMNER, JOHN BIRD (1780-1828), English archbishop, elder brother of Bishop Charles Sumner, was born at Kenilworth, Warwickshire, and educated at Eton and Cambridge. In 1802 he became a master at Eton, and in the following year he took orders. He was elected a fellow of Eton in 1817, and in 1818 the college presented him to the living of Maple Durham, Oxfordshire. After holding a prebendaryship of Durham for some years, he was consecrated bishop of Chester in 1828. During his episcopate many churches and schools were built in the diocese. His numerous writings were much esteemed, especially by the evangelical party, to which he belonged; the best and again wound in the battle of Antietam. When Burnside succeeded to the command of the army of the Potomac he grouped the corps in "grand divisions," and appointed Sumner to command the right grand division. In this capacity the old cavalry soldier took part in the disastrous battle of Fredericksburg, in which the II. corps suffered most severely. Soon afterwards, on Hooker's appointment to command the army, Sumner was relieved at his own request. He died suddenly, on the 21st of March 1869, while on his way to assume supreme command in Missouri.

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1 George Cornelius Gorham (1787-1855) was refused institution by Bishop Phillpotts because of his Calvinistic views on baptismal regeneration. The court of arches upheld the bishop, but its decision was reversed by the privy council.
SUMPTUARY LAWS

(1) The Opillian law, 215 B.C., provided that no woman should possess more than half an ounce of gold, or wear a dress of different colors on the same day, or take part in a meal on occasions of public religious ceremonies. This law, which had been partly dictated by the financial necessities of the conflict with Hannibal, was repealed twenty years later, against the advice of Cicero. Like the law of 161 B.C., limited the sums to be spent on entertainments; it provided among other things that no flour should be served but a single hen, and that not fattened. (2) The Didian law, 143 B.C., extended to the whole of Italy the provisions of the Punic fleet. In 130 B.C. the decree passed in the Senate permitting the wearing of gold rings by men. But it appears from Tacitus (Ann. i. 5, where a speech is put into his mouth very much in the spirit of Horace's "Quid leges sine moribus vanae proficiunt?"

In modern times the first important sumptuary legislation was: in Italy that of Frederick II; in Aragon that of James I., in 1234; in France that of Philip IV; in England that of Edward II. and Edward III. In 1294 Philip IV. made provisions as to the dress and the table expenditure of the several orders of men in his kingdom. Charles V. of France forbade the use of long-pointed shoes, a fashion against which popes and councils had protested in vain. Under later kings the use of gold and silver embroidery, silk stuffs and fine linen wares was restricted to church officials. The effect of these rules was to stimulate the growth of the British wool industry and to permit the growth of the British clothmaking industry. In England we hear much from the writers of the 14th century of the extravagance of dress at that period. They remark both on the great splendour and conspicuousness of the apparel of the higher orders and on the fantastic and deforming fashions adopted by persons of all ranks. The parliament held at Westminster in 1363 made laws (37 Edw. III. c. 8-14) to restrain this undue expenditure and to regulate the dress of the several classes of the people. These statutes were repealed in the following year, but similar ones were passed again in the reign of Richard II. However, to have had little effect, for in the reign of Richard II. the sums increased upon the account of the cause of war. Another statute was passed in the year 1463 (3 Edw. IV. c. 5) for the regulation of the dress of persons of all ranks. In this it was stated that "the customs of the realm, as well men as women, wear excessive and inordinate apparel to the great displeasure of God, the enriching of strange realms, and the destruction of this realm." An act of 1444 had previously regulated the clothing, when it formed part of the wages, of servants employed in husbandry: a halfling or over was to have an allowance of 5s. a year for his clothing, a hind or prime, 25s. 4s. 5d. a year for clothes, 7s. 10s. 10s. 9d. in sums equivalent respectively to 50s., 40s., and 33s. 4d. of our money (Henry). Already in the reign of Edward II. a proclamation had been issued against the "outrageous and excessive multitude of meats and dishes which the great men of the kingdom had used, and still used, in their castles," as well as "persons of inferior rank imitating their example, beyond what their stations required and their circumstances could afford"; and the rule was laid down that the great men should have but two courses of flesh meat served up to their tables, and on fish days two courses of fish, each course consisting of but two kinds. In 1463 (temp. III.) the ordinances were attempted also to legislate against luxury in living, and in 1563, at the same time when costumes were regulated, it was enacted that the servants of gentlemen, merchants and artificers should have only one meal of fish or flesh in the day, and that their other food should consist of milk, butter and cheese. Similar acts to those above mentioned were passed in Scotland also. In 1433 (temp. James I.), by an act of a parliament which sat at Perth, the manners of living of all orders in Scotland was prescribed, and in particular the use of pies and baked meats, which had been only lately introduced into the country, was forbidden to all under the rank of baron. In 1457 (temp. James II.) an act was passed against "sumptuous clothing." A Scottish sumptuary law of 1621 was the last of the kind in Great Britain.

In Japan sumptuary laws have been passed with a frequency and minuteness of scope such as has no parallel in the history of the western world. At the beginning of the 11th century we find an Imperial edict regulating the size of a house and even imposing restrictions as to the materials of which it is to be built. But it was during the Tokugawa period that sumptuary legislation reached its fullest expression. All classes were subjected to austerities of dress, and to a careful regulation of the kindling of fires, every detail of a man's life was regulated down to the least particular—from the wearing of a beard or the dressing of the hair down to the cost of his wife's hairpins or the price of his child's doll.

A. Ferguson and others have pointed out that "luxury" is a term of relative import and that all luxuries do not deserve to be discouraged. Roscher has called attention to the fact that the nature of a sumptuaries law has changed in the course of time, a change due to a change in the character of the social classes affected. He endeavours to show that there are three periods in the history of luxury—one in which it is coarse and profuse; a second in which it sinizes mainly at comfort and elegance; and a third, propitious to periods of decadence, in which it is purifying and unnatural. The second of these began, in modern times, with the emergence of the Western nations from the medieval period, and in the ancient communities at epochs of similar transition. Roscher holds that the sumptuary legislation which regularly appears at the opening of this stage was then useful as promoting the reformation of habits. He remarks that the contemporary application of the stronger sate's laws resulted perhaps from two influences: firstly, the idea of the private man's right to regulate his own actions against the will of society; and secondly, the idea of the social policy that habits of wasteful expenditure and frequent and wanton changes of fashion should be discouraged. But such action looks more properly to the spiritual than to the temporal power. In ancient, especially Roman, life, when there was a confusion of the two powers in the state system, sumptuary legislation was more natural than in the modern world, in which those powers have been in general reality, though imperfectly, separated. Political economists are practically unanimous in their repudiation of the policy of legislative compulsion in these matters. In a well-known passage Adam Smith protests against the "imperariance and presumption of the minister's mind" in his attempt "to impose upon the private and public expense, being themselves always and without any exception the greatest spendthrifts in the society." Yet he does not seem to have availed from all attempts to influence through taxation the expenditure of the greater part of the people. The modern taxes on carriages, coats of arms, male servants, playing cards, &c., ought perhaps not to be regarded as resting on the principle of sumptuary laws, but only as means of proportioning taxation to the capacity of bearing the burden.

The loci classicus on Roman sumptuary laws are Celsus, Notae atticae, ii. 24, and Macrobius, Saturn. iii. 17. For Great Britain the earliest materials are in the "History of Husbandry and Huntingdon, During the Reign of Henry VII," ed. T. Arnold, 1879; W. Cunningham, Growth of English Industry and

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Commerce; W. J. Ashley, Introduction to English Economic History and Theorizing England in the Fifteenth Century (1888). One of the best extant treatments of the whole subject is that by Roscher, in his essay, _Über den Luxus, republiert in seinen Ansichten der Volkswirtschaft auf dem geschichtlichen Standpunkt_ (J. K. L. 1898).

SUMTER, THOMAS (1736–1832), American soldier, was born in Hanover county, Virginia, on the 14th of July 1736. He served in the Virginia militia during the French and Indian War and was present at Braddock's defeat (1755). Some time after 1762 he removed to South Carolina. He is best known for his service during the War of Independence, but he saw little active service until after the fall of Charleston in May 1780. In July 1780 he became a brigadier-general of state troops. During the remainder of the war he carried on a partisan campaign, and earned the sobriquet of the "Gamcock." He fell in an attack upon Rocky Mount (Chester county) on the 1st of August 1780, but on the 6th defeated 500 Loyalists and regulars at Hanging Rock (Lancaster county), and on the 15th intercepted and defeated a convoy with stores between Charleston and Camden. His own regiment, however, was almost annihilated by Lieut.-Colonel Banastre Tarleton (1754–1833) at Fishing Creek (Chester county) on the 18th. A new force was soon recruited, with which he defeated Major James Wemys at Fishdam (Union county) on the night of the 8th–9th of November, and repulsed Tarleton's attack at Blackstock (Union county) on the 20th, when he was wounded. In January 1781 Congress formally thanked him for his services. He was a member of the state convention which ratified the Federal constitution for South Carolina in 1788, he himself opposing that instrument; of the national House of Representatives in 1789–1793 and again in 1797–1801, and of the United States Senate from 1801 to 1810.

At the time of his death at South Mount, South Carolina, on the 1st of June 1832, he was the last surviving general officer of the War of Independence.


SUMTER, a city and the county-seat of Sumter county, South Carolina, U.S.A., 42° 41' N. lat. by R. E. of S. of Columbia. Pop. (1900) 5673 (3160 negroes); (1910) 8109. Sumter is served by several divisions of the Atlantic Coast line and by the Southern railways. It is the seat of St Joseph's Academy (Roman Catholic) for girls. The region produces tobacco, vegetables and cotton, and there are various manufactories in the city. Sumter was founded in 1800 and was named in honour of General Thomas Sumter; it was first chartered as a city in 1887.

SUMY, a town of Little Russia, in the government of Kharkoff, 112 m. by rail N.W. of the city of Kharkof, founded in 1638. Pop. (1900), 28,519. It is an important centre for the trade of Great Russia with Little Russia—cattle and corn being sent to the north in exchange for manufactured and grocery wares. It has important sugar manufacture, and a technical school.

SUN (O. Eng. sunne, Ger. sonne, Fr. soleil, Lat. sol, Gr. ἡλίος, from which comes heliot—in various English compounds), the name of the central body of the solar system, the luminous orb from which the earth receives light and heat; (see SUNSHINE), hence by analogy other heavenly bodies which form the centre of systems of called suns.

To understand the phenomena of the sun, we should reproducible upon the earth; but this is clearly impossible since they take place at temperatures which volatilize all known substances. Hence our only guides are such general laws of mechanics and physics as we can hardly believe any circumstances will falsify. But it must be remembered that these require extrapolation from experience sometimes sufficiently remote, and it is possible they may lead to statements that are obscure, if not contradictory. The body of the sun must consist of uncombined gases; at the surface the temperature is some 200° C. above the boiling point of carbon, and is a little below what the hypothesis of the derivation of the sun's light and heat requires to exceed the critical point at which increase of pressure can produce the liquid state in any substance. But as the mean density exceeds that of water, and probably falls but little from the centre to the surface, these gases are gases only in the sense that if the pressure of neighbouring and outward parts gravitating towards the centre were relaxed, they would expand explosively, as air is happening in the eruptive phenomena. They have lost completely the gaseous characteristic of producing a spectrum, and radiate like incandescent solids. The surface region which yields a continuous spectrum is called the photosphere; it possesses optically a sharp boundary, which is generally a perfect sphere, but shows occasionally at the rim slight depressions or more rarely elevations. Enclosing the photosphere is a truly gaseous envelope which is called the chromosphere, and which shows a spectrum of bright lines when we can isolate its emission from that of the photosphere. This envelope is also sharply defined, but its normal appearance is compared to the sputters which blazes of grass show on the skyline of a hill, and it is disturbed by the outbursts, called prominences, of which details are given below. Outside this again is an envelope of matter of enormous extent and extreme tenuity, whether gaseous or partly minute liquid or solid drops, which is called the corona. It has no sharp boundary, its brightness diminishes rapidly as we recede from the limb, and such structure as it shows consists of long streaks or filaments extending outwards from the limb in broad curved sweeps. Finally there is the envelope of still vaster extent and of unknown constitution which gives the solisidal light (p.e.); its greatest extent is along the ecliptic, but it can also be certainly traced for 35° in a perpendicular direction. The lower gaseous cloaks absorb a large part of the light admitted by the photosphere, and especially at the limb and for the more refrangible rays the loss of intensity is very marked.

In the instant when a sharp image of the photosphere is seen or photographed, it shows a granulated appearance like white flakes stirred freely upon a dark ground. The figs. 1, 2, 3, 4 (plate) show enlargements from photographs by Hansky at Pulkowa (June 25, 1903); they are separated by intervals of 25 to 80 sec. The spots show with more or less completeness the granules in many of the granules, or more properly, clouds represented. Thus they exhibit at once general appearance and its changes. The diameters range from 400 m. or less up to 1200 m., and the speeds relative to the spot range up to 2 or 3 m. per second. M. Hansky believes these motions may be the consequences of matter rising from below and thrusting the surface groups aside. Usually the changes are such that it is impossible even to recognize the formations in successive photographs. Besides granulations the sun's disk shows, as a rule, one or more spots or groups of spots. Each spot shows with more or less completeness a ring-shaped penumbra enclosing a darker umbra; the umbra, which looks black beside the photosphere, is actually about as brilliant as limelight. In the neighbourhood surrounding the penumbra the granules appear to be packed more closely, forming brilliant patches called faculae. In the shape of a spot there is neither rule nor permanence, though those that are nearly circular seem to resist change better than the others. They arise from combinations of smaller spots, or from nothing, in a short period, say a day. They are never wholly quiescent. Bridges, more brilliant than the rest of the photosphere, form across them, and they may divide into two parts which separate from one another with great velocity. The largest spots are easily seen by the naked eye, if the brilliancy of the disk is veiled; the umbra may be many—ten or more—diameters of the earth in breadth. The length of their life is difficult to assign, because there is some tendency for a new group to arise where an old one has disappeared; but one is recorded which appeared in the same place for eighteen months; the average is perhaps two months. They are carried across the disk by the sun's rotation, partaking in the equatorial acceleration; they also show marked displacements of their own, whether with, or relative to, the neighbours. In the course of their life they usually outrun the average daily rotation appropriate to their latitude. Spots are rarely found on the equator, or
more than 35° N. or S. of it, and at 45° are practically unknown. Their occurrence within these zones follows statistically a uniform law (see Aurora). Other information about the spots is given below, in connexion with their spectra. It may be said that nothing definite has been established as to what they are. The statement known as A. Wilson's theory (1774), that they are hollows in the photosphere, long supposed to be proved by perspective effects as the spot approached the limb, is discredited by F. Howlett's careful drawings, which, however, do not establish the contrary. A conclusion it is necessary that the spot should be quiescent, show a well-developed and fairly symmetrical penumbra, and be observed near the limb and also near the centre, and these conditions are satisfied in so few cases as to withdraw all statistical force from the conclusion. Figs. 5, 6, 7, 8 (plate) are reproductions of the Greenwich photographs of the sun from the 30th of January to the 8th of February 1905. The first, taken alone, might seem to bear out Wilson's theory, but the others show that the penumbra is really very unsymmetrical and much broader on the side towards the limb, apart from anything which perspective may have to say. The photosphere does not rotate in one piece, lower latitudes outrunning higher. This was discovered by R. C. Carrington from observations of the spots, extending from 1833 to 1861, from which he determined also the position of the sun's axis. But conclusions from the spots are full of anomalies. E. W. Maunder and Mrs Maunder found that different spots in the same zone differ more than do the means for different zones, while a long-lived spot settles down to give more consistent results than are furnished by spots of one apparition. In the span of two complete sun-spot periods no evidence was found of periodic or other change with lapse of time. The problem still awaits complete discussion. The irregularities incidental to use of the spots are escaped by comparing the relative Doppler displacements of the same spectral line as given by the receding and advancing limbs of the sun. The observation is a delicate one, and was first successfully handled by N. C. Dunér in 1890. But his determinations, repeated recently (Adia specul. IV. vol. I., 1907) as well as those of J. Halm at Edinburgh (Adia Nach. vol. 173, 1907), are superseded by a photographic treatment of the problem by W. S. Adams (Astrophys. Journ., xxvi., 1907).

The diagram (fig. 9) shows Adams's value for the angular velocity \( \xi \) for different latitudes \( \phi \), the dots representing the actual observations. Fig. 10 shows the consequent distortion of a set of meridians after one revolution (at lat. 30°). An important feature added to the discussion by Adams is the different behaviour of spectral lines which are believed to originate at different levels. The data given above refer to the mean reversing layer. Lines of lanthanum and carbon which are believed to belong to a low level showed systematically smaller angular velocity than the average. This promises to be a fertile field for future inquiry. Pending more conclusive evidence from the spectroscope, the interpretation of the peculiar surface rotation of the sun appears to be that the central parts of the body are rotating faster than those outside them; for if such were the case the observed phenomenon would arise. For consider first a frictionless fluid. The equations of surfaces of equal angular motion would be of the form \( r = R (1 - \epsilon \cos \theta) \), where \( \epsilon \) is proportional to the square of the angular motion, supposed to be impressed to the pole from the equator along any meridian, the angular velocity would continually increase, at a rate which was greatest in the middle latitudes. This is exactly what the observations show. Now if the sun's state be supposed established in a frictionless fluid, the consideration of internal friction would simply extend the characteristics found at any spot to the neighbourhood, and therefore if the boundary were a sphere and so for a frictionless fluid an exception, it would cease to be an exception when we allow for viscosity. But this theory gives no clue to the results relating to hydrogen, which belongs to a high level, and which Adams has shown to move with an angular velocity decidedly greater than the equatorial angular velocity, and so to show no sign of falling off towards the poles.

It is useful to form a conception of the mechanical state within the sun's body. Its temperature must be dominated directly or indirectly by the surface radiation, and since the mechanical matter is gaseous and so open to redistribution, the state in the outer parts is true of density and pressure. It is true that within the body radiations must be stifled within a short distance of their source; none the less, they will determine a temperature gradient, falling from the centre to the borders, though for the most part falling very slowly, and we may ask what relative temperatures in different parts would maintain themselves if once established. Stefan's law of radiation according to the fourth power of the temperature is too difficult to pursue, but if we are content with cognate results we can follow them out mathematically in a hypothetical law of the first power. We then find that the density would increase as we go outwards, at first slowly, but finally with extreme rapidity, the last tenth of the radii comprising half the mass. The reason for such a density, if the body was practically nil, no matter how hot the centre was. Of course such a state would be statically unstable. It would never get established because currents would arise to exchange the positions of the hotter, less dense, inner parts and the cooler, more dense, outer ones. By this interchange the inner parts would be opened out and the total radiation raised. Since the only cause for these convection currents is the stational instability produced by radiation, and the rapid stifling of radiations within the body produces there a temperature gradient falling very slowly, they would be for the most part extremely slight. Only near the surface would they become violent, and only there would there be a rapid fall of temperature and density. Through the main body these would remain nearly constant. Indeed it seems that, in the final distribution of density throughout the part which is not subject to violent convection currents, it must increase slightly from the centre outwards, since the currents would cease altogether as soon as a uniform state was restored. In the outer strata a different state must prevail. Rapidly falling temperature must (and visibly does) produce furious motions which wholly outrun mere restoration of statical balance. Portions change places suddenly and so continually, that we may take it, where any average is reached, the energy is so distributed that there is neither gain nor loss when such a change occurs. This is the law of convective equilibrium. But in the sun's atmosphere gravitation alone is a misleading guide. Convective equilibrium, which depends upon it, gives far too steep a temperature gradient, for it yields a temperature of 6000° only 200 m. within the free surface, whereas the chromosphere is of an average thickness of 5000 m., and attains that temperature only at its base. Probably the factor which thus diminishes the effective

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\begin{align*}
\text{FIG. 9.} \\
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\text{FIG. 10.} \\
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ENLarged Photographs of the Solar Surface. Taken by M. A. Hansky at the Observatory of Pulkowa (1905, June 25), at intervals from 25s. to 80s.
PHOTOGRAPHS OF THE SUN, TAKEN AT THE ROYAL OBSERVATORY, GREENWICH.

The pressure of radiation.

The radiations from the sun must be considered in two parts, corresponding respectively to the continuous spectrum and the line spectrum. The latter is considered below; it is indicative of the chemical elements from which the lines can proceed, and its state at the time of emission; the former is indicative only of the rate of loss of energy from the sun by radiation. The result of many and remarkable experiments in physical theory and experiment, known as the theory of the black body, or as black radiation. The “black body” is an ideal body with surface so constructed as to reflect no part of any radiations that fall upon it; in the case of such a body Kirchhoff and Balfour Stewart showed that unless energy were to be lost the rate of emission and absorption must be in fixed ratio for each specific wave-length.

The name has no reference to the appearance of the body to the eye; when emitting energy, its radiation will be of all wave-lengths, and if intense enough will appeal to the eye as luminous between about wave-lengths 7600 and 4000 tenth-metres; this intensity is a question of temperature, and as it is exquisitely inappropriate to speak of the bulk of the solar radiation as black, the term will speak instead of amorphous radiations from an ideal radiator. The ideal radiator is realized within any closed cavity, the walls of which are maintained at a definite temperature. The space filled with radiations corresponds to the radiating temperature, and these attain a certain equilibrium which permits the energy of radiation to be spoken of as a whole, as a scalar quantity, without express reference to the propagation or interference of the waves of which it is composed. It is then found both by experiment and by thermo-dynamic theory that in these amorphous radiations there is for each temperature a definite distribution of the energy over the spectrum according to a law very exactly represented by the equation in wave-lengths, length, and as to the form of the function ϕ, Planck has shown (Sitzungsber. Berlin Akad. S. 441) that an intelligible theory can be given which leads to the form 

\[ \phi(\nu) = c_1 \exp(c_2/\nu) - 1, \]

a form which agrees in a satisfactory way with all the experiments. Fig. 11 shows the resulting distribution of energy. The enclosed area for each temperature represents the total emission of energy for that temperature, the abscissae are the wave-lengths, and the ordinates the corresponding intensities of emission for that wave-length. It will be seen that the maximum ordinates lie upon the curve \( \lambda = \text{constant} \) dotted in the figure, and so, as the measure of the temperature of the radiator, the wave-length of most intense radiation shifts from the infra-red toward the continuous spectrum. When we speak of the sun’s radiation as a whole, it is assumed that it is of the character of the radiations from an ideal radiator at an appropriate temperature.

The first adequate determination of the character as well as amount of solar radiation was made by S. P. Langley in 1893 at Mount Whitney in California (4,000 ft.), with the bolometer, an exceedingly sensitive instrument which he invented, and which enabled him to feel his way thermally over the whole spectrum, noting all the chief Fraunhofer lines and bands, which were shown by sharp serrations, or more prolonged depressions of the curve which gave the emissions, and discovering the lines and bands of the invisible ultra-red portion. The bolograph thus obtained must be cleared of the absorption of the earth’s atmosphere, and that of the transmitting apparatus—a spectroscope and siderostat. The first in itself requires an elaborate study. The first essential is an elevated observatory; the next is a long series of bolographs taken at different times of the year and of the day, to examine the effect of interposing different thicknesses of air and its variation in transparency (chiefly due to water vapour). It is found that atmospheric absorption is generally larger in summer than in winter, a difference of 20% being found between March and August; morning hours show a rapid and often irregular increase of transparency, culminating shortly after noon, after which the diminution is slow and comparatively regular.

The resulting allowances and conclusion are illustrated in fig. 12, taken from an article by Langley in the Astrophysical Journal (1903), xvii. 2. The integrated emission of energy is given by the area of the (asterism) square, or, in other words, if one bolograph is that the “solar constant” is 2.54 calories. The meaning of this statement is that, away from the earth’s atmosphere, which wastes about one-half what is received, a square

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(From Astrophysical Journal, xvii, by permission of the University of Chicago Press.)

**Fig. 12.**

centimetre, exposed perpendicularly to the sun’s rays, would receive sufficient energy per minute to raise 2.54 grams of water 1°C. C. Langley’s general determination of the constant was greater than this—3.0 to 3.5 calories; more recently C. G. Abbot at Mount Wilson, with instruments and methods in which Langley’s experience has been translated into greatly, having proved that one of Langley’s corrections was erroneously applied. The results vary between 1.89 and 2.22, and the variation appears to be solar, not terrestrial. The temperature of the sun’s surface, the rate of receiving energy at the rate of 1.47 kilowatts per square metre, or 1:70 horse-power per square yard. The corresponding intensity at the sun’s surface is 3.46×10^6 as great, or 6.79×10^6 kilowatts per square metre, or 600 horse-power per square yard! Enough to melt a thickness of 13.5 metres (=39 ft.) of ice, or to vaporize 1.81 metres (=5.92 ft.) of water per minute.

If we assume that the bolograph of solar energy is simply a graph of amorphous radiation from an ideal radiator, exactly as though it be, the constants of Planck’s formula determined terrestrially to apply to it, the hyperbola of maximum intensity is \( I = 2.941\times10^9 \), and as the sun’s maximum intensity occurs for about \( \lambda = 4000 \), we find the absolute temperature to be 5900° abs. If we calculate from the total energy emitted, and not from the position of maximum intensity, the same result is obtained within a few degrees. By way of temperature of the sun’s surface, is a convention, which sets aside some material factors. We may ask first whether the matter of which the surface is composed is such as to give an ideal radiator; it is impossible to answer this, for terrestrial experience is admitted to admit a departure from terrestrial exception, the estimated temperature is diminished only some 10%. A second question relates to the boundaries. The theory refers to radiation homogeneous at all points within a single closed boundary, maintained at uniform temperature; in the actual case we have a double boundary, one the sun’s surface, and the other infinitely remote, or, say, non-existent, and at zero temperature; not terrestrial. But the radiation of the sun at 2.5 microns is therefore inversely as the squares of the distance from the sun. Though there is no experiment behind this assumption it can hardly lead to error.

The question is more difficult. The temperature gradient at the confines of the photosphere must certainly ascend sharply at first. When we say the sun’s temperature is 6000°, of what level are we speaking? The fact is that radiation is not a superficial phenomenon. The solar spectrum is not a uniform glow, but a mosaic, so to speak, of a great many different phenomena. The temperature of the photosphere is so high that it is uncertain how it is maintained. The solar atmosphere is continually circulating, and it is not certain that the solar spectrum is not a more or less diffuse atmosphere. The help of theory and observation the part played by this atmosphere is tolerably precise. Its absorptive effects upon the radiations of the inner photosphere can be readily traced progressively from the centre to the rim of the sun’s disk, and it has been measured as a whole by Langley, W. E. Wilson and others, and for each separate wave-length by F. W. Very (Astrophys. Journ., vol. xvii). The entries in the table on following page express the reduction of intensity for different wave-lengths \( \lambda \), when the slit is set at a horizontal radius from the centre of the disk.

Building upon these results A. Schuster has shown (Astrophys. Journ., vol. xvi) that, if for the sake of argument the solar atmosphere be taken as homogeneous in temperature and quality, forming a sheet which itself radiates as a whole, the radiation of an unshielded ideal radiator at 6000° would give is represented well, both in sum and in the distribution of intensity with respect to wave-length, by another ideal radiator—now the actual body of
The energy which the sun pours out into space is, so far as we know, and except for the minute fraction intercepted by the disks of the planets, absolutely lost for the purposes of further mechanical effect. The amount is such that, supposing the average specific heat of the sun's body as high as that of iron, a general temperature of 2ø to 2.5ø C. In the lapse of empty 200 years ago, the sun's heat would have been greater than now by the factor 2ø to 3ø. The calculations of the solar temperature. It seems possible that n is not a large number, and if we take \( x \) equal, say, to 200, we come to the most recent estimate—the astronomical—of the date of the earth's glacial epoch, when the sun's radiation was certainly very much more intense than it is now, while this factor would differ materially from unity. Hence loss does not go on without regeneration, and we are apparently at a stage when there is an approximate balance between them. It is in fact an impossibility that loss should go on without regeneration, for if any part of the sun's body loses heat, it will be unable to support the pressure of neighbouring parts upon it; it will therefore be compressed, in a general sense towards the sun's centre, the velocities of its molecules will rise, and its temperature will again tend upwards. In consequence of the radiation of heat the whole body will be more condensed than before, but whether it is hotter or colder than before is not determined by the present method. The temperature is less than enough to restore an exact balance. If we are dealing with comparatively recent periods there is no evidence of progressive change, but if we go to remote epochs and suppose the sun to have once been diffused in a nebulous state, it is clear that its shrinkage, in spite of radiation, has left it hotter, so that the shrinkage has outrun what would suffice to maintain its radiation. It is equally clear that there is a point beyond which contraction cannot go, and, thereafter, if not before, the body will begin to grow colder. There is thus a turning-point in the life of every star. The movement towards a lower temperature will be offset by radiation until the process of radiation sets up, like other motions, overruns the contraction point, only however by a minute amount; the accumulated excesses from all past time now stored in the sun would maintain its radiation at its present rate for 2\( x \)3000 years, that is, for a few thousand years only.

There is a superior limit to the quantity of energy which can be derived from contraction. If we suppose the sun's mass once existed in a state of extreme diffusion, the energy yielded by collecting it into its present compact would not suffice to maintain its present rate of radiation for more than 17,000,000 years in the past; nor if its mean density were ultimately raised to eight times its present amount, for more than the same period in the future. This supposes the present density nearly uniform; if it is not uniform, any amount added to the former period is subtracted from the latter. A contraction of 0.5 or 0.6 of the sun's radius would maintain the present emission for 3500 years. Such a rate of change would be quite insensible, and we can affirm that for recent times there is no reason to look for any other factor than contraction; but for remote periods we cannot pass a strict judgment, for we have nothing quantitatively of the radiations from a nebulous body; and it is quite possible that the loss of radiant energy in this early stage was very small; but it is at least certain that in any previous inference that 17,000,000 years ago the earth itself was of its present dimensions, a comparatively old body with sea and living creatures upon it, and it is impossible to believe that the sun's radiations were wholly different; and if, but, if not, the same radiations have been maintained from some other source than contraction.

The fall of meteoric matter into the sun must be a certain source of energy; if considerable, this external supply would retard the sun's contraction and so increase the radiated amount. To bring about a reconciliation with geological theory, very nearly the whole amount must be thus supplied. It is easy to calculate that this would require a body 6000 miles in diameter to fall in on the line of density 2, over its whole surface in the course of the year. So far there is nothing impossible in the theory. But there are two fatal objections. The sun is a small target for a meteoric cloud of the probable size of Jupiter, and for an infinity of time before it reached its mark, a much greater amount would circulate round the sun in parabolas, and there is no evidence of it where it would often strike itself. But as the objects are out of the question, because no combinations of different elements are known to exist at a temperature 600ø.

A second objection is that it fails in its purpose, because 20,000,000 years ago it would give a sun quite as much changed as the contraction theory gave. If we examine chemical sources for maintenance of the temperature, complications are introduced, but the question is out of the question, because no combinations of different elements are known to exist at a total temperature of 600ø.

A source which seems plausible, perhaps the easiest to test, is the infrared energy of the structure of the elements' atomic rotation. It is no longer figured as indivisible, it is made up of more or less complex, and more or less permanent, systems in internal circulation. Now under the law of attraction according to the inverse square of the distance, or any other inverse power beyond the first, the energy of even a single pair of material points is unlimited, if their possible closeness of approach to one another is unlimited. If the energy of the sun were to change, it would change on the same principles, and no phenomena of radio-activity leave doubt about this, there is here an incalculable source of heat which takes the cogency out of any other objection. The sun's radiation. An equivalent statement of the same conclusion may be put thus: supposing a gaseous nebula is destined to condense into a sun, the elementary matter of which it is composed will develop in the course of time enough known terrestrial and solar elements, partaking with energy as it does so.

The continuous spectrum leads to no inference, except that of the temperature of the central globe; but the multitude of dark lines which it is crossed reveal the elements in the sun, in the truly gaseous clots which enclose it. A table of these lines is a physical document as exact as it is blank. The visual portion extends from 3700 to 7200 tenth-metres; the ultra-violet begins about 2970, beyond which point our atmosphere is almost perfectly opaque to it; the infra-red can be traced for more than ten times the visual length, but the temperature which indicates it is reduced to below 9870. The ultra-violet and the visual portions are recorded photographically; Rowland's classical work shows some 5700 lines in the former, and 14,200 in the latter, on a graduated scale of intensities from 1000 to 0, or 0000, for the faintest lines; between a quarter and a third of these lines have been identified, fully 2000 belonging to iron, and several hundred to water vapour and other atmospheric absorption. The infra-red requires special appliances; it has been examined visually by the help of phosphorescent plates (Beccquerel), and with special photographic plates (Abney); but the most efficient way is to use the bolometer or pyrometer; by this means some 500 or 600 lines have been mapped.

The first problem of the spectrum is to identify the effects of atmospheric absorption, especially oxygen, carbonic acid and water vapour; this is done by comparing the line of the sun at great and small zenith-distances, or by reducing the atmospheric effect by observing from a great elevation, as did P. J. T. C. Tanan from the summit of Mont Blanc, but the only unquestionable test is to find those lines which are not touched by Doppler effect when the reeding and advancing limbs of the sun are compared (Coru); by this method H. F. Newall has verified the presence of cyanogen in the photosphere, and it had previously served to disprove the solar origin of certain oxygen lines. In fact, doubt long surrounded the presence of oxygen in the sun, and was not set at rest until K. D. T. Rune and P. C. Pechers in 1896 identified an unmistakable oxygen triplet in the infra-red region of the spectrum, essentially in the vacuum tube, where the spectrum is very different from that of atmospheric absorptions. The absence of lines of oxygen in the spectrum of any element from the solar spectrum is no proof that the element is absent from the sun; apart from the possibility that the high temperature and other circumstances may show it transformed into some unknown mode, which is perhaps the explanation of the absence of nickel, the element of high atomic weight which we should expect it to be found only in the lowest strata of the sun's atmosphere, where its temperature is high enough to equalize it to the ground glass, and so an absorption line which it showed would be weak. This is particularly the case with lead and silver, and probably with mercury also. In Rowland's table lines from the arc-spectra of the following are identified. The order in which the lines are given is that of the arc-spectra, the lines of identified elements. Excepting strontium, those which are low upon the list are represented also by lines of small intensity. The chromosphere adds the three last of the list. The strongest lines, nickel, in the order named.
The spectrum taken near the limb of the sun shows increased general absorption, and also definite peculiarities of great interest in connexion with the spectra of the spots, which it will be convenient to describe first.

When the slit of the spectroscope is set across a spot, it shows, as may be expected, a general reduction of brightness as we pass from the photosphere to the umbra; and a still greater one as we pass to the umbral. This is not a uniform shade over the whole length of the spectrum, but shows changes in bands or flutings of greater or less darkness, which in places and at intervals have been resolved by Young, Dunér and other unques-
tionable observers into hosts of dark lines. Besides this the spectrum shows very many differences from the mean spectrum of the disk, the interpretation of which is at present far from clear. Generally speaking, the same absorption lines are present, but with altitudes of great heights, different from those of the disk; some of lines of certain elements are always seen fainter or thinner than on the photosphere, or even wholly obliterated; others sometimes show the same features, but not always; other lines of the same elements, perhaps not present at all in the disk, are now to be observed. Some of these differences in element of course are visible when the spot is absent, and sometimes such a bright line will correspond to a dark line on the photosphere; most generally the lines are intensified, general absorption is increased, and the individual lines strengthened, sometimes in both together, sometimes in one at the expense of the other; certain lines not seen in the photosphere show only across the umbra, others everywhere and of varying intensity. When the spectroscope was first introduced, it has been found G. E. Hale and W. S. Adams make its direction downward; but round the rim and on bridges the characteristic distortions due to the prominences are often observed. There appears to be some connection between prominences and the forms, prominences are sometimes found above the spots, and W. M. Mitchell records an eruptive prominence followed next day in the same place by the appearance of a small spot. It does not appear that the spectral lines follow in any way the sun-spot cycle. The radiation from a spot changes little as it approaches the sun’s limb; in fact Hale and Adams find that the absorption from the limb itself differs from that of the disk. The effect of the disk is an additional one that from a spot, the same lines being strengthened or weakened in exactly the same way, though in much less degree, with, however, one material exception: if a line is winged in the photosphere the wings are much less in the spot; and as the spot fills up the wings may be entirely obliterated. If the spot is separated from that of the chromosphere it appears that the lines of most frequent occurrence in the latter are those least affected in the spot, and the high level chromospheric lines not at all; the natural interpretation is that the spot is below the chromosphere. As to whether the spots are regions of higher or lower temperature than the photosphere, the best qualified judges are reserved or discouraged, but recent evidence seems to point very definitely to a lower temperature. Hale and Adams have shown that the spectrum contains, besides a strong line spectrum of titanium, a faint banded spectrum which is that of titanium oxide, and the at the same time it is clear that this line has been identified by A. L. Fowler as manganese hydride. The band spectrum, which corresponds to the compound or combination of the two elements, certainly belongs to a lower temperature than the line spectrum of titanium. These vapours of temperature low enough to give the banded spectra of this refractory metal, while only line spectra of sodium, iron and other elements at some moderate temperatures are found (see also Spectrohelioiaphy).

The chromosphere, which surrounds the photosphere, is a cloak of gases of an average depth of 5000 m., in a state of luminescence less intense than that of the photosphere. From the chromosphere the photosphere is viewed through it an absorption spectrum is shown, but when it is viewed separately a bright line spectrum appears. Most of the metallic vapours that produce absorption lines when added to the photosphere. The spectrum was made except during eclipses, when a flash spectrum of bright lines shines out for, say, five seconds after the continuous spectrum has disappeared, and again before it reappears (see Eclipse). F. W. Dyson has measured some eight hundreds lines in the lower chromosphere and identified them with emission spectra of the following elements: hydrogen, helium, carbon, with the cyanogen band, sodium, magnesium, aluminium, silicon, calcium, scandium, titanium, vanadium, chromium, manganese, iron, zinc, strontium, yttrium, cerium, lutecium, erbium, ytterbium, lead, europium, besides a few doubtful identifications; it is a curious fact that the agreement is with the spark spectra of these elements, while the photosphere shows exclusively or more definitely the arcs lines which were associated with greater temperature. In the higher chromosphere the following were recognized: helium and parahelium, hydrogen, strontium, calcium, indium, aluminium, magnesium, barium, yttrium.

In the higher chromosphere on occasions metallic gases are carried up to such a level that without an eclipse a bright line spectrum of many elements may be seen, but it is always possible to see those originating near the photosphere. The great extent of these lines makes it so as to weaken still further the continuous spectrum from the photosphere (now a mere reflection) the actual forms of the gaseous elements are revealed plainly in these bands. In the visual spectrum there are four hydrogen lines and one helium line in which the actual shapes may be examined. The features seen differ according to the line used, as the circumstances prevailing at different levels of the chromosphere call for one line with greater intensity. The helium formations do not reach the sun’s limb, and it is another puzzling detail that the spectrum of the disk shows no absorption line of anything like an intensity to correspond with the emission line of helium in the chromosphere. The prominences are of two kinds, quiescent and eruptive. Some of the former are to be seen at the limb on most occasions; they may hang for days or weeks in small groups; those which are left to the observer to classify are perhaps 20,000 m., and show the spectral lines of hydrogen and helium. Sometimes they float above the surface, sometimes they are connected with it by stems or branches, and they show delicate thin but continuous lines. The bright areas, generally focused in circular spots, are sometimes at the surface, sometimes, when they descend, in the form of elongated columns some 100 m. high. M. Mitchell watched one rise in 250 m. a second to the height of 70,000 m., and in five minutes after it had faded away and the region was quiet. This is remarkable for the velocity, as 70,000 m. in 250 m. represents 280,000 m. per second, a figure about six times the velocity of sound. These records which are not common, and are the only ones which are known, are the only ones which are known, must be examined scrupulously. We have seen above numerous applications of the Doppler effect. Two other causes of displacement—call for mention in their bear on the solar spectrum—pressure and anomalous dispersion. The pressure which produces a continuous spectrum in gases at a temperature of 6000° must be very great. Recent experiments on arc spectra at pressures up to 100 atmospheres by W. J. Humphreys and by W. H. Duffield show several suggestive peculiarities, though their bearing on solar phenomena is not yet determined. The lines are broadened (as was already known), the general intensity is much weaker. They are weakened and some strengthened, nor is the amount of broadening the same for all lines, nor is it always symmetrical, being sometimes greater on the red side; but besides the effect of pressure, it is probable that different lines with different differences again behave differently, and they may be arranged somewhat roughly in a few groups according to their behaviour; reversals are also effected, and correspond with the most intense part of the emission line. For example, in the iron three groups about wave-length 4500 are found by Duffield to be displaced respectively 0-17, 0-34, 0-17 tenth-metres, at 100 atmospheres. This shift, towards the red J. Larmor suggests is due to relaxation of the spring of the surrounding ether by the crowding of the molecules; a shift of 0-17 tenth-metres would, if interpreted by Doppler’s principle, have been caused by a relative motion of 250,000 m. per second. It is possible that these results may give a simple key to some puzzling anomalies, and on the other hand, they may throw a measure of uncertainty over absolute determination. The line-of-sight anomalons of anomalous dispersion are varied and interesting, and have recently had much attention given to them. W. H. Julius holds that this sole fact holds of 0-60 of the intensity is the intensity of some other line, including prominences, spots, faculae and fociuli, and even the eleven-year period. Though few follow him so far, an explanation of the principle will make it clear that there are numerous cases in which this is the case. Not all lines are removed from the spectrum. Theoretically anomalous dispersion is inseparable from absorption. When a system vibrating in a free period of its own encounters, say through the medium of an enveloping cloud, another system of vibrations, it is evident that two vibrations at right angles, the amplitude of the second vibration, the amplitude of the second vibration is incomparable, except when the periods approach equality. In such a case the two systems must be regarded as a single more complex one, and the absorbed becomes large, though remaining always finite, and the transmitted undergoes a remarkable change in
Apart then from absorption there will be a discontinuous change in brightness in the apparent disk at that value of the angular radius $d$ which corresponds to tangential emission from the upper limb of the sun. It is of course obvious that it is not possible to say whether such a region is an actuality in the sun, on the earth it is an exception and transient, but the greater the dimensions of the body the more probable is its occurrence. The theory can be applied to test certain facts cast by the moon, and to explain its different tints and colour. The greater $\mu$ is, the greater would be the value of $d$, the apparent angular radius, corresponding to horizontal emission from the upper limb, or such a region as the moon might reveal in its appearance.

Hence if the sun's diameter were measured through differently coloured screens, the violet disk must appear greater than the red. Now measures made by Auwers with the Cape heliometer showed the sun's diameter, at distance 1.8, to vary, and so it is possible that the rays reach us after issuing from a level where $\mu$ is sensibly different from unity. Presumably, then, the inner emissions are absorbed and those which reach us start from very remote parts of the sun's surface. The Sun's Distance.

The Sun's Diameter.

The Sun's Diameter.

The Sun's Diameter.
heterogeneous, and that in places where it would hardly be expected. The result is nearly the same as found at Greenwich alone, 8:806° ± 0·0026°, or a mean distance of 92,830,000 m. = 1·493X10¹⁴ cm. with an error of about 1:3 cm.

The greater distance enters into other relations, three of which permit of its determination, viz. the equation of light, the constant of aberration, and the parallactic inequality of the moon; the value of the parallax is found in the manner indicated the relations of the two first, but as this is better known than the sun's parallax, no disadvantage results. The equation of light is the time taken by light to traverse the sun's mean distance; it is found by the observed retardation or advancement of the eclipses of Jupiter's satellites according as Jupiter is approaching opposition or conjunction with a sun; a recent analysis shows that its value is 496-6", which lead to an equation of light of 9927-0", which, according to E. W. Brown's lunar theory would imply a parallax 8:778°.

The best discussion of the sun's apparent diameter has been made by G. F. J. Auwers, in connexion with his reduction of Stephenson's observations, and the result is 30·260" ± 0·004", which, according to Brown's lunar theory would imply a parallax 8:787°.

The Sun's Dimensions. 1874 and 1882. It was found that personality played an important part; the average effect might be 1", but frequently it reached 3", 4", 5", and even 6", with or without inconsistency, nor was any fixed for the same observer. Some 15,000 observations, from 1851 to 1883, taken by one hundred observers at Greenwich, Washington, Oxford and Neuchâtel, cleared up the question of persistence, and it was shown that could with probability be called progressive or periodic, particularly there was no sign of adhesion to the sun-spot period. Better determinations of the actual value came from the heliometer, and the mean of the observations of 1874 and 1875 of the solar diameter exceeded the equatorial by 0·038" ± 0·023".

The conclusion is that the photosphere is very sharply defined and shows no definite departure from a truly spherical shape. Using the observations of 1880, the resulting diameter of the sun is 664,000 m. = 1·390X10¹⁴ cm.

If we regard the sun as one of the stars, the first four questions we should seek to answer are its distance from its neighbours, proper motion, magnitude and spectral type. In some respects the systematic prosecution of these inquiries has only begun, and properly considered they involve vast resources of observation which will be of great value for the whole class of problems. It is not too far to treat them at any length, but it may be convenient to summarize some of the results. The sun's nearest neighbour is a Centauri, which is separated from it by 270,000 times the earth's distance from the sun. The sun would be within a year's journey of it. It is fairly certain that not more than six stars lie within twice this distance. No certain guide has been found to tell which stars are nearest to us; both brightness and large proper motion are indications of nearness, but proximity, are apparently without systematic average relation to parallax.

The sun's proper motion among the stars has been sought in the past as the assumption that the universe of stars showed as a whole no definite displacement of its parts, and, on this assumption, different methods of reduction which attributed apparent relative displacement of parts to real relative displacement of the sun agreed fairly well in concluding that the apex of the sun's way was directed to a point in right ascension 275°, declination +3° (F. W. Dyson and W. G. Thackeray), that is to say, not far from the star Vega in the constellation Lyra, and was moving thither at a rate of two and a half years. But recent observations by J. C. J. Adams and A. S. Eddington, confirmed by Dyson, show that there is better ground for believing that the universe is composed mainly of two streams of stars, one moving in the direction of Vega and the other in the opposite direction. Vet they are the motions of the same sense and magnitude on the average, than that the relative motions of the stars with one another are fortuitous (see STAR). This removes completely the ground upon which the discussion of the sun's Proper Motion has hitherto been calculated, and leaves the question wholly without an answer.

A star is said to rise one unit in magnitude when the logarithm of its brightness diminishes by 0·4. Taking as a star of magnitude 1 the star whose light is exactly one unit of the brightness of the sun, several estimates have been made which agree well together; whether direct use is made of known parallaxes, or comparison is made with the brightness of the sun, the result is the same. The brightness of the sun, therefore it may be assumed there is the same relation between magnitude and brilliancy (Gore), the result is found that the sun's magnitude is -26·5, or the sun is 10⁴ times as brilliant as a first magnitude star; it would follow that the sun viewed from a Centauri would appear as of magnitude 0·7, and from a star of average distance which has a parallax certainly less than 0·1", it would be at least fainter than the fifth magnitude, or, say, upon the boundary of the range of naked-eye visibility with increased prominence. These are the white stars, and the most prominent examples are Sirius, Vega and Procyon. It is commonly though not universally held that the difference between the white and yellow stars arises from their stages of development and that the former represent the earlier stage. This again is disputed, and there is indeed as yet slight material for a decisive statement.

Summary of Numerical Data.

Parallax: 8·806° ± 0·003° (Time taken by light to traverse this distance: 496-6β) 
Linear, 109X6 earth's equatorial diameter = 664,000 meters. 
Mass: 332,000 X mass of the earth. 
Mean density: 286X6 mean density of earth = 1.415. 
Equator: Inclination to ecliptic: 7° 15'. 
Longitude: at maximum opposition (1860-8), 7° 28'. 
Rotation period: latitude 0°: 24-64β. 
60°: 26-43β. 
90°: 29-56β. 
Solar constant, or units of energy received per minute per square centimetre at earth's mean distance: 2:1 calories. 
Effective temperature, as an ideal radiator or "black body": 6000° abs.

Bibliography. Nearly all the chief data respecting the sun have lately been and are still under active revision, so that publications have tended to fall rapidly out of date. The most important series is in the Astrophysical Journal, which is indispensable, and in itself almost sufficient; among other matter it contains all the publications of Mount Wilson Solar Observatory (Professor G. E. Hale), H. A. Rowland's Tables of Wave-Lengths, many theoretical papers, and some reproductions of important papers issued elsewhere. But there are also papers which cannot be disregarded in Monthly Notices and Memoirs of the Royal Astronomical Society, and in Astronomische Nachrichten. C. P. Langley's Researches on Solar Heat are published by the War Department (Signal Service, xv.) (Washington, 1884), and Gill's parallax researches in Cape Annals, vols. vii. Auwer's discussion of the sun's diameter is in the discussion of the transit of Venus in 1874, and the best single volume upon the whole subject is C. A. Young's The Sun, 2nd ed. (Inter. Sci. Series), and an excellent summary of solar spectroscopy, as far as rapid progress permits, is in Fresh's translation of Scheiner's Astronomical Spectroscopy (1894). Fresh's translation of 'Studien u. Versuche der Sonnenphysik' (1899), contains a great quantity of interesting matter carefully collected and discussed. For authoritative declarations upon the latest moon points the Transactions of the International Union for Solar Research (1880) may be consulted, vol. i, and the last two issues of the Annals des Ponts et Chaussées are published in 1906, and vol. ii. in 1908.

SUN-BIRD, a name more or less in use for many years, and now generally accepted as that of a group of over 100 species of small birds, but when or by whom it was first applied is uncertain. Those known to the older naturalists were for a long while referred to the genus Certita (TREE-CREEPER, g.v.) or some other group, but they are now fully recognized as forming a valid Passerine family Nectarinidae, from the name Nectarinia invented in 1881 by Illiger. They inhabit the Ethiopian, Indian, and Australian regions, and, with some notable exceptions, the species of the family Nectarinae are by range and habitat a little advanced, and a few are the most restricted in range of the whole group, and is perhaps curious that of the Indian region, but the fact of its being found there may be a reason for including that country within the region, just as the presence of another species in the Jordan valley induces zoographers to regard the Ghor as an outlying of the Ethiopian region. 1

1 Certainly since 1826 (cf. Stephens, Gen. Zoology, vol. xiv, pt. i, p. 292). W. Swinson (Nat. Hist. and Classif. Birds, i, 145) says they are "so called by the natives of Asia in allusion to their splendid and shining plumage," but gives no hint as to the nation or language from which the name is derived. A more remote derivation may be found in the Madagascan name of one given in 1858 by Flacourt as Seunanga. These specimens of the genus Nectarinia, which is perhaps outside of the Indian region, but the fact of its being found there may be a reason for including that country within the region, just as the presence of another species in the Jordan valley induces zoographers to regard the Ghor as an outlying of the Ethiopian region.
but their relations to the last require further investigation. Some of them are called “humming-birds” by Anglo-Indians and colonists, and with that group, which, as before indicated (see HUMMING-BIRD), belongs to the Picaricæ, the sun-birds, being true Passeres, have nothing to do. Though part of the plumage in many sun-birds gleams with metallic lustre, they owe much of their beauty to feathers which are not lustrous, though almost as vivid, and the most wonderful combination of the brightest colours—scarlet, purple, blue, green and yellow—is often seen in one and the same bird. One group, however, is dull in hue, and but for the presence in some of its members of yellow or flame-coloured precostal tufts, which are very characteristic of the family, might at first sight be thought not to belong to heron. Graceful in form and active in motion, sun-birds flit from flower to flower, feeding on small insects which are attracted by the nectar and on the nectar itself; but this is usually done while perched and rarely on the wing as is the habit of humming-birds. The extensible tongue, though practically serving the same end in both groups, is essentially different in its quasi-tubular structure, and there is also considerable difference between this organ in the Nectarineæ and the Meliphagæa. The nests of the sun-birds, domed with a penthouse porch, and pensile from the end of a bough or leaf, are very neatly built. The eggs are generally three in number, of a dull white covered with confluent specks of greenish grey.

The Nectarineæ form the subject of a sumptuous Monograph by G. E. Shelley (40, London, 1870—1880), in the coloured plates of which, where it is done to the varied duties which these gloriously arrayed little beings display, while almost every available source of information has been consulted and the results embodied. This author divides the family into three sub-families: Nectarineæ, consisting of a single genus and species peculiar to Madagascar; Nectarineæ, containing o genera, one of which, Cinnyris, has more than half the number of species in the whole group; and Anrochyeriæ (sometimes known as “spider-busters”), with 2 genera including 11 species—all large in size and plain in hue. To these he also adds the genus Promeropæ, composed of 2 species of South African birds, of very different appearance, whose affinity to the rest can as yet hardly be taken as proved. According to E. L. Layard, the habits of the Cape Promeropæ, its mode of nidification, and the character of its eggs are very unlike those of the ordinary Nectarineæ. In the British Museum Catalogue of Birds (ix., 1—126 and 291) H. J. Gadaw has more recently treated of this family, reducing the number of both genera and species, though adding a new genus discovered since the publication of Shelley’s work.

**SUN-BITTERN, the Eurypyga helias of ornithology, a bird that has long exercised systematists and one whose proper place can scarcely yet be said to have been determined to everybody’s satisfaction.**

According to Pallas, who in 1781 gave (N. nordl. Beyträde, vol. ii., pp. 48—54, pl. 3) a good description and fair figure of it, calling it the "Surnamische Sonnenvögel," Ardea helias, the first author to notice this form was Fermor, whose account of it, under the name of "Sonnenvogel," was published at Amsterdam in 1759 (Deser. Oe. de Sarinam, i. 192), but was vague and meagre. In 1772, however, Pallas satisfactorily figured and described it in his Observations sur la physique, Sci. (vol. v, pt. 1, p. 212, pl. 1), as the Petit paon des roseaux—by which name it was known in French Guiana. A few years later D’ Aubenton figured it in his well-known series (Pl. End., p. 782), and then in 1781 came Buffon (H.L.N., Oiseaux, vol. viii., pp. 169, 170, pl. xiv.), who, calling it “Le Caurâlé ou petit paon des roses,” announced it as hitherto undescribed and placed it among the Rallidiæ. In the same year appeared the above-cited paper by Pallas, who, notwithstanding his name above, was better informed as to its presence than his great contemporary, whose ignorance, real or affected, of his fellow-countryman’s province in the field is inexplicable; and it must have been by inadvertence that, writing “roses”

2 Ibid. (1883), pp. 62—69, pl. xvi.
3 According to M. J. Brisson (Ornithologie, ii. 400), this name was the invention of Réaumur. It seems to have become Anglicized.
4 This figure and description were repeated in the later, issue of this work in 1777 (vol. i. pp. 679—781, pl. 1).

**SUN-BITTERN** for “roseaux,” Buffon turned the colonial name from one that had a good meaning into nonsense. In 1783 Boddaert, equally ignorant of what Pallas had done, called it Scopolas solasærius, and in referring to it that genus he was followed by Latham (Synopsis, iii. 156), by Illiger (Ann. Nat. Hist., 3d ser. ii. 415), and by Illiger (Zool. Syst., 1784, p. 254), who introduced to English readers the ““Cautrale Snipe.” Thus within a dozen years this bird was referred to three perfectly distinct genera, and in those days genera meant much more than


**FIG. 1.**—Sun-Bittern (Eurypyga helias).

they do now. Not until 1811 was it recognized as forming a genus of its own. This was done by Illiger, whose appellation, Eurypyga has been generally accepted.

The sun-bittern is about as big as a small curlew, but with much shorter legs and a rather slender, straight bill. The wings are moderate, broad, and rounded, the tail rather long and pointed. The head is almost bare. The bill is fierce, but blackish, and the cere and legs are yellow. It has the habit of perching upon a branch, or a stick, and another under each eye, the chin and throat being also white. The rest of the plumage is not to be described in a limited space otherwise than generally, being variegated with black, brown, chestnut, bay, buff, grey and white—so mottled, speckled and belted either in wave-like or zigzag forms as somewhat to resemble certain moths. The bay colour forms two conspicuous patches on each wing, and also an antepenultimate bar on the tail, behind which is a subterminal band of black. The irides are red; the bill is greenish olive; and the legs are pale yellow. As in the case of most South American birds, very little is recorded of its habits in freedom, except that it frequents the muddy and wooded banks of rivers, feeding on small fishes and insects. In captivity it soon becomes tame, and has several times made its nest and reared its young (which, when hatched, are clothed with mottled down; Proc. Zool. Soc., 1866, p. 76, pl. ix. fig. 1) in the Zoological Gardens (London), where examples are generally to be seen and their plaintive piping heard. It ordinarily walks with slow and precise steps, keeping its body in a horizontal position, but at times, when excited, it will go through a series of fantastic performances, spreading its broad wings and tail so as to display their beautiful markings. This species inhabits Guiana and the interior of Brazil; but in Colombia and Central America occurs a larger and somewhat differently coloured form which is known as E. major.

For a long while it seemed as if Eurypyga had no near ally, but on the colonization of New Caledonia by the French, an extremely curious bird was found inhabiting most parts of that island, to which it is peculiar. This the natives called the Kagu, and it is the Rhinolophus jutatus of ornithology. Its original describers, MM. Jules Verreaux and Des Murs, regarded it first as a heron and then as a crane (Rev. et Mag. de Zoologie, 1860, pp. 439—441, pl. 21; 1862, pp. 142—144); but, on Mr George Bennett sending two live examples to the Zoological Gardens, Mr Bartlett quickly detected in them an affinity to Eurypyga (Proc. Zool. Soc., 1862, pp. 218, 219, pl. xx.), and in due time the naturalist’s investigation showed him to be right. The kagu, however, would not strike the ordinary observer as having much outward resemblance to the sun-bittern, of which it has neither the figure nor posture. It is rather a long-legged bird, about as large as an ordinary fowl, walking quickly
and then standing almost motionless, with bright red bill and legs, large eyes, a full pendent crest, and is generally of a light slate-colour, paler beneath, and obscurely barred on its longer wing-coverings and tail with a darker shade. It is only when it spreads its wings that these are seen to be marked and spotted with white, rust-colour, and black, somewhat after the pattern of those of the sun-bittern. Like that bird, too, the kagu will, in moments of excitement, give up its ordinary placid behaviour and execute a variety of violent gestures, some of them even of a more extraordinary kind, for it will dance round, holding the tip of its tail or one of its wings in a way that no other bird is known to do. Its habits in its own country were described at some length in 1863 by M. Jounin (Mém. Soc. Nat. Cherbourg, ix. 97 and 235), and in 1870 by M. Marie (Asters Soc. Linn. Bordeaux, xxvii. 323-326), the last of whom predicts the speedy extinction of this interesting form, a fate foreboded also by the statement of Messrs Layard (Ibis, 1882, pp. 534, 535) that it has nearly disappeared from the neighbourhood of the more settled and inhabited parts.

The internal and external structure of both these remarkable forms is now fully known and it appears that they, though separable as distinct families, Eurypterygidae and Rhinocetidae, must be deemed the relics of very ancient and generalized types more or less related to the Railidae (see Rail), and Pelecanidae (see Trumpeter). It is only to be remarked that the eggs of both Eurypteryx and Rhinocetes have a very strong rattle appearance—stronger even than the figures published (Proc. Zool. Soc., 1868, pl. 12) would indicate.

(A. N.)

SUNBURY, a borough and the county seat of Northumberland county, Pennsylvania, U.S.A., on the Susquehanna river about 53 m. by rail N. by E. of Harrisburg. Pop. (1900), 6810, of whom 197 were foreign-born; (1910 U.S. census) 13,770. It is served by the Pennsylvania, the Northern Central (controlled by the Pennsylvania) and the Philadelphia & Reading railways. Sunbury's principal industry is the manufacture of silk; the Pennsylvania railway has repair shops here. The total value of the borough's factory products increased from $1,868,157 in 1900 to $2,502,829 in 1905, or 38.8%. The borough stands on the site of the old Indian village, Shamokin, which was occupied by Delawares, Senecas and Tutelos, and was long the most prominent Indian village in the province; in 1747-1755 there was a Moravian mission here. Owing to the strategic importance of the place the provincial government erected Fort Augusta here in 1756; during the War of Independence many of the fugitives from the Wyoming Massacre tamed this fort. Sunbury was first surveyed in 1772 and was incorporated as a borough in 1797.

SUNBURY-ON-THEM, an urban district in the Uxbridge parliamentary division of Middlesex, England, 17 m. S.W. of St. Paul's Cathedral, London, on a branch of the London & South Western railway. Pop. (1901), 4544. It is a favourite riverside resort and has grown considerably as a residential district. The church of St Mary, Byzantine in style, dates from 1752. There are pumping works and filtration beds for the water-supply of London. To the north-east is Kempston Park, the manor-house of which was a royal residence early in the 14th century. The park is famed for its race-meetings, the principal fixture being the Jubilee Handicap, established in 1887. The manor was granted by Edward the Confessor to Westminster Abbey, and passed in the 13th century to the see of London and in the 16th to the Crown; but was not so held later than 1603.

SUN COPYING, or Photo COPYING, the name given to that branch of photographic contact printing which is carried out without the aid of a camera-made negative. It is now used very extensively for copying documents, especially the plans of architects and engineers.

The earliest discovered process, the ferroprussiate, is still the one most largely used, on account of its economy and permanence, combined with a simplicity of manipulation that renders it highly suitable for office use; it was invented in 1840 by Sir John Herschel. This method has the disadvantage that the copies are blue in colour, and, as it is a negative process, the black lines of the original become the white lines of the print; the development is by washing in water, so that the important feature of accuracy of scale is lost. The next step of importance was in 1864, when William Willis of Birmingham, the father of the inventor of the platinotype system of photographic printing, invented the aniline process. In this method a paper sensitized with bichromate of potassium is exposed to light, with the document (generally a tracing) in front of it; the unprotected lines are bleached out, but the protected ones remain and are developed by contact with vapour of aniline, a subsequent washing for the removal of chemicals completing the print. For twenty years this process was successfully used with little opposition other than that of the blue prints previously referred to, and of the Pellet process, which gave a blue line on a white ground, the inventor being associated throughout with the firm of Vincent Brooks, Day & Son; but since that time a large number of other methods have come into use, some requiring a paper negative in the first instance and some not, but all much aided by improved methods of applying electric light. The earliest of these improved systems utilizing electric light was that invented by Mr B. J. Hall, whose photo-copier consists of two semi-circular glasses forming a cylinder, which may be revolved, and through which an arc lamp travels, while the tracing and sensitized paper are strapped to its outer surface.

Between 1900 and 1908 attention was chiefly directed to overcoming the variation of scale that is inevitable in all systems that require a final washing in water either for development or for the removal of chemicals; and at least four excellent systems have arisen. While Mr F. R. Vandyke was perfecting the system which he patented in 1901 and which has been adopted by the Ordnance Survey Department at Southampton, Messrs Vincent Brooks, Day & Son were working along somewhat similar lines, the outcome of which was their "True-to-Scale Photo Litho" system. In both these methods a reversed positive print is secured on zinc, from which copies can be made in printer's ink of any colour by the usual lithographic method on almost any material that may be desired. The plates prepared by these methods are so sensitive to light that excellent results can be secured from drawings made even on semi-transparent material such as drawing paper, and of course the plates when made are capable of alteration or addition and can be stored for reprints.

An admirable process had since been invented by M.M. Dorel Freres of Paris, which is even more expedient, and boards in private cost is more suitable when only a small number of prints is required. In this case a large sheet of thin zinc is coated with chemically-treated gelatin, with the result that when a ferroprussiate print is pressed down on it either with the hand or by a roller the protected lines affect the gelatin in such a way that the parts that have been in contact with them receive a greasy ink while the remainder of the surface rejects it, so that a small number (not generally exceeding six) of very excellent prints can be secured. The inventors refrained from taking out a patent either in France or elsewhere, preferring to
work their invention as a secret process, but the formula appears either to have leaked out or to have been discovered, so that the process is, perhaps with slight variations, used under numerous names. With the aid of the various systems of rotary copiers, by which blue prints of almost any length can be secured, Dorel prints identical in scale with the originals have been made of the length of 22 ft. An interesting kindred process but with well defined variations is photographic lithography. For the technical and chemical details of the various methods reference may be made to Ferric and Heliographic Processes by G. E. Brown (Dawbarn & Ward).

(F. V. B.)

SUNDA ISLANDS, the collective name of the islands in the Malay Archipelago which extend from the Malay Peninsula to the Moluccas. They are divided into the Great Sunda Islands—i.e. Sumatra, Java, Borneo, Celebes, Banka and Billiton, with their adjacent islands—and the Little Sunda Islands, of which the most important are Bali, Lombok, Sumbawa, Flores, Sumba and Timor.

Sunda Strait is the channel separating Sumatra from Java and uniting the Indian Ocean with the Java Sea. It is 15 m. broad between the south-eastern extremity of Sumatra and the town of Anjer in Java. In the middle is the low-lying well-wooded island of Dwars-in-den-Weg ("right in the way"), otherwise Middle Island or Sungarian. In 1883 Sunda Strait was the scene of the most terrific results of the eruption of Krakatoa (g.v.), a volcanic island further west in the strait.

There are a few small islands and a great waste country in Bengal, India, forming the seaward fringe of the Gangetic delta. It has never been surveyed, nor has the census been extended to it. It stretches for about 165 m., from the mouth of the Hugli to the mouth of the Meghna, and is bordered inland by the three settled districts of the Twenty-four Parganas, Khulna and Backergunj. The total area (including water) is estimated at 63,26 sq. m. It is a water-logged jungle, in which tigers and other wild beasts abound. Attempts at reclamation have not been very successful. The future importance of the delta is not altogether removed. The characteristic tree is the sundari (Heritiera littoralis), from which the name of the tract has probably been derived. It yields a hard wood, used for building, and for making boats, furniture, &c. The Sundarbans are everywhere intersected by river channels and creeks, some of which afford water communication between Calcutta and the Brahmaputra valley, both for steamers and for native boats.

SUNDAY, or the LORD’S DAY (η τοῦ Ἑσυχία ἡμέρα, dies solis; ἡ κυριακή ἡμέρα, dies dominica, dies dominicus), in the Christian world, the first day of the week, celebrated in memory of the resurrection of Christ, as the principal day for public worship. An additional reason for the sanctity of the day may have been found in its association with Pentecost or Whit’sun. There is no evidence that in the earliest years of Christianity there was any formal observance of Sunday as a day of rest or any general cessation of work. But it seems to have from the first been set apart for worship. Thus according to Acts xx. 7, the disciples in Troas met weekly on the first day of the week for exhortation and the breaking of bread; i Cor. xvi. 2 implies an earlier habit of meeting together. The solemn commemorative character it had very early acquired is strikingly indicated by an incidental expression of the writer of the Apocalypse (i. 10), who for the first time gives it that name ("the Lord’s Day") by which it is almost invariably referred to by all writers of the century immediately succeeding apostolic times. Indications of the manner of its observance during this period are not wanting. Teaching of the Apostles (c. 14).

1 The Teutonic and Scandinavian nations adopt the former designation (Sunday, Sundag, Søndag, &c.), the Latin nations the latter (dimanche, domenica, domingo, &c.).
2 From an expression in the Epistle of Barnabas (c. 15), it would almost seem as if the Ascension also was believed by some to have taken place on a Sunday.
3 In the Epistle of Barnabas already referred to (c. 15) it is called “the eighth day”; “We keep the eighth day with joyfulness, the day also in which Jesus rose again from the dead.” Cf. Justin Martyr, Dial. c. Tryph. c. 138.

contains the precept: “And on the Lord’s day of the Lord (κυριακή κυριακῆ κυριου) come together and break bread and give thanks after confessing your transgressions, that your sacrifice may be pure.” Ignatius (Ad Magn. c. 9) speaks of those who he addresses as “no longer Sabatizing, but living in the observance of the Lord’s day both in work and in prayer, which also our life springing up again.” Eusebius (H. E. iv. 23) mentions that they wrote a letter of Dionysius of Corinth (A.D. 175) to Soter, bishop of Rome, in which he says: “To-day we have passed the Lord’s holy day, in which we have read your epistle”; and the same historian (H. E. iv. 26) mentions that Melito of Sardis (A.D. 170) had written a treatise on the Lord’s day. Pliny’s letter to Trajan in which he speaks of the meetings of the Christians “on a stated day” need only be alluded to. The first writer who mentions the name of Sunday as applicable to the Lord’s day is Justin Martyr; this designation (v. 20; cf. i. 59, v. 16) is to have come into general use in the Roman world shortly before Justin wrote. He describes (Apol. i. 67) how “on the day called Sunday” town and country Christians alike gathered together in one place for instruction and prayer and charitable offerings and the distribution of bread and wine; they thus meet together on that day, he says, because it is the first day in which God made the world, and because Jesus Christ on the same day rose from the dead.

As long as the Jewish Christian element continued to have an influence in the Church, a tendency to observe Sabbath as well as Sunday naturally persisted. Eusebius (H. E. iii. 27) mentions that the Ebionites continued to keep both days, and that there is abundant evidence from Tertullian onwards that so far as public worship and abstention from fasting are concerned the practice was widely spread among the Gentile churches. Thus we learn from Socrates (H. E. vi. c. 8) that in his time public worship was held in the churches of Constantineople on both days; the Apostolic Canons (can. 66 [65]) sternly prohibit fasting on Sunday or Saturday (except Holy Saturday), and the most important of the synods held by the early Church define a Sunday (v. 20; cf. ii. 59, xii. 21) as “to hold your solemn assemblies and rejoice every Sabbath day (excepting one), and every Lord’s day.” Thus the earliest observance of the day was confined to congregational worship, either in the early morning or late evening. The social condition of the early Christians naturally forbade any general suspension of work. Ireneaus (c. 140—202) is the first of the early fathers to refer to a tendency to make Sunday a day of rest in his mention that harvesting was forbidden by the Church on the Sabbath. Tertullian, writing in 202, says: “On the Lord’s day we ought always from all labor to lift up our hands, putting away even our business.” But the whole matter was placed on a new footing when the civil power, by the constitution of Constantine mentioned below, began to legislate as to the Sunday rest. The fourth commandment, holding as it does a conspicuous place in the decalogue, the precepts of which could not for the most part be regarded as of merely transitory obligation, and never of course escaped the attention of the fathers of the Church; but, remembering the liberty given in the Pauline writings “In respect of a feast day or a new moon or a Sabbath” (Col. ii. 16), they had determined to make the “Sabbath day” of the commandment as meaning the new era that had been introduced by the advent of Christ, and interpreted the rest enjoined as meaning cessation from sin. But when a series of imperial decrees had enjoined with increasing stringency an abstinence from labour on Sunday, it was inevitable that the Christian conscience should be roused on the subject of the Sabbath rest also, and in many minds the tendency would be such as finds expression in the Apostolic Constitutions (viii. 33): “Let the slaves work five days; but on the Sabbath day and the Lord’s day let them have their leisure.” The longer recension runs: “But let every one of you keep the Sabbath after a spiritual manner. And after the observance of the Sabbath let every friend of Christ keep the Lord’s day as a festival, the resurrection day, the queen and chief of all the days.” The writer finds a reference to the Lord’s day in the titles to Ps. vi. and xii., which are “set to the eighth.”
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leisure to go to church for instruction in piety." There is evidence of the same tendency in the opposite canon (29) of the council of Laodicea (363), which forbids Christians from Judaism and resting on the Sabbath day, and actually enjoins them to work on that day, preferring the Lord's day and so far as possible resting as Christians. About this time accordingly we find traces of a disposition in Christian thinkers to distinguish between a temporary and a permanent element in the Sabbath day precept; thus Chrysostom (10th homily on Genesis) discerns the fundamental principle of that precept to be that we should dedicate one whole day in the circle of the week and set it apart for exercise in spiritual things. The view that the Christian Lord's day or Sunday is but the Christian Sabbath transferred from the seventh to the first day of the week does not find categorical expression till a much later period, Alcuin being apparently the first to allege of the Jewish Sabbath that "ejus observationem mos Christianus ad diem dominican competentius transitullt" (cf. Decalogue).

**Law Relating to Sunday**

The earliest recognition of the observance of Sunday as a legal duty is a constitution of Constantine in 321 A.D., enacting that all courts of justice, inhabitants of towns, and workshops were to be at rest on Sunday (venerabilis die solis), with an exception in favour of those engaged in agricultural labour. This was the first of a long series of imperial constitutions, most of which are incorporated in the Code of Justinian, bk. iii. tit. 12 (De ferioriis). The constitutions comprised in this title of the code begin with that of Constantine, and thereafter provide that emancipation and manumission were the only legal proceedings permissible on the Lord's day (die dominico), though contracts and compromises might be made between the parties where no intervention of the court was necessary. Pleasure was forbidden as well as business. No spectacle was to be exhibited in a theatre or circus. If the emperor's birthday fell on a Sunday, its celebration was to be postponed. The seven days before and after Easter were to be kept as Sundays. In Cod. i. 4, 9, appears the regulation that prisoners were to be brought up for examination and interrogation on Sunday. On the other hand, Cod. iii. 12, 10, distinctly directs the torture of robbers and pirates, even on Easter Sunday, the divine pardon (says the law) being hoped for where the safety of society was thus assured. After the time of Justinian the observance of Sunday appears to have become stricter. In the West, Charlemagne forbade labour of any kind. A century later in the Eastern Empire No. liv, of the Leone constitutions abolished the exemption of agricultural labour contained in the constitution of Constantine; but this exemption was specially preserved in England by a constitution of Archbishop Mepham. The canon law followed the lines of Roman law. The decrees of ecclesiastical councils on the subject have been numerous. Much of the law is contained in the Decretals of Gregory, bk. ii. tit. 9 (De ferioriis), c. 1 of which (translated) runs thus: "We decree that all Sundays be observed from vespers to vespers (a vespera ad vesperam), and that all unlawful work be abstained from, so that in them trading or legal proceedings be not carried on, or any one condemned to death or punishment, or any oaths be administered, except for peace or other necessary reason." Works of necessity (especially in the case of perishable materials or where time was due important, as in fishing) were allowed, on condition that a due proportion of the gain made by work so done was given to the church and the poor. The consent of parties was insufficient to give jurisdiction to a court of law to proceed on Sunday, though it was sufficient in the case of a day sanctified by the ecclesiastical authority for a temporary purpose, e.g. a thanksgiving for vintage or harvest.

In England legislation on the subject began early and continues down to the most modern times. As early as the 7th century the laws of Ina, king of the West Saxons, provided that, if a "thowment" worked on Sunday by his lord's command, he was to be free and the lord to be fined 30s.; if a freeman worked without his lord's command, the penalty was forfeiture of freedom or a fine of 60s., and twice as much in the case of a priest. The laws of Æthelstan forbade marking, of Æthelred folkmoots and hunting, on the Sunday. In almost all the pre-Conquest compilations there are admonitions to keep the day holy. The first allusion to Sunday in statute law proper is in 1354 (25 Edw. III. c. 14 rep.), forbidding the sale of wool at the staple on Sunday. The mass of legislation from that date downwards may be arranged in the case of the question, probably, into five classes—ecclesiastical, constitutional, judicial, social and commercial. The terms "Sunday" and "Lord's day" are used in the statutes, but the term "Sabbath" occurs only in ordinances of the Long Parliament. "Sabbath-breaking" is sometimes used to describe a violation of the Sunday observance acts, but is objected to by Blackstone as legally incorrect. Good Friday and Christmas Day are as a rule in the same legal position as Sunday. In English law Sunday is reckoned from midnight to midnight, not as in canon law a vespera ad vesperam. The acts to be mentioned are still law unless the contrary is stated.

**Ecclesiastical.**—Before the Reformation there appears to be little or no statutory recognition of Sunday, except as a day on which trade was interdicted or national sports directed to be held. Thus the repealed acts of 1388 (12 Ric. II. c. 6) and 1409 (11 Hen. IV. c. 4) enjoined the practice of archery on Sunday. The church itself by provincial constitutions and other means declared the sanctity of the day, and was strong enough to visit with its own censures those who failed to observe Sunday. At the Reformation it was thought necessary to enforce the observance of Sunday by the state in face of the question, properly, whether the time as to the divine or merely human institution of the day as a holy day. Sunday observance was directed by injunctions as well as by statutes of Edward VI. and Elizabeth. The second Act of Uniformity of 1551 (5 & 6 Edw. IV. c. 1) enacted that all inhabitants of the realm were to endeavour themselves to resort to their parish church or chapel accustomed, or upon reasonable let thereof to some usual place where common prayer is used every Sunday, upon pain of punishment by the censures of the church. The same principle was re-enacted by the Act of Uniformity of 1558 (1 Eliz. c. 2), with the addition of a temporal punishment, viz. a fine of twelve pence for each offence. This section of the act is, however, no longer law, and it appears that the only penalty now incurred by non-attendance at church is the shadowy one of ecclesiastical censure. Protestant dissenters, Jews and Roman Catholics were in 1846 (q & 10, Vict. c. 59) exempted from the act, and the pecuniary penalties were abrogated as to all persons; but the acts as to Sundays and holy days are still binding on members of the Church of England [Marshall v. Graham, 1907, 2 K.B. 112].

An act of 1551 (5 & 6 Edw. VI. c. 3) directed the keeping of all Sundays as holy days, with an exception in favour of husbandmen, labourers, fishers and other persons in harvest or other time of necessity. Canon 13 of the canons of 1603 provides that "all manner of persons within the Church of England shall celebrate and keep the Lord's day, commonly called Sunday, according to God's holy will and pleasure and the orders of the Church of England prescribed in that behalf, that is, in hearing the word of God read and taught, in private and public prayers, in acknowledging their offences to God and amendment of the same, in reconciling themself to God and to all their neighbours, in holy works, and in oftentimes receiving the communion of the body and blood of Christ, in visiting the poor and sick, using all godly and sober conversation." The Long Parliament, by an ordinance of 1644, directed the Lord's day to be celebrated as holy, as being the Christian Sabbath. Ordinances of 1650, c. 9, and 1656, c. 15, contained various minute descriptions of crimes against the sanctity of the Lord's day, including "theherein as well as in the walking, The". These ordinances lapsed with the Restoration. The Act of Uniformity of 1661 (13 & 14 Car. II. c. 4) enforced the reading on every Lord's day of the morning and evening prayer according to the Book of Common Prayer on duty. This was previously enjoined by canon 14 of 1603. By the Church Building Act 1818, the bishop may direct a third service, morning or evening, in any church, where necessity, in his opinion, may require it (s. 65). By the Church Building Act 1838, he may order the performance of two full services, each if he so direct to include a sermon (s. 8). The Burial Laws Amendment Act 1880, which authorizes burials in churchyards of the Church of England without the use of the funeral
office of that church, does not allow such burials to take place on Sunday, Good Friday or Christmas Day if the parson of the church objects. Under the Metropolitan Police and Streets Acts, the Town Police Clauses Act 1847 and the Public Health Acts, street traffic may be regulated during the hours of divine service.

Constitutional.—Parliament has occasionally sat on Sunday in cases of great emergency, as on the demise of the Crown. Occasionally divisions in the House of Commons have taken place early on Sunday morning. The Ballot Act 1872 enacts that in reckoning time for election proceedings Sundays are to be excluded. A similar provision is contained in the Municipal Corporations Act 1882, as to proceedings under that act.

A general rule Sunday for the purpose of judicial proceedings is a dies non juridicus on which courts of justice do not sit (9 Car. & 10 Vict., c. 70, s. 6). By s. 6 of the Sunday Observance Act 1867 legal process cannot be served or executed on Sunday, except in cases of treason, felony or breach of the peace. Proceedings which do not need the intervention of the court are good, e.g. service of a citation or notice to quit or claim to vote. By s. 4 of the Indictable Offences Act 1848 justice may issue a warrant of apprehension or a search warrant on Sunday. The rules of the Supreme Court provide that the offices of the Supreme Court are not open on Sunday, and that no business is admissible to be reckoned in the computation of any limited time less than six days allowed for doing any act or taking any proceeding, and that, where the time for doing any act or taking any proceeding expires on Sunday, such act or proceeding is good if done or taken on the next day. In the divorce rules Sundays are excluded from compilation. In the county court rules they are excluded if the time limited is less than forty-eight hours, and the only county court process which can be executed on Sunday is a warrant of arrest in an Admiralty act.

Social.—Under this head may be grouped the enactments having for their object the regulation of Sunday travelling and amusements. The earliest example of non-ecclesiastical interference with recreation appears to be the Book of Sports issued by James I. in 1618. The Act impliedly allows sports other than the expected ones as long as only parishioners take part in them. In 1807 some lads were prosecuted at Streatham under this act for playing football in an adjoining parish, but the justices dismissed the charge, treating the act as obsolete. But in 1862 the Society for the Prevention of Cruelty to Animals instituted a prosecution under the act with the object of preventing extra-parochial rabbit-coursing on Sundays. The Game Act 1831 (1 & 2 Will. IV. c. 32, s. 2) makes it punishable to kill or take game, or to use a dog, net or other instrument (e.g. a snare), for that purpose on Sunday. The prohibition only applies to game proper and does not extend to rabbits.

There is no law in England against fishing on Sunday except as to salmon. Fishing for salmon on Sunday by means other than a rod and line is prohibited by the salmon Fishery Act 1861, and free passage for salmon through all cribs, &c., used for fishery is to be left during the whole of Sunday.

The Sunday Observance Act 1751 (21 Geo. III. c. 49), drawn by Dr Porteus, bishop of London, enacts that any place opened or used for public entertainment and amusement or for public debate upon any part of the Lord's day called Sunday, to which persons are admitted by payment of money or by tickets sold for money, is to be deemed a disorderly house. The keeper is to forfeit £200 for every day on which it is opened or used as aforesaid on the Lord's day, the manager or master of the ceremonies £100 and every doorkeeper or servant £50. The advertising or publishing any advertisement of such an entertainment is made subject to a penalty of £50. Proceedings under this act for penalties may be instituted by a common informer within six months of the offence. It was held in 1868 that a meeting the object of which was not pecuniary gain (though there was fee for admission), but an honest intention to introduce religious worship, though not according to any established or usual form, was not within the act. The hall used was registered for religious worship. On this principle, forms of worship such as Mormonism or Mahommedanism are protected. In 1875 actions were brought against the Brighton Aquarium Company and penalties recovered under the act. As doubts were felt as to the power of the Crown to remit the penalties in such a case, an act was passed in 1875 to remove such doubts and to enable the Crown to remit in whole or in part penalties recoverable for offences against the act of 1875.

The substantive effect of the act is to hit all Sunday exhibitions of amusements, and the decision as to where money is charged for admission. In 1875 it was decided that the chairman of a meeting held to hear a lecture was not liable as manager of the meeting, and the solicitor of the act did not come within the meaning of a company. A ruling that the hall for the meeting. In 1906 an attempt was unsuccessfully made to apply the act of 1871 to open-air meetings for rabbit-coursing. The rules for the government of theatres and places of public amusement (within the meaning of the Act of 1875) usually prohibit performances on Sundays. The lessees of certain places of public resort in London have in some cases obtained their licences from the London County Council on condition that they do not hold Sunday concerts, but the recent policy of the Council has been not to interfere with or restrict the giving of Sunday concerts unless they are given for private gain or by way of trade. The Council has no legal authority to dispense with the Sunday Observance Act 1867, which enforces penalties on giving entertainments to which persons are admitted by payment of money or by tickets sold for money. The law has been judicially interpreted, however, to mean that charges for reserved seats are not incompatible with free admission. In consequence of this ruling Sunday concerts have been regularly given at the Albert Hall, which is not under the licensing jurisdiction of the London County Council, and at the Queen's Hall and other theatres in London. The Act of 1875 also makes it a penal offence to sell any article for the purpose of enabling a person to enter a place kept for the purpose of entertainment on Sunday. In the case of the towns of Croydon and West Bromwich, the local authorities have decided that this subject between the advocates and opponents of Sunday music.

Bands play on Sundays in most of the parks in London, whether royal or under municipal control; and it is said that local authorities do not object to bands playing. In Sydney, bands are prohibited by law (e.g. the Sydney Municipal Act 1886, 6 Q.B.D. 708). Libraries, museums and gymnasiaums maintained by local authorities may, it would seem, be lawfully opened on Sundays, and the national galleries and museums are now so open for part of Sunday.

Commercial.—At common law a contract made on Sunday is not void, nor is Sunday trading or labour unlawful, and enlistment of a soldier on a Sunday has been held valid. At an early period, however, the legislature began to impose restrictions, at first by making Sunday trade impossible by closing the places of ordinary business, later by declaring certain kinds of trade and labour illegal, still later by attempting to prohibit all trade and labour. 28 Edw. III. c. 14 (1354, now repealed) closed the wool market on Sunday. An act of 1448 (27 Hen. VI. c. 5) prohibits fairs and markets on Sunday (necessary victual only excepted), unless on the four Sundays in harvest, and execution (repealed in 1837). An act of 1842 (4 Edw. IV. c. 7 (164) repeals the provision of March 26, 1716, remaining the shoemakers of London from carrying on their business on Sunday. An act of 1627 (3 Car. I. c. 7) imposes a penalty of 20s. on any carrier, wagoner or drover travelling on the Lord's day, and a penalty of 6s. 8d. on any butcher killing or selling on that day. The act does not apply to stage coaches. Both this and the act of 1625 were originally passed only for a limited period, but by subsequent legislation they have become perpetual. Next in order is the Sunday Observance Act 1677 (29 Car. II. c. 7), "An act for
Ward, 2 Will. the for few districts he Sunday The day which in exercising dwelling were ordinary markets to forceable in (but pain exposed offending exercise labourer dead dressing work of ordinary clauses Sunday). The day; 1907, St. Geo. the day, 1762. bread of hawkers for hawkers 13 22, 1836. Certain in 1.30 dressing land, 1761, Lords & Westminster, Act 34. 1871, the workshops, the day, 1877, or & to 109). The act of 1871 does not apply 1.22. A good many bills have been introduced with respect to Sunday trading. Most have been directed to the closing of public houses on that day; but the Shop Hours Bill introduced in 1907 contained clauses for closing shops on Sundays, with the exception of certain specified trades. The result of the act of 1871 in London has been in substance to make the Lord’s Day act a dead letter as to Sunday trading. The commissioner of police rarely if ever allows a prosecution for Sunday trading. Sunday markets are usual in all the poorer districts, and shopkeepers and hawkers are allowed freely to ply their trades for the sale of eatables, temperance drinks and tobacco. But the conditions

It is curious that by an order in council of Hen. VI. to regulate the sanctity of St Martin-le-Granth it was provided that all artificers dwelling within the said sanctuary (as well bakers as others) keep holy the Sundays and other great festival days without breach or exercising their craft as do the citizens of London (Gomme, Government of London, 1907, p. 329).

SUNDAY

of licences for the sale of intoxicants and for refreshment houses are strictly confined with respect to Sunday. In districts where the town councils have control of the police, prosecutions for Sunday trading are not infrequent; but they seem to be instituted rather from objection to the annoyance caused by street traders from religious scruples. The limitation of the time for prosecution to ten days, and the necessity of the previous consent of the chief constable, have a great effect in restricting prosecutions. In most districts there is a distinct disposition to refrain from enforcing the strict letter of the older law, and to permit the latitude of what is described as the "Continental Sunday," except in the case of businesses carried on to interfere with the public comfort. In most districts libelarity in administration has progressed pari passu with a change in public opinion as to the uses to which Sunday may properly be put; it is becoming less of a holy day and more of a holiday.

There is great activity among those interested in different theories as to the proper use of Sundays. On the one side, Lord’s day observance societies and the organizations concerned in the promotion of "temperance" (i.e. of abstinence from alcoholic drinks) have been extremely anxious to enforce the existing law against Sunday trading and against the sale of intoxicants. Lord’s day societies have endeavored to obtain legislation against the sale of any alcohol on Sundays. On the other side, the Sunday League and other like organizations have been active to organize lectures and concerts and excursions on Sundays, and to promote so far as possible every variety of recreation other than attendance at the exercises of any religious body. Travelling and boating on Sunday are now freely resorted to, regardless of any restrictions in the old acts, and railway companies run their trains at all hours, the power to run them being given by their special acts. Tramcars and omnibuses run freely on Sundays, subject only to the restrictions, if any, which may in London ply for hire on Sundays (1 & 2 Will. IV. c. 22).

Besides the general act of 1677, there are various acts dealing with special trades; of these the Licensing Acts and the Factory and Workshop Acts are the most important. By the Licensing Acts, 1872 and 1874, premises licensed for the sale of intoxicating liquors by retail are to be open on Sunday only at certain hours, varying according as the premises are situate in the metropolitan district, a town or populous place, or elsewhere. The hours may be varied to suit the premises. For the purposes of a person dealing in the liquor trade who is interested in the premises, the Act of 1877 is described as "the most extraordinary Act ever passed by the House of Commons and has frequently received judicial construction. The use of the word "ordinary" in section 1 has led to the establishment by a series of decisions of the principle that the word denotes the ordinary calling of the person doing it is not in the act. The therefore of a Sunday on a horse-dealer would not be enforceable by him and he would be liable to the penalty, but these restrictions are not applicable to a person dealing in fish. Certain acts have been held to fall within the exception as to works of necessity and charity, e.g., baking provisions for customers (but not baking bread in the ordinary course of business), running stage-coaches, or hiring farm-labourers. The legislature has also inter- vened to obviate some of the inconveniences caused by the act. By 10 Will. III. c. 13 (1698) mackerel was allowed to be sold before and after service. By 11 Will. III. c. 16 (1699), forty watermen were ruled "to be at liberty to trade on Thanes day" (July 1701), licensed coachmen or chairmen might be hired on Sunday. By an act of 1794 (34 Geo. III. c. 61), bakers were allowed to bake and sell bread on Saturdays, but all remaining provisions of the law are the acts of 1762 (2 Geo. III. c. 15 s. 7), allowing fish carriages to travel on Sunday in London and Westminster; 1827 (8 Geo. IV. c. 75), repealing s. 2 of the act of 1677 as far as regards Thanes boroughs, and 1835 (9 & 10 Will. IV. c. 37) allow bakers out of London, and of 1836 & 8 (Will. IV. c. 37) allow bakers out of London, to carry on their trade up to 1.30 p.m. Since 1871, by an act annually continued (34 & 35 Vict. c. 87), no prosecution or proceeding for penalties under the act of 1877 can be instituted except with the consent in writing of the chief officer of a police district or the consent of the two justices or a stipendiary magistrate, which must be obtained before beginning the prosecution, i.e., the applying for a summons (Thorpe v. Priestnall, 1897, 1, Q.B. 159). The act of 1871 does not apply to breaches of the Bread Acts (R. v. Mead, 1903, 2 K.B. 212).

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1 The act 1 James I. c. 9 (now repealed) appears, however, to have provided for closing ale-houses in most cases, except in usual working days.
the subject. That of 1457, c. 6, ordered the practice of archery on Sunday; that of 1526, c. 3, allowed markets for the sale of flesh to be held on Sunday at Edinburgh. Then came a long series of acts forbidding the profanation of the day, especially by salmon-fishing, holding fairs and markets, and working in mills and salt-panes. The act of 1577, c. 70, and 1661, c. 18, prohibited handy labouring and working, and trading on the Sab-
bath. Under the act of 1579 the House of Lords in 1837 held that it was illegal for barbers to shave their customers on Sun-
days, although the deprivation of a shave might prevent decently disposed men from attending religious worship, or associating in a becoming manner with their families and friends through want of personal cleanliness. The later legislation introduced an exception in favour of duties of necessity and mercy, in accordance with ch. 21 of the Confession of Faith (1666, c. 5).

In more modern times the exigencies of travelling have led to a still further extension of the exception. In these acts the word Sabbath is generally used as in the Commonwealth ordinances. The Sabbath Observance Acts were frequently confirmed, the last time by the Scots parliament in 1697. The Scottish Episcopalian Act 1711 (4 Ann. 10) contains a proviso that all the laws made for the frequenting of divine service on the Lord's day commonly called Sunday shall be still in force and executed against all persons who shall be found to come to some assembly or public assembly of religious worship allowed and permitted by this act. The Scots acts were held by the High Court of Justiciary in 1870 to be still subsisting, as far as they declare the keeping open shop on Sundays an offence by the law of Scotland (Baring v. Maxwell, 1 Cooper's Reports, 499), but all except those of 1759 and 1661 above specified were repealed in 1866. The Licensing (Scotland) Act 1903 provides by the scheduled forms of certificate for the closing on Sunday of public-houses, and proclaims licensed for the sale of excisable liquor, and in the case of inns and hotels forbids the sale of intoxicants except for the accommodation of lodgers or travellers. There has been litigation as to the legality of running tram-cars on the Sabbath.

By the Herring Fishery (Scotland) Act 1815, s. 11, herring nets set or hauled on the coast or within two leagues thereon on Sundays are forfeited. By the Salmon Fisheries (Scotland) Act 1868, s. 15, fishing for salmon on Sunday, even where the river is out of season and line, is an offence, as is taking or attempting to take or assisting in fishing for salmon. As to contracts and legal process, the law is in general accordance with that of England.

Sundays. The acts are not void, apart from statute, simply because they are made on Sunday. Diligence cannot be executed but a warrant of imprisonment or meditatio fugae is “exercisable.”

Ireland.—In Ireland an act of 1695 (2 Will. III. c. 17) covers the same ground as the English act of 1677, but the acts referred to under England do not apply. An act of 1851 (14 & 15 V. c. 93, s. 11) provides for the issue and execution of warrants for indictable offences and search-warrants on Sundays. But proceedings for the peace taken on Sunday are void. The Irish act of 1787 against killing game on Sunday (27 Geo. III. c. 35, s. 4) includes rabbits and quail, landrail or other wild fowl. The Sunday closing of public-houses with exemptions as to certain cities and as to railway stations, packet-boats and canals, is enforced by legislation of 1787, continued annually until 1866 and then made perpetual with certain modifications (1886, c. 39, s. 1), and in the case of six-day licences by acts of 1876, 1877 and 1880.

In 1893 a race-course used for Sunday racing was closed by interdict. The nuisance to the Sunday peace and quiet of the neighbourhood and the services of the adjacent churches. Where railway trains are run on Sundays one cheap train each way is to be provided (7 & 8 Vict. c. 85, s. 10; repealed in 1883 as to Great Britain).

British Colonies.—The English law as to Sunday observance was the original law of the colonies acquired by settlement, and in many of them so much of it as does not relate to the Church of England is left to operate without colonial legislation. In other colonies it is supplemented or superseded by colonial acts of their own. In New Zealand the towns and cities, and selling and all exercise by a man of his ordinary vocations or business, either by himself or his employees on the Lord's day, except in cases of works of necessity or mercy. In New Zealand an act of 1884 (c. 24, s. 16; amended 1906, c. 36) prohibits the carrying on Sunday of any trade or calling, but the exceptions are numerous, and, besides works of necessity or charity, include driving live stock, sale of medicines, sale or delivery of milk, hairdressing or shaving before 9 a.m., driving public or private carriages, keeping livery stables, working railways, ships and boats, and letting boats for hire, and work in connection with post offices and telegraph offices and with daily newspapers.

Foreign Countries.—Consequent on the introduction of a Weekly Rest Day Bill (which obtained a second reading) in the English House of Lords in 1908, a parliamentary paper was published in 1909 (cd. 4568) containing “Reports from His Majesty's Representatives Abroad as to Legislation in Foreign Countries Respecting a Weekly Rest Day.” The principal points are summarized below.

Legislation is embodied in laws of 1895 and 1905, which prohibit any industrial work on Sunday, rest on that day beginning not later than 6 a.m., and lasting for not less than twenty-four hours. Permission is given for absolutely necessary work, provided the employer submits to the authorities a list giving the names of the persons employed, and the place, duration and nature of their employment. Sunday work is permitted in certain indus-
tries, such as shops for retailing food, occupations in which place, season, the habits of the public, &c., make observance impossible, and in such the weekly day of rest must be given in rotation to the employees of a compensating holiday instead.

Sunday rest in Belgium are contained in the Trade Regulations (Gewerbeerleidung) of the 26th of July 1900, according to which manufacturers cannot compel workmen to work on Sundays, whereas employers may do so. In the commercial and trading businesses may assistants, apprentices or workmen be employed at all on Christmas Day, Easter Sunday and Whitsunday, or on other Sundays and holidays more than five hours. The regula-
tions do not apply to hotels, cafés, &c., or to theatres or other places of amusement, or to means of communication. Infringement of the regulations is punishable by a fine, not exceeding 600 marks or imprisonment.

By a law of 1901 and others of 1903 and 1906 all industrial work is prohibited on Sundays and St Stephen's Day (the patron saint of Hungary). Certain categories of industries are exempted on account of necessity or the needs of the consuming public, independent small craftsmen who work at home without assistants are also exempted. The law is enforced by the police and infringement is punished by fine.

Sunday rest in France is given by a law of the 7th of July 1907. Exceptions to the law are river, lake and maritime navigation; agricultural, hunting and fishing industries; state railways and tramways and state public services and industrial undertakings.

The act of 1901 provides for a weekly Sunday rest on the 3rd day of each week, and a subvention of the 4th day. The state legislatures, consequently there exists considerable diversity of legislation on the subject, ranging from the old Quaker laws of the state of Pennsylvania of the beginning of the 18th century to the modern regulations of the Far Western agricultural and mining states. . . . There is no state, however, where it is specifically laid down that an employee who is forced to work
SUNDERLAND, 3rd EARL OF—SUNDERLAND, 2nd EARL OF

on Sunday shall receive another equivalent day of rest." (Report of H.M. Ambassador to the U.S. vide supra.) In Massachusetts, which may be fairly taken as representing the Eastern states, public service corporations, such as railway, street railway, steamboat, telegraph, telephone, electric lighting, water and gas companies, are permitted to serve the public in the usual manner. Public parks and baths are open. Tobacco may be sold by licensed innholders, common victuallers, druggists and news-dealers. Bake shops may be open during certain hours. All other shops must be closed. Saloons are closed, and liquor can be served only to the guests of licensed innholders. Horses, carriages, boats and yachts may be let for hire. All games and entertainments, except licensed sacred concerts, are prohibited. In Connecticut Sunday recreation is still prohibited, but electric and steam cars are allowed to run. Sunday is a close time for game and birds (15). In many of the Western states base-ball, games and various entertainments for pay are permitted, and in some saloons are open. In many but not all the states such persons as by their religion are accustomed to observe Saturday are allowed to pursue their ordinary business on Sunday. In Delaware and Illinois barbers may not shave customers on Sundays; and in Georgia guns and pistols may not be fired (1858). In North Dakota the fines for Sabbath-breaking have been raised.

SUNDERLAND, CHARLES SPENCER, 3rd EARL OF (c. 1674—1722), English statesman, was the second son of the 2nd earl, but the death of his elder brother Henry in Paris in September 1688 he became heir to the peerage. Called by John Evelyn "a youth of extraordinary hopes," he completed his education at Utrecht, and in 1695 entered the House of Commons as member for Tiverton. In the same year he married Arabella, daughter of Henry Cavendish, 2nd duke of Newcastle; she died in 1698 and in 1700 he married Anne Churchill, daughter of the famous duke of Marlborough. This was an important alliance for Sunderland and for his descendants; through it he was introduced to political life and later the dukedom of Marlborough came to the Spencer family. He succeeded to the peerage in 1702, the earl was one of the commissioners for the union between England and Scotland, and in 1705 he was sent to Vienna as envoy extraordinary. Although he was tiring with republican ideas and had rendered himself obnoxious to Queen Anne by opposing the grant to her husband, Prince George, through the influence of Marlborough he was foisted into the ministry as secretary of state for the southern department, taking office in December 1706. From 1708 to 1710 he was one of the five whigs, called the Junta, who dominated the government, but he had many enemies, the queen still disliked him, and in June 1710 he was dismissed. He was granted a pension of £1000 a year, but this he refused, saying "if he could not have the honour to serve his country he would not plunder it."

Sunderland continued to take part in public life, and was active in communicating with the court of Hanover about the steps to be taken in view of the approaching death of the queen. He made the acquaintance of George I., in 1706, but when the elector became king the office which he secured was the comparatively unimportant one of lord-lieutenant of Ireland. In August 1715 he joined the cabinet as lord keeper of the privy seal, and after a visit to George I. in Hanover he secured in April 1717 the position of secretary of state for the northern department. He retained until March 1718, when he became first lord of the treasury, holding also the post of lord president of the council. He was now prime minister. Sunderland was especially interested in the proposed peerage bill, a measure designed to limit the number of members of the House of Lords, but this was defeated owing partly to the opposition of Sir Robert Walpole. He was still at the head of affairs when the South Sea bubble burst and this led to his political ruin. He had taken some part in launching the scheme of 1720, but he had not profited financially by it; however, public opinion was roused against him and it was only through the efforts of Sir Robert Walpole that he was acquitted by the House of Commons, when the matter was investigated. In April 1721 he resigned his offices, but he retained his influence with George I. until his death on the 19th of April 1722.

Sunderland inherited his father's passion for intrigue, while his mother's love of repelling, but he played his hand among his associates for disinterestedness and had an alert and discerning mind. From his early years he had a great love of books, and he spent his leisure and his wealth in forming the library at Althorp, which in 1703 was called "the finest in Europe." In 1749 part of it was removed to Blenheim.

The earl's second wife having died in April 1716, after a career of considerable influence, but in which he had shown signs of moral decay, he married an Irish lady of fortune, Judith Tichborne (d. 1749). By Lady Anne Churchill he had three sons and two daughters. Robert (1701—1729), the eldest son, succeeded as 4th earl, and Charles (1700—1749) the second, but both of them died without issue. In 1733 Charles inherited the dukedom of Marlborough and he then transferred the Sunderland estates to his brother John, father of the 1st Earl Spencer (see MARLBOROUGH, EARLS AND DUKES OF).

For the career of Sunderland see W. Cox, Memoirs of Marlborough (1847—1848); Earl Stanhope, History of England (1853), and I. S. Leadam, Political History of England, 1702—1760 (1900).

SUNDERLAND, ROBERT SPENCER, 2nd EARL OF (1640—1702), English politician, was the only son of Henry Spencer (1620—1645), who succeeded his father, William, as 3rd Baron Spencer of Wormleighton in 1646. This barony had been bestowed in 1603 upon Sir Robert Spencer (d. 1617), the only son of Sir John Spencer (d. 1600) of Althorp, Northamptonshire, who claimed descent from the baronial family of Despenser. The first baronet of the family were Sir John Spencer (d. 1522) of Snitterfield, Warwickshire, a wealthy grazier. His descendant, Sir Robert Spencer, the 1st baron, was in 1663, "reputed to have by him the most money of any person in the kingdom." Sir Robert's grandson, Henry, the 3rd baron, was created earl of Sunderland in June 1643, and was killed at the battle of Newbury when fighting for the king a little later in the same year. He married Dorothy (1617—1684), daughter of Robert Sidney, 2nd earl of Leicester. She was the Sacharissa of the poems of her admirer, Edmund Waller, and for her second husband she married Sir Robert Smythe. Their son Robert, the 2nd earl, was educated abroad and at Christ Church, Oxford, and in 1665 married Anne (d. 1715), daughter of John Digby, 3rd earl of Bristol; she was both a beauty and an heiress, and is also famous for her knowledge and love of intrigue. Having passed some time in the court circle, Sunderland was successively ambassador at Madrid, at Paris and at Cologne; in 1678 he was again ambassador at Paris. In February 1679, when the country was agitated by real or fancied dangers to the Protestant religion, the earl entered political life as secretary of state for the northern department and became at once a member of the small clique which was responsible for the exclusion of James, duke of York, from the throne, and made overtures to William, prince of Orange, and consequently in 1681 he lost both his secretarship and his seat on the privy council. Early in 1683, however, through the influence of the king's mistress, the duchess of Portsmouth, Sunderland regained his place as secretary for the northern department, the chief feature of his term of office being his rivalry with his brother-in-law, George Savile, marquess of Halifax. By this time he had made his peace with the duke of York, and when in February 1685 James became king, he retained his position of secretary, to which he was appointed by the new lord president of the council. He carried out the wishes of the new sovereign and after the intrigues of a few months he had the satisfaction of securing the dismissal of Lawrence Hyde, earl of Rochester, from his post as lord treasurer. He was a member of the commission for ecclesiastical causes, and although afterwards he claimed that he had used all his influence to dissuade James from removing the tests, and in other ways illegally favouring the Roman Catholics, he signed the warrant for the committal of the seven bishops, and appeared as a witness against them. It should be mentioned that while Sunderland was thus serving James II., he was receiving a pension from France, and through his wife's lover, Henry Sidney, afterwards earl of Romney, he was furnishing William of Orange with particulars about affairs in England.
SUDBURY, Sunderland. In the last months of James’s reign he was obviously uncomfortable. Although he had in 1687 openly embraced the Roman Catholic faith, he hesitated to commit himself entirely to the acts of the fierce devotees who surrounded the king, whom he advised to reverse the arbitrary acts of the last year or two, and in October 1688 he was dismissed by James with the remark of ‘you will become more faithful to your next master than you have been to me.’

Sunderland now took refuge in Holland, and from Utrecht he sought to justify his recent actions in A letter to a friend in the country. He had been too deeply involved in the arbitrary acts of James II. to find a place at once among the advisers of William and Mary, and he was excepted from the act of indemnity of 1690. However, in 1691, he was permitted to return to England, and he declared himself a Protestant and began to attend the sittings of parliament. But his experience was invaluable and soon he became prominent in public affairs, a visit which William III. paid him at Althorp, his Northamptonshire seat, in 1691, being the prelude to his recall into the royal counsels. It was his advice which led the king to choose all his ministers from one political party, to adopt the modern system, and he managed to effect a reconciliation between William and his sister-in-law, the princess Anne. From April to December 1697 he discharged the duties of lord chamberlain, and for part of this time he was one of the lords justices, but the general suspicion with which he was regarded terrified him, and in December he resigned. The rest of his life was passed in seclusion at Althorp, where he died on the 28th of September 1702. The earl was a great gambler, but he was wealthy enough also to spend money on improving his house at Althorp, which he beautified both within and without. His only surviving son was Charles Spencer, 3rd earl of Sunderland (q.v.).

Lord Sunderland possessed a keen intellect and was consumed by intense restless; but his character was wanting in steadfastness, and he yielded too easily to opposition. His aridotism in intrigue and his fascinating manners were exceptional even in an age when such qualities formed part of every statesman’s education; but the characteristics which ensured him success in the House of Lords and in the royal closet led to failure in his attempts to understand the feelings of the mass of his countrymen. Consistency of conduct was not among the objects which he aimed at, nor did he shrink from thwarting in secret a policy which he supported in public. A large share of the discredit attaching to the measures of James II. must be assigned to the earl of Sunderland.

The best account of Sunderland is the article by T. Seccombe in the Dict. Nat. Bio., which gives a full bibliography.

SUDBURY, Sunderland, a seaport and municipal, county and parliamentary borough of Durham, England, at the mouth of the river Wear, on the North-Eastern railway, 281 m. N. by W. from London. Pop. (1801), 131,686; (1901) 146,977. The borough includes the township of Bishopwearmouth, to the south of Sunderland proper, which lies on the south bank of the river; and that of Monkwearmouth, on the north bank. Adjacent to Monkwearmouth on the north-west is the extensive urban district of Southwick, within the parliamentary borough. A great cast-iron bridge crosses the river with a single span of 236 ft. and a height of 100 ft. above low water. It was designed by Rowland Burdon, opened in 1796, and widened under the direction of Robert Stephenson in 1858. The only building of antiquarian interest is the church of St Peter, Monkwearmouth, in which part of the tower and other portions belong to the Saxon building attached to the monastery founded by Benedict Bishop in 674. The church of St Michael, Bishopwearmouth, is on an ancient site, but is a rebuilding of the 10th century. There is a large park at Roker on the north-east of the town, a favourite seaside resort, and (among other parks) that at Bishopwearmouth contains a bronze statue of Sir Henry Havelock, who was born (1793) at Ford Hall in the neighbourhood.

The prosperity of Sunderland rests on the coalfields of the neighbour-
which dropped to £4 in 1590. Bishop Morton incorporated Sunderland in 1634, stating that it had been a borough from time immemorial under the name of the New Borough of Wearnemouth. This charter lapsed during the Civil Wars, when the borough was sold with the manor of Houghton-le-Spring for £3875, £8, 6d. Nevertheless the inhabitants retained their rights. Sunderland became a parliamentary borough returning two members in 1825. The charter of 1634 granted a market and annual fair which are still held. The charter of Bishop Hugh provided for pleas between burgesses and foreign merchants, and directed that merchandise brought by sea should be landed before sale, except in the case of salt and herrings. Bishop Hatfield gave a lease of the fisheries in 1538. In the 16th century commissions were held touching salmon-fisheries and obstructions in the Wear, while Bishop Barnes (1577-1587) appointed a water-bailiff for the port, and licensed the building of wharves for the sale of coal. During the 17th century Sunderland was the seat of a vice-admiralty court for the county palatine and in 1669 letters patent permitted the erection of a pier and lighthouse as the harbour was "very commodiously situate for the shipping of vast quantities of sea-coles plentifully gotten and wrought there."

See William Hutchinson, History and Antiquities of the County Palatine of Durham (Newcastle, 1785-1794); J. W. Summers, History and Antiquities of Sunderland (Sunderland, 1850); Victoria County History, Durham.

**Sundew**, in botany, the popular name for a genus of plants known as Drosera (Gr. ἄγγελος, dew; Fr. rosée, Ger. Sonnenhut) so called from the drops of viscid transparent glittering secretion borne by the tentacles which cover the leaf-surface. It is a cosmopolitan genus of slender glandular herbs, with leaves arranged in a basal rosette or alternately on an elongated stem, and is represented in Britain by three species, which are found in spongy bogs and heaths.

The common sundew (D. rotundifolia) has extremely small roots, and bears five or six radical leaves horizontally extended in a rosette around the flower-stalk. The upper surface of each leaf is covered with gland-bearing filaments or "tentacles," of which there are on an average about two hundred. Each gland is surrounded by a large dew-like drop of the viscid secretion. A small fibro-vascular bundle (6, fig. 3, B), consisting mainly of spiral vessels, runs up through the stalk of the tentacle and is surrounded by a layer of elongated parenchyma cells outside of which is the epidermis filled with a homogenous fluid tinted purple by a derivative of chlorophyll (cytophylly). The epidermis bears small multicellular prominences. The glandular head of the tentacle contains a central mass of spirally thickened cells (tracheids) in immediate contact with the upper end of the fibrovascular bundle. Around these is a layer of large colourless thin walled cells which reaches the surface at the base of the head and acts as absorbing cells. Outside these (the outer one the epidermis) filled with purple fluid.

Insects are attracted by the leaves; a fly alighting on the disk, or even only touching one or two of the exterior tentacles, is immediately entangled by the viscid secretion; if the blade or the leaf may even become almost cup-shaped; and the insect, bathed in the abundant secretion which soon closes up its tentacles, is drowned in about a quarter of an hour. The leaves clasp also, for a much shorter time, over inorganic bodies.

The bending of the tentacle takes place near its base, and may be excited (1) by repeated touches, although not by gusts of wind or drops of rain, thus saving the plant from much useless movement; (2) by contact with any solid, even though insoluble and of far greater minuteness than could be appreciated by our sense of touch—a morsel of human hair weighing only 736 of a grain, and this

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**Fig. 1.—Leaf of Sundew (Drosera rotundifolia).** (X 4.)

**Fig. 2.—Leaf of Sundew, enlarged, with the tentacles on one side inflected over a bit of meat placed on the disk.**

**Fig. 3.—Glands of Sundew magnified.**

A, External aspect with drop of secretion; B, Internal structure. largely supported too by the viscid secretion, sufficing to induce movement; (3) by the absorption of a trace of certain fluids, mostly nitrogenous. During the inflexion of the tentacle, and even before it touches the stimulating object, the secretion of the gland increases in quantity, and, instead of remaining neutral, becomes acid. The secretion contains a digestive enzyme which renders soluble the nitrogenous substances of the insect's body; these are then absorbed through thin-walled cells at the base of the gland. After absorption the tentacles recurve and the leaf assumes its normal appearance.

Closely allied to Drosera is Drotophyllum plantains, which catches such vast numbers of flies in a state of nature that the Portuguese cottagers call it the fly-catcher, and hang up branches of it in their houses for this purpose. Its long narrow leaves are covered with stalked glands, which resemble in the main the tentacles of Drosera, save in that they are incapable of movement, and that the gland is less viscid; the leaves of the main the tentacles of Drosera, save in that they are incapable of movement, and that the gland is less viscid; the leaves of the gland to wet the insect, which, creeping onward, soon clogs its wings and dies. There are, moreover, many minute colourless sessile glands, which, when stimulated by the absorption of nitrogenous matter, excrete an acid digestive secretion similar to that of the sundew, by means of which the body of the captured insect is digested and absorbed.

**Fig. 4.—Part of Leaf of Drotophyllum plantains.** (X 7.)
SUNDSVALL, a seaport of Sweden in the district (län) of Västernorrland, on a wide bay of the Baltic, at the north of the Selanger River, 360 m. N. by W. of Stockholm, the terminus of a branch from Anga on the northern railway. Pop. (1900), 14,531. It was rebuilt in brick and stone after a destructive fire in 1888. In the town and its vicinity are numerous steam saw-mills, besides wood-pulp factories, steelworks, brickworks, engineering shops, breweries and joineries, but Sundsvall owes its chief importance to its export trade in timber (6 to 7 million cub. ft. annually), the bulk of which goes to Germany, France and Great Britain. It also exports wood-pulp, iron and fish. There is a special trade with Finland. The harbour, which is usually closed by ice from about the middle of December to the second week in May, is sheltered against the east winds by a group of islands.

SUNFISH, a name chiefly and properly applied to a marine fish (Orthagonicus) of the order Plecognathi, which by its large size, grotesque appearance and numerous peculiarities of organiza-
tion has attracted the attention equally of fishermen as of naturalists. Only two species are known, the rough or short sunfish (O. mola), which is found in all seas of the temperate and tropical zones; and the smaller and scarcer smooth or oblong sunfish (O. truncatus), of which only a small number of specimens have been obtained from the Atlantic and Indian oceans.

Sunfishes have the appearance of tailless fish. This is due to the extreme shortening of the caudal region which is sup-
ported by only a few short vertebrae; the caudal fin is absent, what appears to be a tail being formed by the confluence of dorsal and ventral fins: pelvic fins are also wanting. The anterior parts of the dorsal and ventral fins are high and broad, similar to each other in size and triangular in form. The head is com-
pletely merged in the trunk, the boundary between them being indicated only by a very small and narrow gill-opening and a comparatively small pectoral fin. This fin can be of but little use in locomotion, and the horizontal and vertical movements of the fish, as well as the maintenance of its body in a vertical position, are evidently executed by the powerful dorsal and anal fins. The small mouth, situated in front of the head, is armed with an undivided dental plate above and below, similar to but weaker than the teeth of the goby-fish (Diodon).

Sunfishes are truly pelagic, propagating their species in the open sea, and only occasionally approach the coast. During the stormy season they live probably at some depth, but in calm, bright weather they rise and rest or play on the surface with their dorsal fin high above the water. This habit has given rise to the popular name "sunfish," a term also sometimes applied to the basking-shark. In some years the rough sunfish is by no means scarce on the south coast of England and on the Irish coasts, where it appears principally in the summer months. The usual size is from 3 to 4 ft. in length, but this species attains to 7 ft. and more. One of the largest specimens (shown in the figure) was caught near Portland (Dorsetshire) in 1846, and is now in the British Museum; its length is 7 ft. 6 in. The sunfish has no economic value, and is rarely, if ever, eaten.

Whilst the rough sunfish has a granulated, rough, shagreen-like skin, the second species (O. truncatus) has the surface of the body smooth and polished, with its small dermal scutes arranged in a tesselated fashion. It is oblong in shape, the body being much longer than it is deep. The sides are finely ornamented with transverse silvery, black-edged stripes running downwards to the lower part of the abdomen. It has not been found to exceed 2 ft. in length. Only a few specimens have been captured on the coasts of Europe, at the Cape of Good Hope and off Mauritius.

SUNFLOWER. The common sunflower, known botanically as Helianthus annuus, a member of the natural order Compositae, is a native of the western United States. It is an annual herb with a rough hairy stem 3 to 12 ft. high, broad coarsely toothed rough leaves 3 to 12 in. long, and heads of flowers 3 to 6 in. wide in wild specimens and often a foot or more in cultivated. Double forms are in cultivation, one (globosus fistulosus) having very large globular heads. The plant is valuable from an economic as well as a decorative point of view, and not only the heads, but as fodder, the flowers yield a yellow dye, and the seeds contain oil and are used for food. It is cultivated in Russia and other parts of Europe, in Egypt and India and in several parts of England hundreds of plants are grown on sewage farms for the seeds. The yellow sweet oil obtained by compression from the seeds is considered equal to olive or almond oil for table use. Sunflower oilcake is used for stock and poultry feeding, and largely exported by Russia to Denmark, Sweden and elsewhere.

The genus Helianthus contains about fifty species, chiefly natives of North America, a few being found in Peru and Chile. They are tall, hardy annual or perennial herbs, several of which are well known in gardens where they are of easy cultivation in moderately good soil. H. decapetalus is a perennial about 5 ft. high with solitary heads about 2 in. across in slender twiggy branchlets; H. multiflorus is a beautiful species with several handsome double varieties; H. orygalis is a graceful perennial 6 to 10 ft. high, with drooping willow-like leaves and numerous comparatively small yellow flower-heads. H. atrorubens, better known as Harpaliu rigidu, is a smaller plant, 2 to 3 ft. high, the flower heads of which have a dark red or purple disk and yellow rays. There are many fine forms of this now, of which grow 6 to 9 ft. high and have much larger and finer flowers than the type. Other fine species are H. giganteus, 10 to 12 ft.; H. laetiflorus, 6 to 8 ft. and H. mollis, 3 to 5 ft. H. tuberosus is the Jerusalem artichoke.

Since the word "sunflower," or something corresponding to it, existed in English literature before the introduction of Helianthus annuus, or, at any rate, before its general diffusion in English gardens, it is obvious that some other flower must have been intended. The marigold (Calendula officinalis) is considered by Dr. Prior to have been the plant intended by Ovid (Met. iv. 269-270)—

"... Ilia suum, quamvis radice tenetur,
Vertitur ad solem; mutataque servat amorem "—

and likewise the solsaece of the Anglo-Saxon, a word equivalent to solsequium (sun-following). But this movement with the sun is more imaginary than real, the better explanation for the application of the name to a flower being afforded by the resemblance to "the radiant beams of the sun," as Gerard expresses it. The rock-rose (Helianthemum vulgare) was also termed sunflower in some of the herbs from its flowers opening only in the sunshine. Actinella grandiflora, a pretty perennial 6 to 9 in. high, from the Colorado mountains, is known as the Pigmy sunflower.
SUNNIA—SUNNITES

SUNNIA (Colovar; mod. Cape Colonna), a cape at the southern extremity of Attica, with a temple of Poseidon upon it, which serves as a landmark for all ships approaching Athens from the east. The rocky promontory on which the temple stands was fortified by a wall with towers, in 413 B.C., as a protection against the Spartans in Decela; but it was soon afterward seized by a body of fugitive slaves from the Laurium mines. In the 4th century it was still kept up as a fortress. The temple was shown by an inscription found in 1898 to be dedicated to Poseidon, not, as formerly supposed, to Athena, the remains of whose temple are to be seen about a quarter of a mile away to the north-east; they are of a peculiar plan, consisting of a hall with a colonnade on two sides only. The extant temple on the promontory was probably built in the time of Pericles. It took the place of an earlier one, of similar proportions but built of tufa or “poros” stone. There are still standing nine columns of the south side and two of the north of the peripteral, and one of the outer and an inner column of the prosomas. They are built of local white marble, which has suffered much from the weather. In form they resemble those of the Parthenon and Theseum, but they have only sixteen fluting. Recent excavations have revealed porticoes, a gateway and other buildings, and also the remains of several colossal early statues, the best preserved of which is now in the museum at Athens. The site of Cape Colonna is extolled by Byron, and is the scene of Falconer’s “Shipwreck." (E. Gr.)

SUNNIA, or INDIA HEMP (Crotalaria juncea), a plant which is a native of India and Ceylon. It frequently receives other names, e.g. false hemp, brown hemp, Bombay hemp, Jubbulpore hemp, sana, &c. The plant is an annual, requires a light soil, and is easily cultivated. The ground is ploughed two or three times, and from 80 to 100 lb of seed are sown broadcast. The seedlings quickly appear above the surface, but it is about four months before the plant begins to flower. Sometimes the seed is sown in October for the winter crop, and sometimes in May or June for the summer crop. When the seeds are sown in May, the bright yellow flowers appear in August, when the plant may be gathered. It is not unusual, however, to defer this operation until the seed is ripe, especially if the fibre of great strength is desired. The stems may be pulled up, as is the case with flax, or they may be cut down. Different opinions exist as to whether the stems should be steepled immediately after they are pulled, or left to dry and then steepled: in the wet districts they are taken direct to the water. Since the root ends are much thicker and coarser than the tops, it is common to place the bundles erect, and to immerse the root ends in about a foot of water. Afterwards the bundles are totally immersed in the ponds, and in two to four days the fibre should be ready for stripping. There is the same danger of over-retting and under-retting as in other fibres, but when the retting is complete, the workmen enter the ponds, take up a handful of stems, and sow them upon the surface of the water until the fibre becomes loose. After the fibre has been peeled off it is hung over poles to dry. When intended for cloth it is combed in order to remove any foreign matter, but if it is intended to be used for rope or similar purposes, the fibres are simply separated and the woody matter combed out with the fingers. The fibre is of a light grey colour, and has an average length of 3 to 4 ft. It is extensively used for rope and cordage and also for paper-making in its native country, but it has made little, if any, progress in this country. According to Warden, the fibre was tried in Dundee in the beginning of the 19th century. About 1820 the price of India hemp bagging, as quoted in the Dundee Advertiser, was 1½d. per yard below hemp bagging, and 4½d. a yard below tow warp bagging.

It is stated in Sir G. Watt’s Dictionary of the Economic Products of India that a cord 8 in. in size of best Peters burg hemp broke with 14 tons, 8 cwt. 1 qr., while a similar rope of sown only gave way with 7 tons, 16 cwt. 1 qr. Ruxton’s experiments with ropes made from this and other fibres appear on p. 607 of the above work. The ropes were tested in the fresh state, and also after having been immersed in water for 110 days. His results, reproduced in the following table, show the comparison.

<table>
<thead>
<tr>
<th>Names of the Plants</th>
<th>Average Weight at which each sort of line broke.</th>
</tr>
</thead>
<tbody>
<tr>
<td>English hemp, a piece of new tiller-ripe</td>
<td>105</td>
</tr>
<tr>
<td>Hemp from the East</td>
<td></td>
</tr>
<tr>
<td>India Company’s farm near Calcutta.</td>
<td></td>
</tr>
<tr>
<td>Sunn hemp of the Bengalese.</td>
<td></td>
</tr>
<tr>
<td>Jute (Bunph-pår)</td>
<td></td>
</tr>
</tbody>
</table>

It would appear that, after maceration, neither ordinary hemp nor sunn hemp can compare with jute for strength.

SUNNITES, literally, "those of the path," *sunnā*, i.e. followers of the Prophet’s directions, the name of one of the two main divisions of Islam, the other being the Shi’ites (q.v.). The Sunnites, who accept the orthodox tradition (*sunnā*) as well as the Koran as a source of theologico-juridical doctrines, predominate in Arabia, the Turkish Empire, the north of Africa, Turkestan, Afghanistan and the Mahomedan parts of India and the east of Asia; the Shi’ites have their main seat in Persia, where their confession is the state religion, but are also scattered over the whole sphere of Islam, especially in India and the regions bordering on Persia, except among the nomad Tatars, who are all nominally Sunnite. Even in Turkey there are many native Shi’ites, generally men of the upper classes, and often men in high office (see generally MAHOMMEDAN RELIGION).

Orthodox Islam preserves unchanged the form of doctrine established in the 10th century by Abū l-Hasan al-Asbā’ī (see ASBA’I). The attacks of rationalism, aided by Greek philosophy, were repelled and vanquished by the weapons of scholastic dialectic borrowed from the enemy; on most points of dispute discussion was forbidden altogether, and faith in what is written in Koran and tradition was enjoined without question as to how these things were true (būla kaijū). Freer allegorical views, however, were admitted on some specially perplexing points, such as the doctrine of the eternity of the Koran, the crude anthropomorphisms of the sacred text, &c.; and, since Mo’tazīlī (*Mu’tazīlī*) views had never taken deep root among the masses, while the caliphs required the help of the clergy, and from the time of Motawakkīl (a.d. 847) became ever more closely bound to orthodox views, the freethinking tendency was thoroughly put down, and to the present day no rationalizing movement has failed to be crushed in the bud. Philosophy still means no more than scholastic dialectic, and is the humble servant of orthodoxy, no man venturing on devious paths except in secret. In the years 1572–1578 the Afghan Šāhīd ud-Dīn, a professor in the Azhar mosque at Cairo, attempted to read Avicenna with his scholars, and to exercise them in things that went beyond theology, bringing, for example, a globe into the mosque to explain the form of the earth. But the other professors rose in arms, forbade him to enter the mosque, and in 1579 procured his exile on the pretex that he entertained democratic and revolutionary ideas. Thus the later movements of thought in Islam never touch on the great questions that exercised Mahomedanism in its first centuries, e.g. the being and attributes of God, the freedom of the will, sin, heaven and hell, &c. Religious earnestness, ceasing to touch the higher problems of speculative thought, has expressed itself in later times exclusively in protest against the extravagances of the dervishes, of the worship of saints, and so forth, and has thus given rise to movements analogous to Puritanism. That even in early times the masses were never shaken in their attachment to the traditional faith, with all its crude and grotesque conceptions, is due to the zeal of the umma (clergy). Mahomedanism has no priest-hood standing between God and the congregation, but Koran and Sunna are full of minute rules for the details of private
SUNNITES

civil life, the knowledge of which is necessarily in the hands of a class of professors, theologians. These are the "ulema (q.v.), "knowers," theology being briefly named "the knowledge" ('ilm). Their influence is enormous and hardly has a parallel in the history of religions. For it is not supported by temporal agencies like the spiritual authority of the Christian priesthood in theirognos, and is a public act of knowledge. Among the ignorant masses, who do nothing without consulting their spiritual advisers. When the vigorous Spanish sultan Manṣūr b. Abī 'Amīr proposed to confiscate a religious foundation and the assembled ulema refused to approve the act, and were threatened by his vizier, one of them replied, "All the evil you say of us applies to yourself; you seek unjust gains and support your injustice by threats; you take bribes and practise ungodliness in the world. But we are guides on the path of righteousness, lights in the darkness, and bulwarks of Islam; we decide what is just or unjust and declare the right; through us the precepts of religion are maintained. We know that the sultan will soon think better of the matter; but, if he persists, every act of his government will be null, for every treaty of peace and war, every act of sale and purchase, is valid only through our testimony."

With this answer they left the assembly, and the sultan's apology overtook them before they had passed the palace gate. The same consciousness of independent authority and strength still survives among the ulema. Thus the sheikh ul-Islam 'Abbasī (who was deposed by the professed ulema as the head of the religion and judged the first of the present presidency a sharp conflict with 'Abbās Pasha, viceroy of Egypt, who asked of him an unlegal opinion in matters of inheritance. When bribes and threats failed, the sheikh was thrown into chains and treated with great severity, but it was the pasha who finally yielded, and 'Abbās was recalled to honours and rich rewards.

The way in which the ulema are recruited and formed into a hierarchy with a vigorous esprit de corps takes an instructive light on the whole subject before us. The brilliant days are past when the universities of Damascus, Bagdad, Nishāpur, Cairo, Kairawan, Seville, Cordova, were thronged by thousands of students of theology, when a professor had often hundreds or even, like Bukhārī, thousands of hearers, and when vast estates in the hands of the clergy fed both masters and scholars. Of the great universities but one survives—the Azhar mosque at Cairo—where thousands of students still gather to follow a course of study which gives an accurate picture of the Mahommedan ideal of theological education.

The students generally begin their course in early youth, but seldom in later years. Almost all come from the lowest orders, a few from the middle classes, and none from the highest ranks of society—a fact which in itself excludes all elements of free and refined education. These sons of poor peasants, artisans or tradesmen are already disposed to narrow fanaticism, and generally take up study as a means of livelihood rather than from genuine religious interest. The scholar appears before the president's secretary with his poor belongings tied up in a red handkerchief, and after a brief interrogatory is entered on the list of one of the four orthodox rites—Shafi'ite, Hanifi, Maķkite and Hanbalite (see MAHOMMEDAN LAW). If he is lucky he gets a sleeping-place within the mosque, a chest to hold his things, and a daily ration of bread. The less fortunate must shift to live outside as best they can, but are all day in the mosque, and are selected in the presence of the sheikh and his assistants to the pillars of the great court and the students crouch on mats at their feet. The beginner takes first a course in the grammar of classical Arabic, which is called, and is known, in Arabic, tajwīd. The rules of grammar are read out in the memorial verses of the Ajrīmiya, and the teacher adds an exposition, generally read from a printed commentary. The student's chief task is to know the rules by heart, without help; but the other parts of the Ottoman Empire, 8 from North Arabia, 1 from the government of Bagdad, 12 from Kurdistan, and 7 from India with its thirty million Sunnites.

Except in India, where it is controlled by the government, the learning seems to have been raised by Russian and Western scholars. The madrasa is here a college, generally attached to a mosque, with lands whose revenues provide the means of instruction and in part also lod and residence for scholars and teachers.
the organization of the priestly and judicial persons trained in the schools is a compromise between what theological principles dictate and what the state demands. Neither Koran nor Sunna distinguishes between temporal and spiritual powers, and no such distinction was known as long as the caliphs acted in all things as successors of the prophets and heads of the community of the faithful. But, as the power of the 'Abbasids declined (see article Caliphate, ad fin.) and external authority fell in the provinces into the hands of the governors and in the capital into those of the amir al-omarā, the distinction became more and more palpable, especially when the Buyids, who were disposed to Shi'ite views, proclaimed themselves sultans, i.e. possessors of all real authority. The theologians tried to uphold the orthodox theory by declaring the sultanate to be subordinate to the imāmate or sovereignty of the caliphs, and dependent on the latter especially in all religious matters; but their artificial theories have never modified facts. The various dynasties of sultans (Buyids, Ghaznevis, Seljuks, and finally the Mongols) never paid heed to the caliphs, and at length abolished them; but the fall of theocracy only increased the influence of the clergy, the expounders and practical administrators of that legislation of Koran and Sunna which had become part of the life of the Mahomedan world. The Mengeluke in Egypt tried to uphold the caliphate as the result of the Islamic law, and to render possible the idea of a person who is not only the legal but the spiritual successor of the caliph. Thus in India too the sultan was something perhaps to his spiritual title. But among his own subjects he is compelled to defer to the ulemā and has no considerable influence on the composition of that body. He nominates the Sheikh ul-Islam or mufti (q.v.) of Constantinople (grand mufti), who is his representative in the imāmate and issues judgments in points of faith and law from which there is no appeal; but the nomination must fall on one of the mollahs, who form the upper stratum of the hierarchy of ulemā. And, though the various places of religious dignity are conferred by the sultan, no one can hold office who has not been examined by learned ulemā, so that the corporation is self-propagating, and palace intriguers, though not without influence, can never break through its iron bonds. The deposition of 'Abd ul-Aziz is an example of the tremendous power that can be wielded by the ulemā at the head of their thousands of pupils, when they choose to stir up the masses; nor would Mahmūd II. in 1826 have ventured to enter on his struggle with the janissaries unless he had had the hierarchy with him.

The student who has passed his examinations at Constantinople or Cairo may take up the purely religious office of wakil (pensionary or worship) or khaṭṭīb (preacher) at a mosque. These offices, however, are purely ministerial, and not necessarily limited to students, and give no place in the hierarchy and no particular consideration or social status. On the other hand, he may become a judge or cadi. Every place of any importance has at least one cadi, who is nominated by the government, but has no further dependence upon the Russians gained preponderating influence the khan of Khwarazm also proclaimed himself Sultan in the East.

2 Mollah is the Perso-Turkish pronunciation of the Arabic mualī, literally "patron," a term applied to heads of orders and other religious dignitaries of various grades.

3 Called in Constantinople süfî, Persian šāhīkha, burned up, secti, with zeal or love to God.

4 In Egypt before the time of Sa'd Pasha (1854-1863) the local judges were appointed by the chief cadi of Cairo, who is sent from Constantinople. Since then they have been nominated by the Egyptian government.

on it, and is answerable only to a member of the third class of the ulama, viz. the mufti or pronouncer of fatwas. A fatwa is a decision according to Koran and Sunna, but without reasons, on an abstract case of law which is brought before the mufti by appeal from the cadi's judgment or by reference from the cadi himself. For example, a dispute between master and slave may be found by the cadi to turn on the general question, "Has Zaid, the master of 'Amr, the absolute right to dispose of his slave's earnings?" When this is put to the mufti, the answer will be simply "Yes," and from this decision there is no appeal, so that the mufti is supreme judge in his own district. The grand mufti of Constantinople is, as we have seen, nominated by the sultan, but his hold on the people makes him quite an independent power in the state; in Cairo he is no longer nominated by the government, but each school of law chooses its own shiek, who is also mufti, and the Şafīite is head mufti because his school is official in the Turkish Empire.

All this gives the judges great private and political influence. But the former is tainted by venality, which, aggravated by the scantiness of judicial salaries or in some cases by the judge having no salary at all, is almost universal among the administrators of justice. Their political influence, again, which arises from the fusion of private and public law in Koran and Sunna, is highly inconvenient to the state, and often becomes intolerable now that relations with Western states are multiplied. And even in such distant parts as Central Asia the law founded on the conditions of the Prophet's lifetime proves so unsuited to modern life that cases are often referred to civil authorities rather than to canonical jurists. Thus a customary law (urf) has there sprung up side by side with the official sacred law (shari'a), much to the displeasure of the mollahs. In Turkey, and above all in Egypt, it has been found necessary greatly to limit the sphere and influence of the canonical jurists and to introduce a more independent power in the state; in Cairo he is no longer nominated by the government, but each school of law chooses its own shiek, who is also mufti, and the Şafīite is head mufti because his school is official in the Turkish Empire.
SUNSHINE

have tended to bring them closer to one another, we still find
that of the thirty-six chief orders three claim an origin from the
caliph Abü Bekr, whom the Sunnites honour, and the rest from
Alī, the idol of the Shi'ītes.1 Mystic absorption in the being
of God, with an increasing tendency to pantheism and ascetic
practices, are the main scope of all Šī'īism, which is not neces-
sarily confined to members of orders; indeed the secret practice
of contemplation of the love of God and contempt of the world
is sometimes viewed as specially meritorious. And so ultimately
the word ściī has come to denote all who have this religious
direction, while those who follow the special rules of an order
are known as dervishes (beggars, in Arabic ṣfārādī, slang ṣfārī
—originally designating only the mendicant orders).
In Persia at the present day a ściī is much the same as a free-
thinker.2

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SUNSHINE. As a meteorological element sunshine requires
some conventional definition. There is uninterrupted continu-
ance of gradation from the burning sunshine of a tropical noon
to the pale luminosity that throws no shadow, but just identifies
the position and shape of the sun through the thin cloud of
northern skies.

The Campbell-Stokes Sunshine Recorder.—In the British Isles
the sun is allowed to be its own timekeeper and the shadow of
a specially prepared card used as the criterion for bright sunshine.
The practice arose out of the use of the sunshine recorder which
depends upon the glowing effect of a glass sphere in the sun's
rays. The original form of the instrument was suggested by
J. F. Campbell of Islay in 1857. He used a glass sphere within
a hemispherical bowl of wood. The scorching of the wood along
successive lines of the bowl as the sun alters its declination from
solstice to solstice leaves a rugged monument of the duration
and intensity of the sunshine during the half-year, but does not
lend itself to numerical measurement. The design of a metal
frame to carry movable cards and thus give a decipherable
record of each day's sunshine is due to Sir G. G. Stokes. The
excursions of the sun to the north and south of the equator are
limited by the tropical circles, and the solar record on the hemi-
spherical bowl will be confined within a belt 23° 27' north and
south of the plane through the centre parallel to the equator
or perpendicular to the polar axis. Thus a belt 46° 54' in angular
width will be suitable for a sunshine recorder for any part of
the world. Whatever place be chosen for the observation the
same belt will do if it is set up perpendicular to the earth's
polar axis. But there can be no record if the sun is below the
horizon; hence any part of the belt projecting above the horizon
is not only useless for recording but is liable to shadow a part
of the belt where there might be a record. Hence to meet the
requirements of a particular locality the belt as set up round the
polar axis should be cut in two by a horizontal plane through
the middle of the half projecting above the horizontal removed.
Reversed it makes a half belt, exactly similar to what is left,
and thus each complete belt is cut by a horizontal plane through
the centre into two frames suitable for sunshine recorders for
the particular locality.

The cutting of the belt may, of course, vary between the direct
transverse cut along the polar axis which gives a half-ring belt
for a recorder to project a point on the equator, and the cut perpendicular to the polar axis which
divides the belt into two similar rings suitable for recording the
sunshine at the poles. Clearly, when the belt is so cut that two
complete rings are formed, a continuous record of sunshine
throughout the twenty-four hours may be expected, so that for
the polar circles the cut will run diagonally between opposite
points of the extreme circles of the sun's records. As examples
of the cutting of the belt for different latitudes we may put side
by side the recorder as used in temperate latitudes (fig. 1) and

FIG. 1.—Campbell-Stokes Sunshine Recorder.

the special form designed in the Meteorological Office, London,
for use on the National Antarctic Expedition, 1901–1904 (fig. 2).
A belt cut for a particular latitude is serviceable for some 10°

Antarctic Sunshine Recorder, to carry 24-hour record.

FIG. 2.—Antarctic Sunshine Recorder, to carry 12-hour record.

on either side of that latitude if the cards are not trimmed too
closely to the cutting of the belt. The belt must always be
adjusted round the parallel to the polar axis. If the cut of the
belt is too oblique for the latitude of the place where it is exposed,
and the cards are cut strictly to the belt, the northern side of the
cut will be below the horizon and the southern side above it,
some sunshine may be lost near sunrise or sunset in the winter because there is no card to receive it. The part projecting above the horizon in summer will partly shadow the globe, and faint sunshine may be lost, for at most only half the globe can be solarized at sunset. But the loss due to this cause is unimportant.

Stokes designed the complete belt to use successively three cards of different shape for different times of the year. The equinoctial card forms a portion of a cylinder round the polar axis for spring and autumn, the summer card and the winter card each forms a part of a cone making a vertical angle of 16° with the polar axis as indicated in fig. 3.

Adjustments.—The adjustments of the instrument are to set the belt so that its axis is parallel to the polar axis and symmetrically adjusted with reference to the meridian of the place, and to set the sphere so that its centre coincides precisely with the centre of the belt. No one of the three adjustments is easy to make or to test because neither the centre of the sphere nor the centre (nor indeed the axis) of the belt can be easily identified. For an instrument for testing these adjustments see Quart. Journ. Roy. Met. Soc., xxxii., 249.

Instruments differ according to the means provided for mounting or adjusting the positions of the belt or sphere, and in that known as the Whipple Casella instrument the fixed belt is replaced by a movable card holder. The chief advantage of Stokes's specification is the simplicity of the use of the instrument when once it has been properly adjusted and fixed.

It is essential that the glass sphere and refractive index to give an image of the sun on the prepared card or within the 20th of an inch of it nearer the centre. It is also essential that the cards used should not only be of suitable material but also of the right dimensions for the bowl. The colour and material of the cards were selected by Stokes in consultation with Warren De la Rue, who was at that time his colleague on the Meteorological Council, and the cards used by the meteorological office are still supplied by Messrs De la Rue & Co. Accuracy in the comparative measurements of sunshine by this method depends upon the proper adjustment of the dimensions of the different constituent parts of the recorder and accordingly the following specification of standard dimensions has been adopted by the meteorological office.

The Time Scale.—On the time scale of the equinoctial card twelve hours are represented by 9:00 in.

The Bowl.—The diameter of the bowl, measured between the centres of the 6 o'clock marks on a metal equinoctial card of thickness 0.02 in. when in its place, is to be 5.73 in. (± 0.01 in.). The distance between the exposure edges of the upper winter flange and the lower summer flange must not be less than 2.45 in., nor exceed 2.50 in. The distances from the middle line on the equinoctial card to the middle lines on the summer and winter cards are to be 0.70 in. (± 0.02 in.). The inclination of the summer card, in place, to the winter card, in place, is to be 30° = 1°, symmetrically arranged with regard to the equinoctial card. The section of the supporting surface by a plane through the polar axis is to be as in fig. 3.

The Sphere.—The material for the sphere must be "crown" glass, colourless, or of a very pale yellow tint. The diameter 4 in. The weight between 2.02 and 3.02 lb. The focal length from the centre of the sphere to the geometrical focus for parallel rays should be between 2.96 in. and 2.99 in.

Measurement of the Sunshine Record.—It was mentioned that the Campbell-Stokes recorder involves a conventional definition of sunshine. The recorded day of sunshine is less than the actual time during which the sun is above the horizon by about twenty minutes at sunrise and sunset on account of the want of burning power of a very low sun. Some further convention is necessary in order to obtain a tabulation of the records which will serve as the basis of a comparison of results for climatological purposes. The spot which is scorched on the card by the sun is not quite limited to the image of the sun, and a few seconds of really strong sunshine will produce a circular burn which is hardly distinguishable in size from that of a minute's record. (See fig. 4.) Consequently with intermittent sunshine exaggeration of the actual duration of burning is very probable. Strictly speaking measurements ought to be between the diameters of the circular ends of the burns, but the practice of measuring all the trace that can be distinctly recognized as scorched has become almost universal in Great Britain, and appears to give a working basis of comparisons.

Other Types of Sunshine Recorder.—There are, however, various other conventions as to sunshine which are used as the basis of recorders of quite different types. The Jordan recorder uses ferrocyanide paper and the sun keeps the time of its own record by the traverse of a spot of light over the sensitive paper, arranged as a cylinder about a line parallel to the polar axis. The effect thereby recorded is a photochemical one, and the composite character of the sun's radiation, modified by the elective absorption of the atmosphere makes the relation of the record to that of the sun's scorching power dependent upon atmospheric conditions and therefore on different occasions, so that the two records give different aspects of the solar influence. Other recorders use the thermal or photographic effect.
of the sun's rays and record duration by a clock instead of allowing the sun to keep its own time. In the Marvin sunshine recorders of the United States weather bureau an electrical contact is made by the thermal effect of the sun and the duration of the contact is recorded. An instrument which gives a corresponding result is described by W. H. Dines (Quart. Journ. Roy. Meteor. Soc. xxvi. 243). These define sunshine by the effect necessary to produce or maintain a certain thermal effect, but the definition once accepted there is no uncertainty as to the record. The Calender sunshine recorder1 gives a record of the difference of temperature of two wires, one solarized and the other not, and it is therefore a continuous record of the thermal effect of solar and terrestrial radiation. It is vastly more complicated than that of other instruments (see fig. 5), but the interpretation of the record in terms suitable for meteorological or climatological purposes is a special study, which has not yet been attempted. In a somewhat similar way information about the duration and intensity of sunshine with an abundance of detail can be obtained from the record upon photographic paper passing under an aperture in a drum which revolves with the sun, as in the Lander recorder, but the study of such details has not been begun.

Sunshine Records for the British Isles.—The interest in the sunshine recorders is more widely extended in the British Isles than elsewhere, and it is, so far as the public are concerned, the most important meteorological element, but it is singular that up to the present a knowledge of the total amount of sunshine recorded during the day, the week, the month or the year is all that is apparently required. Except for the observatories in connexion with the meteorological office and a few others the distribution of sunshine during the day is not taken out, so that we are still some distance from attacking the problems presented by the finer details of solar records. Fig. 6 shows the average duration of bright sunshine for each hour of the day for each month at Valencia. The expectation of sunshine is greatest at 1 p.m. and 2 p.m. in May, while there is a well-marked secondary maximum in September.

Exposure.—We now consider what the daily sunshine record for a particular station means. An ideal exposure has an uninterrupted view of those parts of the horizon in which the sun rises or sets; and elsewhere the view of the sun must not be obstructed by the ground, buildings, trees or any other obstacle; but ideal exposures are not always to be obtained. In mountainous districts particularly it may be impossible to find a site in which the sun is not obstructed for an appreciable part of the day. In these circumstances it becomes a question whether the amount of sunshine recorded should be referred to the maximum possible for an uninterrupted horizon or the maximum possible for the particular exposure. The answer to the question really depends upon the purpose for which the information is wanted. As a climatological factor of the locality the shadow cast by the surrounding hills is of importance, it is part of the difference between the fertility of the southern and northern slopes of hill country. This importance is, of course, in many respects

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1 Brit. Assoc. Report (1900), p. 44.

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Sunshine in the Antarctic Regions.—It is clear that so far as concerns the zone from 50° to 60° N. in this particular region, the annual amount of sunshine diminishes as one goes northward. It would, however, not be safe to conclude that this diminution in the aggregate duration of sunshine is above the horizon as one proceeds northward. At least the corresponding statement would not be true of the southern hemisphere. No doubt
the frequency of cloud and the consequent loss of duration of sunshine would increase for corresponding latitudes from the tropical anticyclone southward, but beyond the region of minimum pressure at the winter quarters of the "Discovery" in latitude 77° 51' S., longitude 166° 45' E., the amount of bright sunshine recorded during the two years 1902 and 1903 was remarkably large. The total for 1903 equaled that for Scilly, and in December of that year an average of 16 hours per day was registered.

FIG. 8.—Sunshine in the British Isles in May and June 1909.

**Sunshine Results for Other Parts of the World.**—Maps showing the average annual distribution of sunshine over Europe and North America are given in Bartholomew's *Physical Atlas*, vol. iii. Atlas of Meteorology. Over Europe the largest totals, over 2750 hours per annum, are shown over central Spain. In North America, values exceed 3250 hours per annum in the New Mexico region. For other parts of the world the information available is not sufficiently extensive for the construction of charts.

**Effect upon Sunshine Records of the Smoke of Great Cities.**—Much discussion has taken place from time to time as to whether the climate of a locality can be altered by artificial means. Questions have been raised as to the effect of forests upon rainfall, as to the indirect effect of irrigation or the converse process, the obliteration of natural irrigation by blown sand, and as to the possibility of producing, arresting or modifying rainfall by the discharge of explosives.

The one question of the kind to which the sunshine records give an absolutely incontrovertible answer is as to the effect of the smoke of great cities in diminishing the sunshine in the immediate neighbourhood. This may be illustrated by the figures for sunshine during the winter months off Bunhill Row, E.C., in the middle of London, Westminster, Kew and Cambridge. **Monthly Average Duration of Bright Sunshine derived from Observations extending over Twenty Years.**

<table>
<thead>
<tr>
<th>Station</th>
<th>November</th>
<th>December</th>
<th>January</th>
<th>February</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bunhill Row</td>
<td>22.8</td>
<td>7.5</td>
<td>14.1</td>
<td>30.6</td>
</tr>
<tr>
<td>Westminster</td>
<td>27.7</td>
<td>13.1</td>
<td>18.4</td>
<td>32.8</td>
</tr>
<tr>
<td>Kew</td>
<td>50.8</td>
<td>38.1</td>
<td>40.3</td>
<td>54.6</td>
</tr>
<tr>
<td>Cambridge</td>
<td>61.0</td>
<td>40.6</td>
<td>48.9</td>
<td>73.8</td>
</tr>
</tbody>
</table>

This is not a question which comes out merely by taking averages. The answer can be seen directly by comparing the daily cards (see fig. 10, Sunshine Cards for Cambridge, Westminster and Bunhill Row for December 1904). Thus it appears that the direct effect of the local contamination of the London atmosphere results in the
diminution of the recorded sunshine for the whole year by 37%, and it is clear that the contamination extends in some degree as far as Kew, where the loss amounts to about 10%. There is evidence of various kinds to show that the effect of the smoke cloud of cities


SUNSTONE, a felspar exhibiting in certain directions a brilliant spangled appearance, which has led to its use as an ornamental stone. The effect appears to be due to reflections from enclosures of red haematite, in the form of minute scales, which are hexagonal, rhombic or irregular in shape, and are disposed parallel to the principal cleavage-plane. These enclosures give the stone an appearance something like that of aventurine (q.v.), whence sunstone is known also as "aventurine-felspar." It is not common, the best-known locality being Tvedestrand, near Arendal, in south Norway, where masses of the sunstone occur embedded in a vein of quartz running through gneiss. It is found also near Lake Baikal, in Siberia, and at several localities in the United States, notably at Middletown, Delaware county, Pennsylvania, and at Statesville in North Carolina. The felspar which usually displays the aventurine appearance is oligoclase (q.v.), but the effect is sometimes seen also in orthoclase (q.v.): hence two kinds of sunstone are distinguished as "oligoclase sunstone" and "orthoclase sunstone." The latter has been found near Crownpoint and at several other localities in the state of New York, as also at Glen Riddle in Delaware county, Pennsylvania, and at Amelia Court House, Amelia county, Virginia.

SUNSTONE (Heatstroke; Insolation; Thermic Fever; Siriasis), a term applied to the effects produced upon the central nervous system, and through it upon other organs of the body, by exposure to the sun or to overheated air. Although most frequently observed in tropical regions, this disease occurs also in temperate climates during hot weather. A moist condition of the atmosphere, which interferes with cooling of the overheated body, greatly increases the liability to suffer from this ailment.

Sunstroke has been chiefly observed and investigated as occurring among soldiers in India, where formerly, both in active service and in the routine of ordinary duty, cases of this disease constituted a considerable item of sickness and mortality. The increased attention now paid by military authorities to the personal health and comfort of the soldier, particularly as regards barrack accommodation and dress, together with the care taken in adjusting the time and mode of movement of troops, has done much to lessen the mortality from this cause. It would appear that, while any one exposed to the influence of strong solar heat may suffer from the symptoms of sunstroke, there are certain conditions which greatly predispose to it in the case of individuals. Causes calculated to depress the health, such as previous disease, particularly affections of the nervous system—anxiety, worry or overwork, irregularities in food, and in a marked degree intertemperance—have a powerful predisposing influence, while personal uncleanliness, which prevents among other things the healthy action of the skin, the wearing of tight garments, which impede the functions alike of heart and lungs; and living in overcrowded and insanitary dwellings have an equally hurtful tendency.

While attacks of sunstroke are frequently precipitated by exposure, especially during fatigue, to the direct rays of the sun, in a large number of instances they come on under other circumstances. Cases are of no infrequent occurrence among soldiers in hot climates when there is overcooling or bad ventilation in their barracks, and sometimes several will be attacked in the course of a single night. The same remark applies to similar conditions existing on shipboard. Further, persons whose occupation exposes them to excessive heat, such as stokers, laundry workers, &c., are apt to suffer, particularly in hot seasons. In the tropics Europeans, especially those who have recently arrived, are more readily affected than natives. But natives are not exempt.

The symptoms of heatstroke, which obviously depend upon the disorganization of the normal heat-regulating mechanism, as well as of the functions of circulation and respiration, vary in their intensity and likewise to some extent in their form. Three chief types of the disease are usually described.

1. Heat Syncope.—In this form the symptoms are those of exhaustion, with a tendency towards fainting or its actual occurrence. A fully developed attack of this description is usually preceded by sickness, giddiness, some amount of mental excitement followed by prostration, and then the passage and then the perspiration which there are pallor and coldness of the skin, a weak, quick and interminent pulse, and gasping or sighing respiration. The pupils are often contracted. Death may quickly occur; but if timely treatment is available recovery may take place.

2. Heat Apoplexy or Asphyxia.—In this variety the attack, whether preceded or not by the premonitory symptoms already mentioned, is usually sudden, and occurs in the form of an apoplectic seizure, with great vascular engorgement, as seen in the flushed face, congested eyes, quick full pulse and stertorous breathing. There is usually insensibility, and convulsions are not infrequent. Death often occurs very sudden. This form, however, is also amenable to treatment.

3. Thermic Fever.—This variety is characterized chiefly by the excessive development of fever (hyperpyrexia), the temperature of the body rising to 105° or 106°, and at some portion of the body remaining so high. Among other symptoms are those of exhaustion, with a tendency towards fainting or its actual occurrence. A fully developed attack of this description is usually preceded by sickness, giddiness, some amount of mental excitement followed by prostration, and then the passage and then the perspiration which there are pallor and coldness of the skin, a weak, quick and interminent pulse, and gasping or sighing respiration. The pupils are often contracted. Death may quickly occur; but if timely treatment is available recovery may take place.

Besides these, other varieties depending on the prominence of certain symptoms are occasionally met with. The chief changes in the body after death from heatstroke are those of anaemia of the brain and congestion of the lungs, together with softness of the heart and of the muscular tissues generally. The blood is dark and fluid and the blood corpuscles are somewhat altered in shape. Attacks of sunstroke are upon the whole, more fatal to Europeans, especially upon the nervous system. A liability to severe headache, which in many cases would seem to depend upon a condition of chronic meningitis, epileptic fits, mental irritability and depression of the disposition are among the more important. It is often observed that heat in any form is ever afterwards ill borne, while there also appears to be an abnormal susceptibility to the action of stimulants. The mortality from sunstroke is estimated at from 40 to 50%.

Treatment.—Should be adopted to prevent attacks in the case of those who must necessarily be exposed to the sun. These consist in the wearing of loose clothing, with the exception of the head-dress, which ought to be worn close to the head, in due attention to the function of the skin, and in the avoidance of alcoholic and other excesses. Cold water may be drunk in small quantities at frequent intervals. Sweat in the face, after exposure, is not recommended. The treatment of a patient suffering from an attack necessarily depends upon the form it has assumed. In all cases he should if possible be at once removed into a shaded or cool place. Where the symptoms are mostly those of shock and there is a
SUPERANNUATION—SUPERINTENDENT

Tendency to death from heart failure, rest in the recumbent position, the use of the moderate stimulants, such as ammonium carbonate, &c., together with friction or warm bath applied to the extremities, are the means to be adopted. Where, on the other hand, the symptoms are those of apoplexy or of hyperpyrexia, by far the most successful results are obtained by the use of cold (the cold affusion, rubbing the surface with ice, emenata of ice-cold water). The effect is a marked lowering of the temperature, while at the same time a stimulus is given to the respiratory function. Mustard or turpentine applied to the nape of the neck or other hot adjutant. Should the temperature be lowered in this way but unconsciously still persist, removal of the hair and blisting the scalp are recommended. The subsequent treatment will depend upon the nature of the resulting symptoms, but change to a cool climate is often followed by marked benefit.

SUPERANNUATION (formed on the basis of “annual,” “annuity,” from the Late Lat. superannatus, one who has lived beyond the year, super, above, and annus, year, Fr. superanumer, to grow very old), properly a disqualification or relief from office or service on account of old age, infirmity, or of passing the limit of age fixed for service, hence the pension or allowance granted in respect of service at the expiry of the term or the retirement (see Pension). Educationally the term is specifically used of the removal of a backward pupil, who would otherwise remain in a class or form below that which his age demands.

SUPERcargo, a term in maritime law (adapted from the Span. sobrecargo, one over or in charge of a cargo) for a person employed on board a vessel by the owners of the cargo to manage their trade, or sell the merchandise at the ports to which the vessel is sailing, and buy and receive goods for shipment homewards. He has control of the cargo unless expressly or impliedly limited by his contract or agreement. He differs from a factor, who has a fixed place of residence at a port or trading place, by sailing from port to port with the vessel to which he is attached.

SUPEREROGATION (Late Lat. supererogatio, payment beyond what is due or asked, from super, beyond, erogare, to pay out, expend, ex, out, rogare, to ask), the performance of more than is asked for, the action of doing more than duty requires. In the theology of the Roman Church, “works of supererogation,” those which are performed beyond what is required by God, thus forming a reserve store of works of merit which can be drawn upon for the dispensation of those whose works fall short of the standard required.

SUPERINTENDENT, a term which, apart from its general use for an official in charge, has a distinct religious connotation, being applied, e.g. to the head of a Sunday school and to the chief minister in a Methodist circuit. In its most important historical sense it refers to certain ecclesiastical officers of reformed churches of the Lutheran model.

At the Reformation the question of the ordering and constitution of the churches was urgent. The greatest confusion prevailed: the priests were often dissolute, the people were ignorant, and meanwhile nobles were seizing the Church lands. Luther and Melanchthon would have preferred to retain the old episcopal control, and to have charged the bishops with the duty of making the necessary alterations in the ecclesiastical constitution. For, while they taught that in spiritual powers all ministers were equal, they recognized the propriety of allowing administrative distinctions. But the bishops were unwilling to come to any terms with the Reformers, and hence became superintendents to certain officers of the new order. The name of superintendant was then given to a class of men who discharged many of the functions of the older bishops, while bearing a character which in several respects was new. Only in Denmark was the name of bishops reserved for the new officers after the Lutheran model had been adopted and the older bishops had been deposed and imprisoned. It is still used there, though no claim is made that it is the sign of formal apostolical succession. In Scotland the First Book of Discipline provided not only for ministers, teachers, elders and deacons, but also for superintendents and readers. The superintendents (who were appointed because of the scarcity of Protestant pastors) took charge of districts corresponding in some degree with the episcopal dioceses, and made annual reports to the general assembly of the ecclesiastical and religious state of their provinces, in the churches of which they also preached.

The distinctive character borne by the new officers was determined by the cardinal principles which Luther had laid down in his work regarding the religious functions of the state. He conceived of the state as the delegated power of God, and as being set to direct and control the external fortunes of the Church. He hoped that righteous magistrates would at all times form a sound court of appeal in times of ecclesiastical disorder, and that they would guard the interests of truth and justice more securely than had been done under papal jurisdiction. The superintendents who now had to undertake large administrative responsibilities in the Church were therefore to be appointed by the civil power and to be answerable to it. They were to stand as intermediaries between the prince or magistrates on the one hand, and the ministers in their districts on the other.

In his earlier writings Luther had laid his main emphasis on the spiritual priesthood of all believers. Every sincere Christian was declared free, not only to preach, but also to administer the sacraments and to rebuke evil livers. The differences in office and function between the members implied no difference in rank, for the members of Christ’s Church were all members of His body, and Luther believed that they would all be ruled into true order and charity by the Head. But he became dismayed by the Peasants’ War, and his faith in the virtues of the average man never recovered itself. The concept was seen in his later writings, where he expresses his conviction that men need to be directed and restrained from without, and he looks to the state to undertake this duty. In the last resort the civil magistrates must take control of the Church. His vindication for thus subordinating the ecclesiastical to the civil lay in his assumption that the rulers of a Christian land would themselves be Christian, and that it was the Christian duty of the Church to render obedience to those who had been ordained of God to bear rule. He, and the rest of the Reformers, were firm believers in a visible Catholic Church as were any of those of whom he speaks as “the adherents of the old religion,” and Luther, always conservative in feeling, clung to an alliance with the state and denied that the repudiation by the Reformers of papal authority had severed them from the visible Church.

The character of the office and duties of the superintendent were not everywhere the same. Luther shrank from imposing any stereotyped forms and asked that the special circumstances of each separate district should be consulted. He hoped that as few changes as possible would be made, and trusted that what was devolved down would be done decently and well. But the civil authorities, when they started to reorganize the Church in their respective dominions as they thought best, was not felt to present any great difficulties in the free towns, for institutions of self-rule had there grown strong and schemes of ecclesiastical readjustment were speedily drawn up. Richter and Sehling1 have published a number of these ordinances, and they show that as a rule one of the city clergy was appointed superintendent by the city fathers and set in a position of administrative authority over all the churches within their jurisdiction. They were invited in as expressing their good will. Great difficulties presented themselves in the territories of the German princes, and in the case of Saxony Luther proposed to the elector that his first step should be to send out a commission of investigation which should report on the moral and spiritual condition of his principality, district by district. His proposal was carried out, and Luther himself became one of the visitors (1527–1528). He found the people in a state of such religious indifference and ignorance, and the clergy living often in such grossness, that his faith in their fitness to govern themselves ecclesiastically sank even lower than before, and he resisted all schemes for self-government such as had been proposed by Francis Lambar.

The church organization which he devised for Saxony provided

1 In their works on Die evangelischen Kirchenordnung des 16ten Jahrhunderts (Weimar, 1846; and Leipzig, 1902–1904).
no place for democratic or representative elements; the grasp of the state must at all times be felt. The superintendent must speak at all times as a minister of the state, and the state must be represented in the synod to which he makes his first report, for upon the synod there must sit not only the pastors but also a delegate from every parish. If any appeal should be made from the decisions of the synod it must be heard in the court of the state, and from the decision of that court, which is final, itself, it must be appealed to the juss episcopole, the right of oversight of the churches. Luther proposed that he should exercise this right by appointing a consistorial court composed in part of theologians and in part of canon lawyers, and it was thus that in 1542 the Wittenberg ecclesiastical consistory was formed. Other principalities adopted the model, so that the institution became common throughout the Lutheran churches.

In this scheme the superintendent (or superintendant) was charged with such part of the duty of the older bishops as had been purely administrative. He must concern himself with the discharge of their duties by the pastors of the churches, as well as with their character and demeanour. He must supervise their conduct of public worship, as well as give them licence to preach. He must take cognizance of their ministry to the indigent in their parishes, and of their management of the schools. He must further direct the studies of candidates for the pastoral office. He was answerable to the state for the conduct of the synod and for reports on the state of his province and those authorities had final power in the matters referred to. If those matters, however, presented technical difficulties, they could be referred to the consistorial courts.

The appointment of such a superintendent would seem to have been found in the decisions of Prince John of Saxony about 1537. He assigns the duties of the office, and commends the new-school teaching of the pastors under him, faithfully to warn them of all errors, and, in case they prove obstinate, to report them to the electoral court. He must further give close attention to the due observance of the marriage laws, for in this matter the previously appointed visitors to the principality had reported grave laxity. The title of this office was not new, but was taken over from the later Scholastics, who had employed it as a suitable translation of the words kirchenordnung, a phrase which had come into the church.

In the case in which the old bishops were retained in Lutheran communities their tenants held office directly from the state.

Some of the smaller principalities appointed but a single superintendant, the later, who was also the pastor, being answerable to a consistory, sat as spiritual member on the territorial council, whilst in towns the superintendent was summoned to the town council when matters of a secular nature arose. In larger states there were various classes of superintendants with their respective duties severally assigned.

In modern times the functions of the superintendent have been somewhat confused in consequence of the introduction into Lutheran Church theory of inconsistent elements of Presbyterian and synodal type.

J. T. M. Lindsay, History of the Reformation (1906), i, 400-416; and the articles "Kirchenordnung" and "Superintendent" in Herzog-Hauck's Realencyklopädie für protestantische Theologie und Kirche.

SUPERIOR, the most north-westerly of the Great Lakes of North America, and the largest body of fresh water in the world, lying between 46° 30' and 48° N., and 89° 30' and 92° W. It is the largest body of inland water in the state of Minnesota, and S. by Wisconsin and Michigan. It has deep, extremely cold, clear water, and high and rocky shores along a large portion of its coast. Its general form is that of a wide crescentic convex towards the north, but its shores are more irregular in outline than those of the other lakes. Following the curves of its axis from west to east the lake is about 383 m. long, and its greatest breadth is 160 m. Its maximum recorded depth is 1308 ft., and its height above mean sea level is 602 ft., or about 21 ft. above that of lakes Michigan and Huron, to which it is joined at its eastern extreme by a narrow connecting arm. In large streams of 200 rivers, and drains a territory of 48,600 sq. m., the total area of its basin being 80,400 sq. m. The largest river which empties into it is the St Louis, at its western end. The principal rivers on the north shore are the Pigeon, which forms the international boundary line, the Kamissakwa, the Nipigon, which drains the lake of the same name and together with the lake is about 200 m. long, the Pic, the White and the Michigan. No large rivers empty into Lake Superior from the south. There are not many islands in the lake, the largest among them being Isle Royal, by far the largest in the eastern part; St Ignace, in the northern part, off the mouth of the Nipigon River; Grand Island between Pictured Rocks and Marquette; Manitou Island, east of Keweenaw Point, and the Apostle Group, to the north of Chequamegon Bay.

The boundary between the United States and Canada runs up the middle of the outlet of the lake and follows a median line approximately to about mid-lake; thence it sweeps north-westward, so as to include Isle Royal within the territory of the United States, and continues near the north shore, to the southwest of Pigeon River, which it follows westward, leaving the whole west end of the lake in United States territory.

Lake Superior lies in a deep rift in rocks principally of Archean and Cambrian age, of the Laurentian, Huronian and Keweenaw formations, rich in minerals that have been extensively worked. The lake is, as it were, surrounded by iron, which is the probable cause of very strong magnetic fields of influence. Native silver as well as silver ores exist around Thunder Bay, native copper was formerly worked on Isle Royal, and rich copper mines are worked on the south shore, while nickel abounds in the north-western part. The Archean belt produces a picturesque coast-line, the northern part particularly being indented by deep bays surrounded by high cliffs, mostly burnt off and somewhat desolate; the islands also rise abruptly to considerable heights, the north shore furnishing the boldest scenery of the Great Lakes. On the south coast, opposite the broadest part of the lake, are precipitous walls of red sandstone, extending about 14 m., famous as the Pictured Rocks, so called from the effect of wave action on them. There are no appreciable tides and little current. A general set of the water towards the outlet exists, especially on the southern shore. From the Apostle Islands to the eastward of Keweenaw point this current has great width, and towards the eastern end of the lake spreads out in the shape of a fan, a branch passing to the northward and westward reaching the north coast. Autumn storms raise dangerous seas. The level varies with the season, and also from year to year, the maximum variation, covering a cycle of years, being about 5 ft. The discharge of the lake is computed to be 75,200 cubic ft. per second at mean stage of water.

The season of navigation, controlled by the opening and closing of the Sault Ste Marie canals, averages about eight months—from the middle of April to the middle of December. The season has been extended for a few days, in both spring and autumn, by the use of ice-breaking tugs at Fort William and Port Arthur, this service being organized by the government particularly to facilitate the movement of grain from the Canadian North-west. (The lake never freezes over, though the temperature of the water does not, even in summer, rise far above freezing point. The bays freeze over and there is border ice, often gathered by wind into large fields in the bays and extremities of the lake.)

Lake Superior is fairly well provided with natural harbours, and works of improvement have created additional harbours of refuge at various points. Marquette, Mich., Presque Isle Point, Mich., Agate Bay, Minn., Grand Marais, Minn., and Ashland, Wis., are harbours which have protective breakwaters across their mouths. Duluth, Superior, Port Wing, Wis., Ontonagon, Mich., and Grand Marais, Mich., are harbours with entrances formed by parallel breakwaters running along the beach, and are no longer supplied with natural harbours. The traffic on Lake Superior grows constantly in volume, the increase in tonnage of each year over that of the preceding year having, for 50 years past, averaged 20%. The freight carried into and out of the lake, as gauged by
SUPPERIOR—SUPPLY AND TRANSPORT

The statistics gathered at the Sault Canal offices, aggregated in 1907
over $8,000,000 (short) tons. The principal freight shipped east-
ward consists of flour, wheat and other grains, through Duluth-
Superior to the United States. Fort William, the
Arthur from the Canadian prairies; copper ore from the mines on
the south shore; iron ore in immense quantities from both shores,
the principal ore shipping ports being Ashland, Two Harbors,
Marquette, Superior, and captive ore bringing into the
tributary rivers. West-bound freight consists largely of coal
for general distribution and for terminal railway points.

The fishing industry of Lake Superior is important, the total tonnage of salmon-trout
(Salvelinus namaycush, Walb), ranging from 10 to 50 lb in weight,
being gathered from the individual fishermen by steam tenders and
shipped by rail to city markets. The river Nixon, on the north
shore, is the chief salmon-trout stream (Salvelinus nuttallii.
Mitchell) of unusual size; and all rivers and brooks falling into the
lake are trout streams.

Sup. Bulletin No. 17, Survey of Northern and Northern-Western Lakes,
U.S. War Department, Lake Survey Office, Detroit (1907); Sailing
Directions for Lake Superior and the St. Mary’s River, U.S. Hydro-
graphic Office publication No. 108 A. (Washington, 1906), with
supplements.

(W. P. A.)

SUPPERIOR, a city, a port of entry and the county-seat of
Douglas county, Wisconsin, U.S.A., about 140 m. N. by E. of
Minneapolis and St. Paul. Superior is on both sides of Lake
Superior, connected directly opposite Duluth, Minnesota, with
which it is connected by ferry and by railway and
road bridges.

The harbour, which has been improved by the Federal govern-
ment, is formed by two narrow strips of sandy land, known as
Minnesota and Wisconsin Points, which extend several miles
across the head of the lake from the Minnesota and Wisconsin
stores respectively and almost meet in the centre. The body
of water thus formed, Superior and Allouez bays, varies in
width from 1 to 12 m., and is 9½ m. long. St Louis Bay, on
the west, is about 1½ by 4 m. The city is situated on gently
rising ground facing the bays, and has 20 m. and Allouze-front.

The second port of Superior at different times and in
different places is responsible for the large area covered by
the city (36½ sq. m.) and its appearance is that of three distinct
towns. The intervening portions have however been platted and
are now largely settled. Superior is the seat of a state normal
school (1866), which occupies a splendidly equipped building,
and, in addition to the ordinary normal courses, has departments
of kindergarten training, manual training and domestic science.
The city is the see of a Roman Catholic bishop. Superior has a
cheap fuel supply and power is furnished by electricity gene-
rally connected to the several towns.

1905 the value of its factory
products was $6,556,081. Flour is the principal product, and
shipbuilding is important. Among steel ships, the type known as
the “whaleback” originated here; and iron and wooden
ships, launches and small pleasure craft are also made. Other
manufactures are railway cars, casks, cooperage, saw and planing
mill products, furniture, wooden ware, windmills, gas-engines,
and mattresses and wire beds. Superior is an important
grain market. Much iron and copper ore is shipped from the
Duluth-Superior harbour; and large quantities of coal, brought
by lake boats, are distributed from here throughout the American
and Canadian markets. The total tonnage of Duluth-
Superior Harbour was estimated in 1908 to be exceeded in the
United States only by that of New York and that of Philadelphia.

Pier Esprit Radisson and Medard Chouart des Grosel-
liers probably visited the site of Superior in 1662, and it is prac-
tically certain that other French coureurs-des-bois were here
at different times before Daniel Greysolon, Sieur Du Lhut
(Duluth), established a trading post in the neighbourhood about
1678. About 1820 the Hudson’s Bay Company established a
post here, but there was no permanent settlement until after
the middle of the 19th century. Attention was directed to
the site by a survey made by George R. Stantz, a government
surveyor, in 1852, and in 1853 a syndicate of capitalists, at
the head of which was William Wilson Corcoran, the wealthy
banker, associated with whom were Senators Stephen A. Douglas (from whom the county was named), R. M.
T. Hunter and J. B. Bright, Ex-Senator Robert J. Walker,
Congressmen John C. Breckinridge and John L. Dawson,
and, by necessity, largely Southern politicians and members of
Congress, bought lands here. A settler of the name of Superior
was among them. The proprietors secured in 1856 the construc-
tion of a military road to St Paul, Minnesota, 160 m. long. The town
grew rapidly, and in 1856–1857 had about 2500 inhabitants.
The panic of 1857 interrupted its growth, and the population
fell so that in 1860 there were only a few hundred settlers
on the town-site. The Civil War increased the depression,
and the lands of those who had taken part against the Union
were confiscated. In 1862 a series of stockade was built as
a protection from the Indians. Within the area under the govern-
ment of the town of Superior, consisting of the land granted
with the county, West Superior was platted in 1883 and South
Superior soon afterwards. A village government was estab-
lished in September 1887, including the three settlements men-
tioned, and in April 1889 Superior was chartered as a city.
The harbour was surveyed in 1823–1825 by Lieut. Henry Wolsey
Bayfield (1795–1885) of the British Navy. In 1860–1861
it was resurveyed by Captain George G. Meade, who was engaged
in the work at the outbreak of the Civil War. A branch of
the Northern Pacific railway was built to Superior in 1881.

SUPPÉ, FRANZ VON (1820–1895), Austrian musical com-
poser, whose real name was Francesco Ezechielle Ermenegildo
Suppé-Demelli, was born at Spalato, in Dalmatia, in 1820, and
died at Vienna in 1895. Originally he studied philosophy at
the university of Padua, but on the death of his father devoted
himself to music, studying at the Vienna conservatoire. He
began his musical career as a conductor in one of the smaller
Viennese theatres, and gradually worked his way up to be one
of the most popular composers of ephemeral light opera of
the day. Outside Vienna his works never won much success.
Of his sixty comic operas Patinites (Vienna, 1870; London,
1871) were the most successful. Suppé’s work was one of
only enjoyed moderate favour. Suppé’s overture to Dichter
und Bauer is his most successful orchestral work. He also
wrote some church music.

SUPPLY (through Fr. from Lat. supplyre, to fill up), pro-
vision; more particularly the money granted by a legislature to
carry on the work of government. In the United Kingdom the
granting of supply is the exclusive right of the House of
Commons, and is carried out by two committees of the House,
one of supply and the other of ways and means (see Parlia-
mment). In the United States supply originates in the House of
Representatives (see United States: Appropriation).

In Scotland commissioners of supply were officers appointed to
assess and collect the land tax offered as surplus to the sovereign.
Under the Lands Valuation (Scotland) Act 1854 all owners of
property of a certain value were qualified as commissioners of
supply. Their duties were also enlarged to comprising the granting of
appropriation, or the legal application of the proceeds of customs,
bating food, forage and stores for men and horses. In modern
history these supplies have become more and more varied as
weapons developed in complexity, power and accuracy of
workmanship. In proportion, the branches of an army which are
charged with the duties of "supply and transport " have become
specialized as regards recruiting, training and organization.

The predatory armies of the middle ages not only lived upon
the country they traversed, but enriched themselves with the
plunder they obtained from it, and this method of subsisting and paying an army reached its utmost limits in the Thirty Years' War. During the last stages of this war Germany had been so thoroughly devastated that the armies marched hither and thither like packs of hungry wolves, every soldier accompanied by two or three non-combatants—camp followers of all sorts, mistresses, ragged children and miserable peasants who had lost all and now sought to live by robbing others under the protection of arms. An English officer of the time wrote that twelve years before the peace of Westphalia, reported that at Bacharach-on-Rhine he had found "the poor people dead with grass in their mouths," and that a village at which he stayed "had been pillaged eight-and-twenty times in two years, and twice in one day."

From these horrors there followed a revulsion to the other extreme. Unless ordered by higher authority for political reasons to sack a particular town or to pillage a particular district, the soldiers were rigidly kept in hand, rationed by their own supply officers and hanged or flogged by the men if an outbreak of the old vices made the example necessary. After 1648 there were very few districts in Middle Europe that could support an army for even a few days, and the burden of their sustenance had to be distributed over a larger area. Thus, at the mere rumour of an army's approach, the peasantry fled with all their belongings into the fortified places, armies soon came to be supplied from "magazines," which were filled either by contract from the home country or by inducing the peasantry—by means of good conduct and cash payments—to bring their produce to market. These magazines were placed in a strong place, and if the town was not available, a traverse had to be undertaken to meet the demand. Moreover, soldiers in Marlborough's time were not as easily obtained as in the Thirty Years' War, and they had to be housed and fed comfortably enough to make it worth their while to stay with the colours instead of deserting. From these and similar conditions there grew up a system of supply and transport usually called the "magazine system," under which an army was bound, under penalty of dissolution, to go no farther than seven marches from the nearest fortress, two days from the nearest field bakery, and so on. When an 18th-century army foraged for itself it was because the regular supply service was interrupted, i.e. when it was in extremis. But the relative rarity of wars in the 18th century, the habit of demanding nothing from the inhabitants of the country traversed by an army, and the virtual exclusion of the people from the prince's quarrels, gave Europe a century's respite in which to recover from the drain of the Thirty Years' War. And therefore, when the French Revolution came, the attempts of the armies of old Europe to suppress it without robbing a single Frenchman of a loaf of bread proved futile, and soon the national army of the Revolution traversed the country unencumbered by tents, magazines and supply trains, swept over southern Germany and Italy. The Revolutionary armies differed indeed from those of the old wars in this, that they did not devastate wantonly, nor did they murder for the sake of loot. But they were merciless in their exactions, and, moreover, the tides of their invasions flowed in particular channels, so that the greater part of the invaded country escaped. This had a considerable, sometimes even a predominant, influence on the strategy pursued, a retreat along their own lines of communication being often in fact avoided by the French as being the worst fate that could befall them. Napoleon, however, systematized the wasteful and irregular requisitioning that his predecessors had introduced, and in his hands the supply service, like all else connected with the art of war, underwent a thorough reform. His strategy in the offensive passed through two distinct stages—

(a) the swift and sudden descent into the theatre of war, and
(b) the close grouping of his armies in view of the decisive blow.

The first stage was characterized by extraordinarily swift movement, complete independence of all trains (other than the reserves of ammunition) and thorough exploitation of the food resources of the traversed zone. If the troops suffered, as well as the inhabitants, this did not shake the emperor's purpose in the slightest. If all the disorders which are the natural consequence of ill-regulated requisitioning—that is, marauding—cost the army 50,000 men, he had foreseen the loss and taken 50,000 men more than he needed for the battle. But the second stage, which as a rule involved three or four days' occupation, without considerable movement, of a restricted area, required other measures of supply. In this the army lived upon magazines which were filled from the captured supply trains from the available supplies in the area, and from the resources accumulated in requisitioned vehicles close to the head of the routes followed in the first period. These resources were collected in the towns within this concentration area, and placed "out of reach of an insult" (that is, made safe against raiders) with a garrison and field works to supplement the town walls and gates. From this centre of operations Napoleon never allowed himself to be severed, whereas to the preservation of the route between France and that centre of operations he gave with Napoleonic arrogance, to a military advantage (other than the existence of railways) with much less than Napoleonic severity. Their system has been accepted as the best for European warfare by all the great powers, whose organizations and methods of transporting and issuing supplies are the same in principle.

This principle is based on the Napoleonic distinction between supplies required during an advance and those required during a concentrated halt. The British Field Service Regulations (1809), pt. ii., lay it down that "the system of subsistence should be elastic and readily adaptable to every situation as it arises, and that it must always be based on the rule that "all mobile supplies are to be regarded as a reserve" for use when neither local nor line-of-communication resources are available. As a general rule local resources should be used before the line of communication is called upon, and last of all the call is made on the mobile supplies in the hands of the fighting units. During a strategical concentration or a long halt "the resources of the immediate neighbourhood cannot be expected to support the troops. At such times they may be supplied from field dépôts established at convenient centres, and filled with supplies that are obtained by purchase or requisition and collected by requisition or hired (civilian) transport." During an advance, on the other hand, "by far the most advantageous method is for the troops to be rationed by the inhabitants on whom they are billeted . . . This method should be employed whenever possible."

The extent to which it can be employed varies considerably with the place and the season, but the British and all continental armies have their own "rules of thumb" or rough generalizations based on experience. General Lewal (Stratégie de marche, p. 47) says that in a country of 20 inhabitants to the square kilometre, or 180 to the square mile, 1,000 men can be subsisted for one day on an area of 22 square
kilometres or 5/8 square miles, or 1200 per square mile. General Napoleon, in his Sadowa gives 36 square miles as sufficient for the maintenance of an army corps (30,000–35,000) or about 1100 men to the square mile during the assembly period, but only on condition of helping out local resources by special supplies from the base. The British Field Service Regulations state that ordinary agricultural districts of Western Europe, not previously traversed by troops, will support a force of twice the strength of the population, and for wheat at a maximum. This would mean using fourteen rations from each inhabitant, but the incidence of the burden is spread over several days. A practical rule therefore would seem to be, in a district of 200 inhabitants to the square mile, to allot 1400 men per square mile for a flying passage of one day and 400 for a stay of one week, the resources of the country being more thoroughly and systematically exploited in the latter case. A British division (combatant column only) closing up to half its marching depth at the end of the day would require 12 square miles, and as its depth would be about 51 miles, its front or width would perhaps extend for only a mile on either side of the road. It is quite possible to move two divisions for several consecutive days on the same road, living on the country exclusively, subject to the condition that the second should halt on the areas which the first has passed through without stopping. In continental armies the rule is, in fact, "one army corps (= 2 British divisions) on one road." During the period of concentration, however, even if in movement, a modern army will necessarily be supplied in somewhat the same way as Napoleon's. The billets will be allotted "without subsistence," so the regimental officers will be called upon to ration their men, while all around the occupied towns and villages the supply officers and their mounted escorts will requisition food and vehicles to bring the food into the concentration area. In view of this, "supply officers will be sent on with cavalry or mounted brigades to investigate the resources of the country ahead of the main body, and if possible to collect supplies at suitable points." Only commissioned officers and, as a rule, only those officers to whom the power is expressly delegated are entitled to carry out requisitions, though in an emergency a commander of any rank may obtain from any inhabitant articles of the requisition. 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European, and to a large extent in other warfare, horseless transport by far the most generally used. Mechanical transport (generally either traction engines with trucks or motor lorries) is, however, superseding to a still greater extent horseless transport. The vehicle usually employed for military transport is the "General Service Wagon," a heavily-built springless four-wheeled vehicle drawn by six or four horses according to circumstances, with a weight of up to and over the allowances of a load of 30 cwt. There are also four-horse "limbered wagons" consisting of body and limber, weighing 13 cwt. empty and 43 cwt. fully loaded, and lighter two-wheeled carts which can take 3 cwt. empty or 15 cwt. load.

As regards organization and functions, road transport is used on the line of communications to supplement the railway, and consists of the General Service Corps or of civilian personnel under A.S.C. control. Transport with the field units is, as has been said, divided into first line, which accompanies the fighting troops, and second line, which finds them. The former is used exclusively by the A.S.C. (or regimental details in the case of regimental transport) and composed of regulation-pattern carts and wagons. The first-line vehicles include ammunition wagons and carts, tool carts, engineer vehicles and medical vehicles. All baggage and store and supply wagons, as well as a proportion of medical, ammunition and engineer vehicles, form the second line.

SUPRA-PERENAL EXTRACT. The extract of the suprarenal gland is one of the most valuable remedies recently introduced in medicine. Feeding with the fresh gland of sheep was at first practised, but the sterilized glycerin preparation known as supra-renal extract is now used, the dose being 5 to 15 minims. The active principle of the gland, best known as adrenaline or epinephrine, occurs only in the medulla of the gland. It forms minute white crystals, soluble in weak solutions of hydrochloric acid. The U.S.P. contains a desiccated preparation, Glandulae suprarenales siccae. Adrenaline is most frequently used in 1% solutions of the chloride.

Adrenaline has no action on the unbroken skin, but locally astringent properties, as well as the tonic and stimulant properties, are shown. On the other hand, the heart, when exposed, is much affected by adrenaline, owing to its powerful constriiction of the capillaries by stimulating the muscular fibres of the vessel walls. It acts rapidly in a similar manner when hypodermically injected. The vessels of the uterus are strongly acted upon by it, but the effect on the cerebral vessels is slight, and the pulmonary vessels are unaffected. The heart is slowed and the systole increased. Adrenaline stimulates the salivary glands. It also produces a temporary glycosuria. In poisonous doses it causes haemorrhages into the visera and oedema of the lungs.

In Addison's disease the use of supra-renal extract has been beneficial in some cases, but its effects in the cases of haemorrhage. For this purpose it is given in conjunction with local anaesthetics such as cocaine in order to produce bloodless operations on the eye, nose and elsewhere. It is also useful in haemorrhage from small vessels, when used as a在我的 bloodspot, as in epistaxis. In menorrhagia and menorrhagia it is also of use in surgical shock and in chlorform syncope an injection of adrenaline often saves life through the rise of blood pressure produced. An attack of bronchial asthma may be treated by an hypodermic injection of adrenaline solution. It should never be used in the treatment of haemoptysis. Similar commercial products on the market are hemins, renadrenaline, supraprene, adrenalin, paramepine and renostypting. Supra-nial snuff containing the dry extract with menthol and boracic acid is of use in hay fever. Rhizodine is of this type. Suppositories containing supra-renal extract are used to effect heating of the lower haemorrhage.

The chemistry of adrenaline has been mainly elucidated by the investigations of Pauli, Jowett and Bertrand; Jowett proposing a constitution (see annexed formula) which was early accepted in codification. Many substances having related constitutional constitutions have been synthetized, and it has been found that they resemble adrenaline in increasing the blood pressure. For example, the corresponding ketone, adrenaline obtained in 1904 by Stolz is active, and the methyl derivative (obtained by Schöpf) has an even greater activity, without destroying the potency. It seems that the para-hydroxyl group is essential. For instance, para-hydroxyphenylalanine, HO-CH(OH)-CH(NH_2)\_2, which is one of the active bases of ergot, clove, and cinchona bark, is not active. (Chem. Ber., 1909, 32, 95, pp. 1123, 1720; K. W. Rosenmund, Ber., 1909, 29, 278.) as does also its dimethyl derivative homoverine, an alkaloid found in the leaf of Rauwolfia (C. Ber., 1909, 29, 1393.). Adrenaline is optically active, the naturally occurring isomer being the laevorotatory form. It seems that, like nicotine, the laevo base has a much greater physiological activity than the dextro.

SUPREME COURT OF JUDICATURE, in England, a court of law established by the Judicature Act 1873, by section 3 of which it was provided that the high court of chancery, the courts of king's bench, common pleas, and exchequer, the high court of admiralty, the court of probate and the divorce court, should be united under this name. By section 4, the Supreme Court was to consist of two divisions, one to be called the "high-court of justice" and the other the "court of appeal." See further under JUDICATURE ACTS, and also the articles under the headings of the different courts enumerated above.

The Supreme Court of the United States is the head of the judicial branch of the Federal Government. It is established by article iii. of the Constitution, which states that the "judicial power of the United States shall be vested in one Supreme Court, and in such inferior courts as the Congress may from time to time ordain and establish." (s. i.) Section ii. states that the "judicial power shall extend to all cases in law and equity arising under this Constitution, the laws of the United States, and treaties made, or which shall be made, under their authority; to all cases affecting ambassadors, other public ministers and consuls; to all cases of admiralty and maritime jurisdiction; and on questions of public policy arising under such regulations as the Congress shall make." The Supreme Court of the United States also occupies the unique position of being guardian of the Constitution. It has to decide whether a measure passed by the legislative powers is unconstitutional or not, and it may thus have to veto the deliberate resolutions of both houses of Congress and the president.

See UNITED STATES.

SURABAYA (Dutch Soerabaja), a seaport of Java, in the eastern division of the island, on the narrow Surabaya strait, which separates the island of Madura from Java, and at the mouth of the Kali Maea river. Pop. (1900), 146,944. (Europeans 106; Chinese 38; Dutch 1.) This arrorable or "the real medina" of Java. Its town. Its roadstead is sheltered by Madura, and it has important dockyards. It is also the headquarters of the military authorities for East Java, and has artillery workshops. Railways running north-west, south-west and south give it connections throughout the island. In the old town, with its partly demolished fortifications, houses, shops and warehouses are more closely packed and the streets are narrower than in most East Indian towns, and, although a considerable number of Europeans live in this quarter, the outlying quarters, such as Simpang (where is the government house) and Tuntungan, are preferable for residence.

SURAJ-UD-DOWLAH (d. 1757), ruler of Bengal. The date of his birth is uncertain, but is generally placed between 1729 and 1736. His name was Mirza Mahommed, and he succeeded his grandfather Aliverdi Khan as nawab of Bengal on the 4th of April 1756. He was a cruel and profligate fanatic. Being offended with the English for giving protection to a native chief who had escaped with treasure from Dacca, he attacked and took Calcutta on the 18th of June 1756. He then permitted the massacre known in history as "The Black Hole of Calcutta" (see CALCUTTA). This atrocious act was soon avenged. Calcutta was retaken by Clive and Admiral Watson on the 2nd of January 1757, and on the 23rd of June, Suraj-ud-Dowlah, routed at Plassey, fled to Rajmahal, where he was captured. He was put to death on the 4th of July 1757 at Murshidabad, by order of Miran, son of Mir Jafar, who had conspired against Suraj-ud-Dowlah and had been present at Plassey without taking part in the battle.
SURAT, a city and district of British India in the northern division of Bombay. The city is on the site where the English first established a factory on the mainland, and so planted the seed of the British Empire in India. Local traditions fix the establishment of the modern city in the last year of the eighteenth century, and in 1814 the Portuguese traveller Barbosa described it as an important seaport, frequented by many ships from Malabar and all parts. During the reigns of Akbar, Jahangir and Shah Jahan it rose to be the chief commercial city of India. By the end of the 16th century the Portuguese were undisputed masters of the Surat seas. But in 1612 Captain Best, and after him Captain Downton, destroyed the Portuguese naval supremacy and obtained an imperial firman making Surat the seat of a presidency under the English East India Company, while the Dutch also founded a factory.

In 1664 Sir George Oxenden defended the factory against Sivaji with a bravery that deserves to rank with Clive's defence of Arcot. The prosperity of the factory at Surat received a fatal blow when Bombay was ceded to the Company (1668) and shortly afterwards made the capital of the Company's possessions and the chief seat of their trade. From that date also the city began to decline. At one time its population was estimated at 800,000, by the middle of the 19th century the number had fallen to 80,000; but in 1901 it had risen again to 119,306. Surat was taken by the English in 1759, and the conquerors assumed the undivided government of the city in 1800. Since the introduction of British rule the district has remained comparatively tranquil; and even during the Mutiny peace was not disturbed, owing in great measure to the loyalty of the leading Mahomedan families.

The city is situated on the left bank of the river Tapti, 14 m. from its mouth, and has a station on the Bombay, Baroda & Central India railway, 167 m. north of Bombay. A moat indicates the dividing-line between the city, with its narrow streets and handsome houses, and the suburbs, mostly scattered among cultivated lands; but the city wall has almost disappeared. On the river frontage rises the irregular picturesque fortress built about 1540. A fire and a flood in 1837 destroyed a great number of buildings, but there remain several of interest, such as the mosque of Nav Saiyid Salih, with its nine tombs, the Saiyid Edroos mosque (1634) and the ornate Mirza Sami mosque and tombs (1661). The principal monuments are the tombs of English and Dutch merchants of the 17th century, especially that of the Oxenden brothers. Surat is still a centre of trade and manufacture, though some of its former industries, such as ship-building, are extinct. There are cotton mills, factories for ginning and pressing cotton, rice-clearing mills and paper mills. Fine cotton goods are woven in hand-looms, and there are special manufactories of silk brocade and embroidery. The chief trades are organized in guilds. There are many wealthy Parsees, Hindu and Mahomedan merchants.

The District of Surat has an area of 1653 sq. m., and the population in 1901 was 617,079, showing a decrease of 2% in the decade. The district has a coast-line of 80 m., consisting of a barren stretch of sand drift and salt marsh; behind this is a rich, highly-cultivated plain, nearly 60 m. in breadth, at the mouth of the Tapti, but narrowing to only 15 m. in the southern part, and on the north-east are the wild hills and jungle of the Dans. The principal crops are millets, rice, pulses, cotton and a little wheat. After Surat city the chief centre of trade is Bulsar. The district is traversed by the main line of the Bombay & Baroda railways with a branch along the Tapti to Nadiad, and the Indian Peninsular Railway in Khandesh. Near the coast, under the influence of the sea breeze, an equable temperature prevails, but 8 to 11 m. inland the breeze ceases to blow. The coast also possesses a much lighter rainfall than the interior, the annual average ranging from 30 in. in Olpad to 72 in Chikhli, while at Surat city the average is 39 in.

The Surat Agency consists of three native states: Dhampur (q.v.), Bansda (q.v.) and Sachin, together with the tract known as the Dans. Total area, 1660 sq. m.; pop. (1901), 179,975. Sachin has a revenue of £17,000 and its chief is a Mahomedan.

SURFACE (Lat. super, whence the Fr. sur, above or upon, and base, q.v.), i.e. upper base, the term in architecture applied to what, in the fittings of a room, is called the chair-rail. It is also used to distinguish the cornice of a pedestal or podium and is separated from the base by the dado or plate.

SURBITON, an urban district in the Kingston parliamentary division of Surrey, England, 13 m. S.W. of Charing Cross, London; and the London & South-Western Railway. Pop. (1891), 12,178; (1901), 15,017. It has a frontage upon the right bank of the Thames, with a pleasant esplanade. The district is largely residential. Surbiton is the headquarters of the Kingston Rowing Club and the Thames Sailing Club.

SURETY, in law, the party liable under a contract of guarantee (q.v.). In criminal practice sureties bound by recognizance (q.v.) are a means of obtaining compliance with the order of a court of justice, whether to keep the peace or otherwise.

SURFACE, the bounding or limiting parts of a body. In the article Curve the mathematical question is treated from an historical point of view, for the purpose of showing how the leading ideas of the theory were successively arrived at. These leading ideas apply to surfaces, but the ideas peculiar to surfaces are scarcely of the like fundamental nature, being rather developments of the former set in their application to a more advanced portion of geometry; there is consequently less occasion for the historical mode of treatment. Curves in space are considered in the same article, and they will not be discussed here; but it is proper to refer to them in connexion with the other notions of solid geometry.

In plane geometry the elementary figures are the point, the line and the plane; and we then have the curve, which may be regarded as a singly infinite system of points, and also as a singly infinite system of lines. In solid geometry the elementary figures are the point, the line and the plane; we have, moreover, first, that which under one aspect is the curve and under another aspect the developable (or torse), and which may be regarded as a singly infinite system of points, of lines or of planes; and secondly, the surface, which may be regarded as a doubly infinite system of points or of planes, and also as a special triply infinite system of lines. The tangents lines of a surface are a special complex.) As distinct particular cases of the first figure we have the plane, which is the special case of the second figure the ruled surface, regulus or singly infinite system of lines; we have, besides, the congruence or doubly infinite system of lines and the complex or tripoly infinite system of lines. And thus the crowds of theories arise which have hardly any analogues in plane geometry; the relation of a curve to the various surfaces which can be drawn through it, and that of a surface to the various curves which can be drawn upon it, are different in kind from those which in plane geometry most nearly correspond to them—the relation of a system of points to the different curves through them and that of a curve to the systems of points upon it. In particular, there is nothing in plane geometry to correspond to the theory of the curves of curvature of a surface. Again, to the single theorem of plane geometry, that a line is the shortest distance between two points, there correspond in solid geometry two extensive and difficult theorems—that of the geodesic lines on a surface and that of the minimal surface, or surface of minimum area, for a given boundary. And it would be easy to say more in illustration of the great extent and complexity of the subject.

In Part I. the subject will be treated by the ordinary methods of analytical geometry; Part II. will consider the Gaussian treatment by differentials, or the E, F, G analysis.

Part I.

Surfaces in General; Torse, etc.

1. A surface may be regarded as the locus of a doubly infinite system of points—that is, the locus of the system of points determined by a single equation 

\[ U = (x^2 + y^2 + z^2)^{\frac{1}{2}} \]

between the cartesian co-ordinates (to fix the ideas, say rectangular co-ordinates) \( x, y, z \); or, if we please, by a single homogeneous relation 

\[ U = (x^2 + y^2 + z^2 + w^2)^{\frac{1}{2}} = 0 \]

between the quadricular co-ordinates \( x, y, z, w \).
The degree \( n \) of the equation is the order of the surface; and this definition of the order agrees with the geometrical one, that the order of the surface is equal to the number of the intersections of the tangent line with the surface. To make the foregoing point definition of the surface, we might develop the notions of the tangent line and the tangent plane; but it will be more convenient to consider the surface \textit{ab initio} from the more general point of view in its relation to the point, the line and the plane.

2. Mention has been made of the plane curve and the cone; it is proper to recall that the \textit{order} of a plane curve is equal to the number of the intersections of it with the tangent line at any point of the plane (the curve), and that its \textit{class} is equal to the number of tangents to the curve which pass through any given point of the plane. The cone is a figure correlative to the plane curve; corresponding to the plane of the curve we have the vertex of the cone, to its tangents the generating lines of the cone, and to its points the tangent planes to the cone; with a given point of view we may consider the generating lines of the cone as corresponding to the points of the curve and its tangent planes as corresponding to the tangents of the curve. From this point of view we define the \textit{order} of the cone as equal to the number of its intersections (generating lines) by an arbitrary plane through the vertex, and its \textit{class} as equal to the number of these tangent planes which pass through any given point of the cone. As a plane curve has singularities (singular points and singular tangents) so a cone has singularities (singular generating lines and singular tangent planes).

3. In order now a surface in connection with an arbitrary line. The line meets the surface in a certain number of points, and, as already mentioned, the \textit{order} of the surface is equal to the number of these intersections. We have therefore with the line a certain number of tangents to the surface, and the \textit{class} of the surface is equal to the number of these tangent planes.

But, further, through the line imagine a plane; this meets the surface in a number of points, and, as we have seen, through the point of contact passes a tangent line which is equal to each other. It may be noticed that for a general surface \((x, y, z, w)^n = 0\), of order \( n \) without point singularities the rank is \( n \); but that the class of the surface is equal to \( n(n-1)/2 \) (what is in fact the case) that the circumscribed cone has singularities, for otherwise its class, that is the class of the surface, would be \( 0(n-1)/2 \), which is not \( n(n-1)/2 \); in other words, the tangent plane of the point of contact of the tangent plane have been assumed as known, but they require to be further explained.

4. In reference to the original point definition of the surface. Speaking generally, we may say that the points of the surface consecutive to a given point on it lie in a plane which is the tangent plane at the given point, and conversely the given point is the point of contact of this tangent plane. This tangent plane is a tangent line touching the surface at the point of contact. Hence we see at once that the tangent line is any line meeting the surface in two consecutive point, or what is the same thing, the point of the surface is a general point of the tangent line as two intersections and in \( n-2 \) other points. But, from the foregoing notion of the tangent plane as a plane containing the point of contact and the consecutive points of the surface, the passage to another point of contact, and the tangent plane, can be made.

A plane in general meets the surface of the order \( n \) in a curve of that order without double points; but the plane may be such that the curve has a double point, and when this is so the plane is a tangent plane having the double point for its point of contact. The double point is either an accnode (isolated point), then the surface at the point in question is convex towards (that is, concave away from) the plane, or it is flat, then the surface in the tangent plane is an \( n-1 \) curve and the plane is tangent to the surface along the line of intersection of the tangent plane and the surface. In the first case there is only one tangent plane, viz., in the point of contact, which gives a plane double point as two intersections, and in \( n-2 \) other points; that is, we have the preceding definition of the tangent line.

5. The complete enumeration and discussion of the singularities of a surface is a question of extreme difficulty which has not yet been solved. A plane curve has point singularities and line singularities; corresponding to these we have for the surface isolated point singularities and isolated plane singularities, but also in the plane curve there are besides the singularities on or torse circumscribed to the surface, and it is among these that we have the non-special singularities which play the most important part in the theory. Thus the plane curve and the surface may be considered to be the same, and the order \( n \), has the non-special line singularities of inflexions and double tangents; corresponding to this the surface represented by the general equation \((x, y, z, w)^n = 0\), of any given order \( n \), has singularities of the isolated line singularities, but the continuous singularities of the spinode curve or torse and the node-couple curve or torse. A plane may meet the surface in a curve or plane, and it is easy to see that in each case there is a singly infinite system of such singular tangent planes, and the locus of the points of contact is the curve, the envelope of the tangent planes the torse. The reciprocal of the surface is therefore defined by the tangent planes; the surface may intersect or touch itself along a curve in such wise that, cutting the surface by an arbitrary plane, the curve of intersection has at each intersection of the plane with the curve on the surface \((1)\) a double point (node) or \((2)\) a cusp. Observe that these are singularities not occurring in the surface represented by the general equation \((x, y, z, w)^n = 0\); of any order; observe also that in this curve a tangent plane or tangent line is defined by cutting the surface by a plane on the surface, and in this way a different definition of the tangent plane must be modified. A tangent plane is a plane such that there is in the plane section a double point in addition to the nodes or cusps at the intersections with the singular lines of the surface.

6. As regards isolated singularities, it will be sufficient to mention the point singularity of the conical line (or cun-node) and the corresponding plane singularity of the conic of contact (or conic trope). In the former case we have a triple curve and a cone, instead of lying in a tangent plane, lie on a quadric cone, having the point for its vertex; in the latter case we have a plane touching a quadric cone in a conic trope, and such a plane must be taken to be the surface enveloped by the polar planes (in regard to a given quadric surface) of the points of the original surface; the surface is thus a cuneo surface in reference to the reciprocal relations of its order, \( n \), class, singularities, etc.

In either case we have a series of unaccented letters and a corresponding series of accented letters, and the relations between them are such that we may in any equation interchange the accented and the unaccented letters; in some cases an unaccented letter may be equal to the corresponding accented letter. Thus, let \( n' \) be as before the order and the class of the surface, but, instead of being continuous to the surface, let it be the order of the plane section and \( a' \) the order of the circumscribed cone; also let \( S, S' \) be numbers referring to the singularities. The form of the equations \( n'' = n'(n'-1)/2; \quad n'' = n'(b-1)/2 \), where the tangent planes of the tangent plane have been assumed as known, but they require to be further explained.

7. In reference to a curve in space in the same manner as a cone corresponds to a plane curve; although capable of representation by an equation \( U = (x, y, w)^n = 0 \), and so of coming under the foregoing point definition of a developable surface, it is an entirely distinct geometric concept. We may indeed, give surface, regard it as a surface characterized by the property that each of its tangent planes touches it, not at a single point, but along a line; this is equivalent to saying that it is the envelope, not of a single, but of an infinite system of tangent planes, or the equivalent of an \( n \) curve, which has been defined to be a singly infinite system of planes. But it is perhaps easier to regard it as the locus of a singly infinite system of lines, each line meeting the consecutive line, or, what is the same thing, the lines being tangent to the line it determines. And in general these lines are through two consecutive lines, or, what is the same thing, an osculating plane of the curve, whence also the tangent plane intersects the surface in the general line of contact, with a residue in the curve of the order \( n-2 \). The curve is said to be the edge of the surface which it encloses, and it is a cuspidal curve thereof; that is to say, any plane section of the developable has at each point a point of contact with the surface, or rather an infinite number; a sheet of paper bent in any manner without crumpling gives a developable.

1 In a plane curve the only singularities which need to be considered are those that present themselves in Pliicker's equations, for every higher singularity whatever is equivalent to a certain number of nodes, cusps, inflexions and double tangents. As regards a surface, no such reduction of the higher singularities has as yet been made.
but we cannot with a single sheet of paper properly exhibit the form in the neighbourhood of the edge of regression: we need two sheets connected along a plane curve, which, when the paper is bent, becomes a complete edge of regression and appears as a cuspal curve on the surface.

It may be mentioned that the condition which must be satisfied in order that the surface be determinate is $H(U) = 0$; that is, the Hessian or functional determinant formed with the second differential coefficients of $U$ must vanish in virtue of the equation $\frac{\partial U}{\partial x} = 0$, or, what is the same thing—$H(U)$ must contain $U$ as a factor. If in cartesian co-ordinates the equation is taken in the form $z = \frac{x}{a} = 0$, then the condition is $r = \frac{s}{a} = 0$ identically, where $a, b, c$ denote as usual the second differential coefficients of $a$ in regard to $x, y$ respectively.

Or consider the surface as the locus of a singly infinite system of lines, where the consecutive lines do not intersect; this is a true surface, for there is a doubly infinite series of tangents to each surface throughout the system. If $n$ is the rank of the lines, there is a tangent plane at the point on the line, and in such wise that, as the tangent plane turns about the line, the point of contact moves along the line.

The complex intersection of the surface is the tangent plane is made up of the unit line counting once and of a residual curve of the order $n - 1$. A quadratic surface is a regulus in a two-fold manner, for there are on the surface two systems of lines each of which passes through a point. A cubic surface may be a regulus (see below, par. 11).

**Surfaces of the Orders 2, 3 and 4.**

10. A surface of the second order or a quadratic surface is a surface such that every line meets it in two points, or—what comes to the same thing—such that every plane section thereof is a conic or quadric curve. Such surfaces have been studied in detail; we have the ellipsoid, the hyperboloid of two sheets, the hyperboloid of one sheet, the elliptic paraboloid and the hyperbolic paraboloid (see Geometry: § Analytical). A particular case of the ellipsoid is the sphere; in abstract geometry this is a quadric surface passing through a given quadric curve, the circle at infinity. The tangent plane of a quadric surface meets it in a quadric curve having a node, that is, in a pair of lines; hence there are on the surface two singly infinite sets of lines. Two lines of the same set do not meet, but each line of the one set meets each line of the other set; the surface is thus a regulus in a two-fold manner. The lines are real for the hyperboloid of one sheet and the elliptic paraboloid; for the other forms of surface they are imaginary.

11. We have next the surface of the third order or cubic surface, which has also been very completely studied. Such a surface may have 27 lines (as related cases with higher points of higher singularity), or it may have a nodal line; we have thus 21 or 22 cases. In the general case of a surface without any singularities, the order, rank and class are $a = 3, b = 6, c = 6$. If, however, we take a line of the general cubic surface lying through 15 planes, we have 45 lines, which are three tangent planes. Observe that the tangent plane is a plane meeting the surface in a curve having a node. For a surface of any given order $n$ there will be a certain number of planes each meeting the surface in a curve with $n$ nodes, that is, triple tangent planes; and, in the particular case where $n = 3$, the cubic curve with 3 nodes is of course a set of 3 lines; it is found that the number of triple tangent planes is, as just mentioned, $= 45$. This would give 135 lines, but through each line we have 5 such planes, and the number of lines is thus $= 27$. The theory of the 27 lines is an important one; we may state that we can, in thirty-six ways, select a system of $6\times 6$ lines, or "double sextet," such that no two of the lines are the same intersect each other, but that each line of the one set intersects each line of the other set.

A cubic surface having a nodal line is a ruled surface or regulus; in fact any plane through the nodal line meets the surface in a node, a line and a plane curve; and there is thus on the surface a singly infinite set of lines. These are called the regulus or ruled surface.

12. As regards quartic surfaces, only particular forms have been much studied. We have the surface at seven points (cnicnodes); an instance of such a surface is Fresnel's wave surface, which has 4 real cnicnodes in one of the principal planes, $4\times 2$ imaginary ones in the other two principal planes, or 9 imaginary ones in all 16 cnicnodes; the same surface has also $4+12$ imaginary planes each touching the surface along a circle (cnicnodes) in all 16 cnicnodes. It was easy by a mere homographic transformation to pass to the more general surface called the tetrahedroid; but this was itself only a particular form of the general surface of the fourth order, the general curves and 16 cnicnodes first studied by Kummer. Quartic surfaces with a smaller number of cnicnodes have also been considered.

Another very important form is the quartic surface having a nodal curve and a ruling, the so-called anallagmatic surface, or the Dupin cyclide (which includes the particular form called Dupin's cyclide). These correspond to the bicuspidate curve of plane geometry. Other forms of quartic surface might be referred to.

**Congruences and Complexes.**

13. A congruence is a doubly infinite system of lines. A line depends on four parameters or can be determined so as to satisfy four conditions; if only two conditions are imposed on the line we have a doubly infinite system of lines known as a congruence. For example the lines meeting each of two given lines form a congruence. It is hardly necessary to remark that, imposing on the line one more condition, we have a ruled surface or regulus; thus we can in an infinity of ways separate the congruence into a singly infinite system of regula or of torses (see below, par. 16).

Considering in connexion with the congruence two arbitrary lines, there will be in the congruence a determinate number of lines which are, for example, concurrent or co-planar, or make up a given surface, or are ruled and so forth. The order of the congruence is the number of number of congruence lines which is the class of the congruence. In other words, the order of the congruence is equal to the number of congruence lines lying in an arbitrary plane, and its class to the number of congruence lines passing through an arbitrary point.

The following systems of lines form each of them a congruence: (A) lines meeting each of two given curves; (B) lines meeting a given plane, each through a given point; (C) lines through a given surface; (D) lines touching each of two given surfaces; (E) lines touching a given surface twice, or, say, the bitangents of a surface.

The last case is the most general one; and conversely for a given congruence there will be in general a surface having the congruence lines for bitangents. This surface is said to be the focal surface of the congruence; the general surface with 16 cnicnodes first presented itself in this manner as the focal surface of a congruence. But the focal surface may degenerate into the forms belonging to the other cases A, B, C, D, E.

A complex is a simply infinite system of lines—for instance, the tangent lines of a surface. Considering an arbitrary point in connexion with the complex, the complex lines which pass through the point form a cone; considering a plane through the point, the complex lines of the plane envelop a curve. It is easy to see that the class of the curve is equal to the order of the cone; in fact each of these numbers is equal to the number of complex lines which lie in an arbitrary plane and pass through an arbitrary point of that plane; and we then have the equation of complex = order of curve; rank of complex = class of curve = order of cone; class of complex = class of cone. It is to be observed that, while for a conic there is in general a surface having the congruence lines for bitangents, for a complex there is not in general any surface having the complex lines for tangents; the tangent lines of a surface are thus only a special form of complex. The theory of complexes first presented itself in the researches of Malus on systems of rays of light in connexion with double refraction.

14. Analytical theory as well of congruences as of complexes is just as easily carried out by means of the six co-ordinates $a, b, c, f, g, h$. viz. there are co-ordinates $(a, b, c, f, g, h)$ connected by the equation $a b c + f g h + a f h + b g h + c f g + a b h + c f g + a b h + c f g + a f g = 0$, and therefore such that the ratios $a : b : c : f : g : h$ of any system of lines have thus a congruence of the order $n$ represented by a single homogeneous equation of that order $(a, b, c, f, g, h) = 0$ between the six co-ordinates; two such relations determine a congruence. But we have now to consider the case when $a, b, c, f, g, h$ are all zero, which presents itself in regard to curves in space; it is not every congruence which can be represented completely and precisely by two such equations (see Geometry: § Line).

For such a curve $a b c = 0$ represents a congruence of the first order or linear congruence; such congruences are interesting both in geometry and in connexion with the theory of forces acting on a rigid body.

**Curves of Curvature; Asymptotic Lines.**

16. The normals of a surface form a congruence. In any congruence the lines consecutive to a given congruence line do not
in general meet this line; but there is a determinable number of consecutive lines which do meet it; or, attending for the moment to only one of these, say the congruence line is met by a consecutive congruence-line. In particular, each normal is met by a consecutive normal; if it be met by a normal, the third equation which determines the normal is,

That is, we have a singly infinite system of normals each meeting the consecutive normal, and so forming a torse; starting from different normals successively, we obtain a singly infinite system of normals. Each of these will meet a consecutive normal, and, using in the construction first the one and then the other of these, we obtain two singly infinite systems of tores each intersecting the given surface at right angles. In other words, if in place of the normal we consider the point on the surface, we obtain on the surface two singly infinite systems of curves such that for any curve of either system the normals at consecutive points intersect the normal of the torse intersected, each normal the tores of the two systems intersect each other at right angles; and therefore for each point of the surface the curves of the two systems intersect each other at right angles. The two systems of curves are said to be the curves of curvature on the surface.

The normal is met by the two consecutive normals in two points which are the centres of curvature for the point on the surface; these lie on the line of the point or on opposite sides, and the surface has at this point in question like curvatures or opposite curvatures in the two cases respectively (see above, p. 17).

In immediate connexion with the curves of curvature we have the so-called asymptotic curves (Haupt-tangentenlinien). The tangent plane at a point of the surface cuts the surface in a curve; if we start from a normal of the surface, two directions of passage to a consecutive point, or, say, two elements of arc; and, passing along one of these to the consecutive point, we obtain the curve of curvature, or, as we say, obtain on the surface a curve. Starting successively from different points of the surface we thus obtain a singly infinite system of curves; or, using first one and then the other of the two directions of arc, we obtain a curve of curvature, or, as we say, a curve of curvature proceeding along the direction in the several tangent lines at the point. If, and, if the direction PP is given, the property given is constructed by successive elements of arc for the required geodetic line.

Considering the geodetic lines which proceed from a given point P of the surface, any particular geodetic line is or is not again intersected by the consecutive generating line; if it is thus intersected, the generating line is a shortest line on the surface up to, but not beyond, the point at which it is first intersected by the consecutive generating line; if it is not intersected, it continues a shortest line for the whole course.

In the analytical theory both of geodetic lines and of the curves of curvature, and in other parts of the theory of surfaces, it is very convenient to consider the three coordinate co-ordinates x, y, z. We have the surface given as functions of two independent parameters p, q; the form of these functions of course determines the surface, since by the elimination of p, q from the three equations we obtain the equation in the two variables x, y, z.

We have for the geodetic lines a differential equation of the second order between p and q; the general solution contains two arbitrary constants, and is thus capable of representing the geodesics. If p, q, r, s are the first and the second differential coefficients of z in regard to x, y, respectively, the equation (as first shown by Lagrange) is

\[
\frac{\partial}{\partial x} (1+p^2) + \frac{\partial}{\partial y} (1+q^2) = 0,
\]

The Minimal Surface.

24. This is the surface of minimum area—more accurately, a surface such that, for any indefinitely small closed curve which can be drawn on it round any point, the area of the surface is less than the second and third equations of the given singular set of surfaces. If, to fix the ideas, f_1, f_2, f_3 are taken to denote each a rational and integral function of x, y, z, then two surfaces of the same set will not intersect each other, and through a given point of the surface, there will pass one, and only one, surface of the set which will be determined as a point of intersection of three surfaces belonging to the three sets respectively; moreover, the whole space will be divided by the three sets of surfaces into a triply infinite system of elements, each of them being a parallelepiped.

Orthotomic Surfaces; Parallel Surfaces.

20. The three sets of surfaces may be such that the three surfaces through any point of space whatever intersect each other at right angles; and they are in this case said to be orthotomic. The term is for any other surfaces almost through the closed curve. In this theory is chiefly due, to the case in question: assuming that the equations \( p=f(x, y, z), q=g(x, y, z), r=f(x, y, z) \), which express curves of that of surfaces, we have in the restricted sense p, q, r as the curvilinear-coordinates of the point.

An interesting special case is that of confocal quadric surfaces. The general equation of a surface confocal with the ellipsoid

\[
\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1 = \frac{x^2}{a^2 + b^2} + \frac{y^2}{b^2 + c^2} + \frac{z^2}{c^2 + a^2} = 1;
\]

and, if in this equation we consider x, y, z as given, we have for a cubic equation with three real roots p, q, r, and thus we have through the point three real surfaces, one an ellipsoid, one a hyperboloid of one sheet, and one a hyperboloid of two sheets. In the case of the plane, it is connected with that of curves of curvature by Dupin's theorem. Thus in any system of orthotomic surfaces each point of one of the three sets is intersected by the surfaces of the other two sets, and the surfaces of the other two sets are called confocal surfaces of the first kind, depending on the square root of a sextic function.

Curvilinear Co-ordinates.

19. The expressions of the co-ordinates x, y, z in terms of p, q may contain a parameter r, and, if this is regarded as a given constant, these expressions will as before refer to a point on a given surface. If it be required to represent the curvilinear co-ordinates x, y, z will be the co-ordinates of a point in space, determined by means of the three parameters p, q, r; these parameters are said to be the curvilinear co-ordinates, or (in a general sense) the co-ordinates of the point. We arrive otherwise at the notion by taking p, q, r each as a given function of x, y, z; say we have p = f(x, y, z), q = g(x, y, z), r = h(x, y, z), which equations of course lead to expressions for p, q, r each as a function of x, y, z. The first equation determines a singly infinite set of surfaces; for any given value of p we have a surface; and similarly the second and third equations determine a singly infinite set of surfaces. If, to fix the ideas, f_1, f_2, f_3 are taken to denote each a rational and integral function of x, y, z, then two surfaces of the same set will not intersect each other, and through a given point of the surface, there will pass one, and only one, surface of the set which will be determined as a point of intersection of three surfaces belonging to the three sets respectively; moreover, the whole space will be divided by the three sets of surfaces into a triply infinite system of elements, each of them being a parallelepiped.
of necessity a single curve: it may be, for instance, a skew polygon of four or more sides.

The partial differential equation was dealt with in a very remarkable manner by Riemann. From the second form given above it appears that we have \( \sqrt{\xi^2 + \eta^2} = \text{constant} \) as a complete differential, or, putting this \( = \xi, \eta \), we introduce into the solution a variable \( \psi \) which combines with \( x \) in the forms \( x = \xi, \eta \). The boundary conditions have to be satisfied by the determination of the conjugate variables \( \eta, \xi \) as functions of \( z, x \); \( z, x \); or, say, of \( Z, x \), respectively, and by writing \( S, S' \) to denote \( x + iy, x - iy \), we obtain finally two of the differential equations of the first order in \( S, S', \eta, \xi, \eta, \xi \), and the results are completely worked out in some very interesting special cases.

(A. C. A.)

PART II.

We proceed to treat the differential geometry of surfaces, a study founded on the consideration of the expression of the lineal element in terms of two parameters, \( u, v \),

\[ ds^2 = Edu^2 + 2Fdudv + Gdv^2, \]

\( u = \text{const}, v = \text{const}, \) being thus systems of curves traced on the surface. This method, which may be said to have been inaugurated by Gauss in his classical paper published in 1828, *Disquisitiones generales circa superficies curvas*, has the great advantage of dealing in the most natural way with all questions connected with geodesics, geodesic curvature, geodesic circles, &c. In short, all relations of lines on a surface which can be formulated without reference to anything external to the surface are established. It is not always possible to deduce the properties of the surface from the properties of the curves which represent it on the surface, but it can be at once generalized in their application holding good for any other surface which has the same expression for its lineal element; e.g., relations involving great circles and small circles on a sphere furnish us with corresponding relations for geodesics and geodesic circles on any syndetic surface of constant specific curvature.

1. Gauss begins by introducing the conception of the integral curve (curvatura integra) of any portion of a surface. This he defines to be the area of the corresponding portion of a sphere of unit radius, traced out by a radius drawn parallel to the normal at each point of the surface; i.e., it is \( \int ds/RR' \) where \( R, R' \) are the principal radii of curvature. The quotient obtained by dividing the integral curvature of a small portion of the surface round a point by the area of that portion, that is \( 1/RR' \), he naturally calls the measure of curvature or the specific curvature at the point in question.

He proceeds to establish his leading proposition, that this specific curvature is a constant for a given point in surface, 

\[ \frac{\xi}{P} = \text{constant} \]

or, 

\[ \xi = \text{constant} \times \frac{P}{\xi}. \]

This, as we shall see, is the expression of the fundamental property of the geodesics on such surfaces. The following are some of the well-known classes for which this integral has been obtained: (1) quadrics; (2) developable surfaces; (3) surfaces of revolution.

In a later part of the 19th century a special study of the geometry of the lines of curvature and the geodesics on quadrics, and were rewarded by the discovery of many wonderfully simple and elegant analogies between the properties of geometrical and the systems of confocal conics and their tangents in \( \text{plano} \). As explained above, the lines of curvature on a quadric are the systems of orthogonal curves formed by its intersection with the two systems of confocal quadrics. Jacobi showed that the interpretation of the first integral of the equation for geodesics on a central quadric is, that along a geodesic \( \phi = \text{constant} \), \( \phi \) denoting the perpendicular let fall from the centre on a plane through the tangent plane at the point of intersection, the element of the geodesic, the envelope of all geodesics having the same \( \phi \) being a line of curvature. In particular, all geodesics passing through one of the real umbilics (the four points where the indicatrix is a circle) have the same \( C \).

Michael Roberts pointed out that it is an immediate consequence of the equation \( \phi = \text{constant} \), that if two umbilics, \( A \) and \( B \) (selecting two not diametrically opposite), be joined by geodesics to any point \( P \) on a given line of curvature, they may be made angles with such line of curvature, and consequently that, as \( P \) moves along a line of curvature, either \( PA + PB \) or \( PA - PB \) remains constant.

Or, conversely, that the locus of a point \( P \) on the surface, for which the sum of the difference of the geodesic distances \( PA \) and \( PB \) is constant, is a line of curvature. It follows that if the ends of a string be fastened at the two umbilics of a central quadric, and a style move on the surface keeping the string always stretched, it will describe a line of curvature.

Another striking analogy is the following: As in \( \text{plano} \), if a variable point or an ellipse be joined to the two focal \( S \) and \( H \),
tan $\frac{1}{2}$ PSH $=\tan \frac{1}{2}$ PHS = const, and for the hyperbola tan $\frac{1}{2}$ PSH $=\tan \frac{1}{2}$ PHS $=\cos t$, so for a line of curvature on a central quadric, if $P$ be joined to two umbilics $S$ and $H$ by geodetics, either the product or the ratio of the tangents of $\frac{1}{2}$ PHS and $\frac{1}{2}$ PHS will be constant.

Chasles proved that if an ellipse be intersected in the point $A$ by a confocal hyperbola, and from any point $P$ on the hyperbola tangents $PT$, $PT'$ be drawn to the ellipse, then the difference of the arcs of the ellipse $TA$, $TA'$ = the difference of the tangents $PT$, $PT'$; and subsequently Graves showed that if from any point $P$ on the outer of two confocal ellipses tangents be drawn to the inner, then the excess of the sum of the tangents $PT$, $PT$ over the intercepted arc $TT'$ is constant. Precisely the same theorems hold for a quadric replacing the confocals by lines of curvature and the rectilinear tangents by geodetic tangents. Hart still further developed the analogies with confocal conics, and established the following: If a geodetic polygon circumscribe a line of curvature, and all its vertices but one move on lines of curvature, this vertex will also describe a line of curvature, and when the lines of curvature all belong to the same system the perimeter of the polygon will be constant.

2. Geodetics on Developable Surfaces.—On these the geodetics are the curves which become right lines when the surface is unrolled into a plane. From this property a first integral can be immediately deduced.

3. Geodetics on Surfaces of Revolution.—In all such the geodetics are the curves given by the equation $r \sin \phi = \text{const}$, $r$ being the perpendicular on the axis of revolution, $\phi$ the angle at which the curve crosses the meridian.

The general problem of the determination of geodetics on any surface can be treated by a method in connection with that of "parallel" curves. By "parallel" curves are meant curves whose geodetic distances from one another are constant—in other words, the orthogonal trajectories of a system of geodetics. Applying this method the determination of a system of parallel curves comes first, and the determination of the geodetics to which they are orthogonal follows as a deduction. If $\phi (u, v) = \text{const}$ be a system of parallel curves, it is shown that $\phi$ must satisfy the partial differential equation

$$E \left( \frac{\partial^2 \phi}{\partial u^2} \right)^2 - 2F \left( \frac{\partial^2 \phi}{\partial u \partial v} \right) + G \left( \frac{\partial^2 \phi}{\partial v^2} \right)^2 = \text{EG} - \text{F}^2.$$  

If $\phi (u, v, a) = \text{const}$ be a system of parallel curves satisfying this equation, then $a \partial \phi/\partial a = \text{const}$ is proved to represent the orthogonal geodetics. The same method enables us to establish a result first arrived at by Jacobi, that whenever a first integral of the differential equation for geodetics can be found, the final integral is always reducible to quadratures. In this method $\phi$ corresponds to the characteristic function in the Hamiltonian dynamics, the geodetics being the paths of a particle confined to the surface when no extraneous forces are in action.

The expression for the lineal element on a quadric in elliptic co-ordinates suggested to Liouville the consideration of the class of surfaces for which this equation takes the more general form $ds^2 = (U - V)(Uu^2d\alpha^2 + Vv^2d\beta^2)$, where $U$, $V$ are functions of $u$, and $V, V$, functions of $v$ and $w$, in this class, the first integral of the equation of the parallels is immediately obtainable, and hence that of the corresponding geodetics. It is to be remarked that for this general class of surfaces the theorems of Chasles and Graves in these points, and the lineal element denoted by a point whose geodetic distance from a given point is constant; and, second, the curves of constant geodetic curvature.

On certain surfaces the curves which satisfy one of these conditions also satisfy the other, but in general the two curves must be carefully distinguished. The property involved in the second definition is more intrinsic, and we shall therefore, following Liouville, call the curves possessing it geodetic curves.

It may be noted that geodetic circles, except surfaces of constant specific curvature, do not return back upon themselves like circles in plane. As a particular instance, a geodetic on an ellipsoid (which is, of course, a geodetic circle of zero specific curvature), starting from a point, returns back upon itself in the same direction. Gauss showed from the fundamental property of a geodetic that this curve resembles the plane circle in being everywhere perpendicular to its radius. In the same way it holds that the curve described by a point the surface (or difference) of whose geodetic distances from two given points (foci) is constant, resembles the ellipse (or hyperbola) in the property that it bisects at every point the external (i.e., internal) angle between the geodetic focal radii, and, as a consequence, that the curves on an oval answering to confocal ellipses and hyperbolas intersect at right angles. The equation for the first integral of this element enables us to discuss geodetic circles on surfaces of constant specific curvature; for we have seen that if we choose as parameters geodetics and their orthogonal trajectories, the equation becomes $ds^2 = du^2 + Pdu^2$; and since $(RR')^2 = P^2 + P'd$, and here $(RR')^2 = P^2 + P'd$, it follows $P = A \cos u + B \sin u$, or $P = A \cosh u + B \sinh u$, according as the surface is synclastic or anticlastic. If a geodetic circle (curve $k^2$) is chosen for the starting curve $u = 0$, and if $v$ be made the length of the arc $OY$ intercepted on this circle by the curve $u = \text{const}$ (see fig. 1), then $A$ and $B$ can be proved to be independent of $u$ and $P = \cos u + A \sin u$ for a synclastic surface, and $P = A \cosh u + B \sinh u$ for an anticlastic surface. It follows from the expression for the geodetic curvature $r = \frac{1}{2}dP/du$ that in both classes of surfaces all the other orthogonal circles $u = \text{const}$ will be geodetic circles. It also appears that on a synclastic surface of constant specific curvature all the geodetics normal to a geodetic circle converge to a point on either side as on a sphere, and can be described with a stretched string taking either of these points as centre, the length of the string being $a \tan \theta = \text{see fig. 2}$. These normals will be all cut orthogonally by an equator, that is, by a geodetic circle of zero curvature.

For anticlastic surfaces, however, we must distinguish two cases. If the curvature $k^2$ of the geodetic circle $> a^2$, the geodetic normals meet a point on the concave side of the geodetic circle, and can be described as on the synclastic by a stretched string, the length of the string being $a \tan \theta = \text{fig. 4}$. But in this case the geodetic normals have no such property (see fig. 3). If on the other hand the curvature of the geodetic circle be $< a^4$, the normals do not meet on either side, but do possess an equator, and at this equator the geodetic normals come nearer together than they do anywhere else (see fig. 4).

On a synclastic surface of constant specific curvature $a^2$, two near geodetics proceeding from a point always meet again at the geodetic
distance \( r_a \); and more generally for any synclastic surface whose specific curvature at every point lies between the limits \( a^2 \) and \( b^2 \) a near geodetics proceeding from a point always such again at a geodetic distance intermediate in value between \( r_a \) and \( r_b \). On an anticlastic surface two near geodetics proceeding from a point never meet again.

**Fig. 5.**

\[ z = \omega \sin \phi, \quad \varphi = \cos \phi + \log \tan \frac{\phi}{2}. \]

This surface can be conformably represented as a plane map by choosing \( x' = \omega \) where \( \omega \) is the longitude of the point and \( y' = \omega \sin \phi \). It will then be found that \( ds = dx' / \sqrt{y'} \), where \( ds = \text{linear element on the surface, } dx' = \text{same on the map} \). It easily appears that geodetic circles on the surface are represented by circles on the map, the angle \( \psi \) at which these circles cut the base depending only upon the curvature of the geodetic circle, cos \( \psi \) being equal to \( p^2 \). As a particular case it follows that the geodetics on the surface are represented by those special circles on the map whose centres lie on the base (see fig. 6). The geodetic lines passing through \( P \) and \( Q \) on the surface is represented by the logarithm of the anharmonic function \( AP : BO' \), where \( P'Q' \) are the representing points on the map, \( A' \) the points in which the circle on the map passes through \( P' \) and \( Q' \) and has its centre on the base cuts the base. The perimeter \( l \) of a geodetic circle of curvature \( p^3 \) turns out to be \( 2 \pi \sqrt{\ln (a^2 - \rho^2)} \), and its area \( (\pi^2 - \pi) \rho^2 \).

**Fig. 6.**

The geometry of coaxial circles in plane accordingly enables us to demonstrate anew by means of the theorems of the present theory that we have shown to hold good in all anticlastic surfaces of constant curvature. Thus the system of geodetics cutting orthogonally a geodetic circle \( C \) will be represented by the hyperboloidal system of lines cutting a given circle \( C \) orthogonally, i.e., by a coaxial system of circles. We know that the other orthogonal trajectories of this last system are another coaxal system, and therefore, going back to the pseudosphere, we learn that the lines represented by these geodetics can be drawn normal to a geodetic circle, all the orthogonal to this system are geodetic circles. It is to be noted that while every point on its surface is represented on the map, the converse does not hold. It is only points lying above the line \( y' = a \) which have their prototypes on the surface, the portion of the plane below this line not answering any prototypes on the surface.

**Representations of Figures on a Surface by Corresponding Figures on a Plane; Theory of Maps.**

The most valuable methods of effecting such representation are those in which small figures are identical in shape with the figures which they represent. This property is known to belong to the representation of a spherical surface by Mercator's method as well as to those of a cylindrical surface by stereographic projection. The problem of effecting this "conformable" representation is easily seen to be equivalent to that of throwing the expression for the lineal element into what is known in the theory of heat conduction by the isotropical formalism \( ds = \sqrt{\Delta x^2 + \Delta y^2} \). We shall always choose for the representing point on the plane that whose rectangular co-ordinates are \( z = u, \ y = v \). A curious investigation has been made by Beltrami—when it is possible to represent a surface on a plane in such a way that the geodetics on the surface shall correspond to the right lines on the plane (as, for example, holds true when a spherical surface is projected on a plane by lines through its centre)? He has proved that the only class of surfaces for which such representation is possible is the class of uniform specific curvature.

Just as the intrinsic properties of a synclastic surface of uniform specific curvature are reducible to those of a particular surface of this type, so the sphere, so we can deal with an anticlastic surface of constant specific curvature, and reduce its properties to a particular anticlastic surface. A convenient surface to study for this purpose is that known as the pseudosphere, formed by the revolution of the tractrix (an involute of the catenary) round its base (see fig. 5). Its equations are \( r = a \sin \varphi, \quad \varphi = \cos \varphi + \log \tan \frac{\varphi}{2} \). This surface can be conformably represented as a plane map by choosing \( x' = \omega \sin \varphi \), where \( \omega \) is the longitude of the point and \( y' = \omega \sin \varphi \). It will then be found that \( ds = dx' / \sqrt{y'} \), where \( ds = \text{linear element on the surface, } dx' = \text{same on the map} \). It easily appears that geodetic circles on the surface are represented by circles on the map, the angle \( \psi \) at which these circles cut the base depending only upon the
surface, and two systems on the second, such that the equation for the lineal element, when referred to these, may have an identical form for the two surfaces. The problem is now to select these corresponding elements. Now, let us consider the curve $u$ the specific curvature on each surface, and choose for $v$ the function $du/du$ which denotes the rate of increase of $u$ along a direction normal to the curve $u = const$. Then, since at corresponding points both $u$ and $v$ will be the same for one surface as for the other, if the surfaces are applicable, $E$, $F$, and $G$, in the equation $ds^2 = Edu^2 + 2Fdu dv + Gdv^2$, must be identical for the two surfaces. Clerk Maxwell has put the geometrical relation which exists between two applicable surfaces following this idea. If any two such surfaces, $P$ and $P^\prime$, be such, it is always possible to draw two elements through $P$ parallel to conjugate semi-diameters of the indicatrix of the corresponding element on $P^\prime$, that will be parallel to conjugate semi-diameters of the indicatrix at $P^\prime$. The curves made up of all these elements will divide the two surfaces into small parallelograms, the four parallelograms having $P$ as a common vertex being identical in size and shape with the four having $P^\prime$ as vertex. Clerk Maxwell regards the surfaces as made up in the limit of these small parallelograms. Now, in order to render these surfaces ready for application, the first step would be to alter the angle between two of the planes of the parallelograms at $P$, so as to make it equal to that between the corresponding planes at $P^\prime$. If this be done, it is readily seen that all the angles between the other planes at $P$ and $P^\prime$, corresponding to those at $P$, will be altered also. The curves which thus belong to the conjugate systems common to the two surfaces may be regarded as lines of bending.

2. Any surface of uniform specific curvature, whether positive or negative, may be obtained in two methods similar to these for the same uniform specific curvature in an infinite variety of ways. For if we arbitrarily choose two points, $0$ and $O'$, one on each surface, and two elements that touch the surfaces, making $O$ and $O'$ corresponding points and the other curves passing through these elements. This follows from the form of the equation of the lineal element, which is for synclastic surfaces $ds^2 = ds' + d^2$ sin($\varphi(s-a)$) $d\varphi$, and for anticlastic surfaces $ds^2 = ds' + d^2$ cos($\varphi(s-a)$) $d\varphi$. This is therefore identical for the two surfaces in question. Again, a ruled surface may evidently be deformed by first rotating round a generator, the portion of the surface lying to one side of this generator, then round the other side, but each generator, the portion of the surface lying to one side, and so on. It is clear that in such deformation the rectilinear generators in the old surface remain the rectilinear generators in the new; it is only necessary to note that areas and volumes of the surfaces can be constructed which shall be applicable, yet so that the generators will not correspond. For, do a hyperboloid of one sheet in the manner described, turning the portions of the surface round the rectilinear generators of one system, and then do the hyperboloid, using the generators of the other system. The two surfaces so obtained are, of course, applicable to one another, yet so that their generators do not now correspond. Conversely Barden has shown that any surfaces in such a manner applicable, without correspondence of generators, must be both applicable to the same hyperboloid of one sheet. The alysseide is a good example of this, revolving a portion of a ruled surface in this case the right circular conoid, the generators of the conoid coinciding with the meridians of the alysseide.

3. As instances of surfaces applicable to themselves, we may take surfaces of uniform specific curvature, which are thus applicable, without correspondence of generators. Two surfaces in such a manner applicable, having given a screw motion round a fixed axis, or, which comes to the same thing, the surface made up of a system of helices starting from the points of a given curve all turning along the same axis in the same direction, will in the end be identical between the successive threads. The applicability of such a surface to itself, if given a screw motion round the axis, is evident from the law of its formation.

A possible small variational $\varepsilon, \eta, \xi$ of the points of the surface when it is subject to a small inextensible deformation are conditioned by the equation $dx dy + dy dz + dz dx = 0$, or making $x$ and $y$ the independent variables, $d^2 x + d^2 y + d^2 z = 0$. From this it follows that the three equations must separately hold $\frac{d^2 x}{d\xi^2} + \frac{d^2 y}{d\eta^2} + \frac{d^2 z}{d\varepsilon^2} = 0, \frac{d^2 x}{d\eta^2} + \frac{d^2 z}{d\varepsilon^2} = 0, \frac{d^2 y}{d\varepsilon^2} + \frac{d^2 z}{d\eta^2} = 0$. Accordingly, the determination of a possible small deformation of a given surface is subject to the application of the same definite functions $\varepsilon, \eta, \xi$ of the variables $x$ and $y$ to satisfy these equations. Changing the co-ordinates to $\alpha$ and $\beta$ where $\alpha = const., \beta = const.$, are the curves of inflexion on the surface, the solution of the equations can be found by supposing that of the equation $d^2 x = 0$ when $\lambda$ is a function of $\alpha$ and $\beta$ depending on the form of the surface. The last equation can be integrated, and the possible deformation determined in the case of a spherical surface, or of any surface of uniform specific curvature. It is easily shown that if we have determined the displacements for any surface $S$ we can do so for any surface obtained from $S$ by a linear transformation of the variables.

For $x = ax = by = cz + d$, $y = ax = by = cz + d$, $z = ax = by = cz + d$, then the displacements $\varepsilon = \frac{A}{2} + B + C$, $\eta = -A + B + C$, $\xi = A + B + C$, then $\frac{\partial A}{\partial a} + \frac{\partial B}{\partial b} + \frac{\partial C}{\partial c} = 0$. Accordingly the known solution for a surface furnishes us with a solution for any quadric. Moutard has pointed out a curious connexion between the problem of small deformation and that of the applicability of two infinitely different surfaces.

$d^2 x + d^2 y + d^2 z = 0$, that if $k$ be any constant, $d^2 x + d^2 y + d^2 z = 0$.

Consequently, if we take two surfaces such that for the first $X = x + k$, $Y = y + k$, $Z = z + k$, then

$X = x - k$, $Y = y - k$, $Z = z - k$,

and for the second

$2X - y + z = 2X - y + z = 0$,

and therefore the new surfaces are applicable.

5. Jellett and Clerk Maxwell have shown by different methods that, if a curve on a surface be held fixed, there can be no small deformation, except this curve be a curve of inflexion. This may be also proved thus: There can be no displacement of the tangent planes along the fixed curve, for, at any point of the curve the geodesic curvature cannot alter; but in present case the ordinary curvature of the curve is also fixed, therefore their ratio is constant, so that $\kappa/\rho = -\sin \theta d\theta = 0$, where $\theta$ is the angle which the osculating plane makes with the tangent plane; therefore unless sin $\theta = 0$, as it is along a curve of inflexion, $d\theta = 0$, and therefore the tangent plane at each point is unaltered. Hence it can be shown that along the given curve not only $\kappa$ is zero, but also their differential coefficients of all orders, and therefore no displacement is possible.

The question has been much discussed: Can a closed synthetic surface be deformed into a new one, such as to be a prevalent opinion amongst mathematicians that such deformation is always impossible, but we do not think any unimpeachable demonstration of this has yet been given. It is certain that a complete spherical surface does not admit of inextensible deformation, for if it did it would follow from Gauss's theorem that the new surface would have a uniform specific curvature. Now, it is not difficult to prove that the only closed surface possessing this property is the sphere itself, provided that the given surface is such that all their tangent planes lie entirely outside them. We can then, by the method of linear transformation already given, extend the theorem of impossibility of deformation to any ellipsoid.

The theorem is that if $S$ be the given surface of constant specific curvature $\kappa$, we may, suggest, be established by means of the following two propositions, which hold for integration on any coordinate system, being the perpendicular from the origin on the tangent plane:

$\int (R + n/R) ds = 2 \int pds/R'$

$2 \int ds = \int p(1 + R)/R ds$.

Now multiply both sides of the first equation by the constant $\sqrt{R'}$, and subtract the second, and we get:

$\int (R/R + 1/R') ds + \int p(R/R - 1/R') ds = 0$

which is impossible unless $R' = R$ everywhere, since in accordance with the proviso $p$ is everywhere positive.

Theorems (1) and (2) are deduced by Jellett by means of the calculus of variations in his treatise on the subject. They may also be very simply proved thus: Draw normals to the surface along the contours of the small squares formed by lines of curvature, and let these meet successive parallel surfaces at distances $d\lambda$, then the volume bounded by two parallel surfaces

$\int dS \int_0^\lambda \sin (n + 1/R)(1 + n/R) ds$

and for outer surface $S = \int_0^{R'} \sin (1 + 1/R') ds$.
SURGE—SURGERY

Hence equating coefficients of the powers of \( n \):

\[
\int \left( \frac{2}{(1 + R/1/R)S} \right) = \frac{2}{R},
\]

and

\[
\int 1 = \int R = \frac{R}{1/R + 1/R}.S
\]

References to the original memoirs will be found in Salmon's "Arithmetical Geometrical and Algebraical Propositions for Dimensions", Frost's "Solid Geometry and, more completely, in Darbois's "Lesons sur la théorie générale des surfaces."

SURGE, in meteorology, an irregular fluctuation of the barometer, extending over a long period (e.g. a month), in contradistinction to the shorter fluctuations, covering two or three days, caused by alternating conditions of high and low pressure. The cause of surges is not understood.

SURGERY (Fr. chirurgie, fro Gr. χειρουργός, i.e. hand-work), the art of the surgeon (chirurgien), connected specially with the cure of diseases or injuries by operative manual and instrumental treatment.

History.—Surgery in all countries is as old as human needs. A certain skill in the stanching of blood, the extraction of arrows, the binding up of wounds, the supporting of broken limbs by splints, and the like, together with an instinctive reliance on the healing power of the tissues, has been common to men everywhere. In both branches of the Indo-European stock surgical practice (as well as medical) reached a high degree of perfection at a very early period. The controversy whether the Greeks got their medicine (or any of it) from the Hindus (through the medium of the Egyptian priest-hood), or whether the Hindus owed that high degree of medical and surgical knowledge and skill which is reflected in Charaka (1st century A.D.) and Suśruta (2nd century) (commentators of uncertain date on the Yajur-Veda) to their contact with Western civilization after the campaigns of Alexander. The evidence in favour of the former view is ably stated by Wise in the Introduction to his "History of Medicine Among the Asians" (London, 1868). The correspondence between the "Susruta" and the Hippocratic Collection is close, the latter being related to the ethics of medical practice; the description, also, of lithotomy in the former agrees almost exactly with the account of the Alexandrian practice as given by Celsus. But there are certainly some dexterous operations described in Suśruta (such as the rhinoplastics) which were of native invention; the elaborate and lofty ethical code appears to be of pure Brahmanical origin; and the copious materia medica (which included arsenic, mercury, zinc, and many other substances of permanent value) does not contain a single article of foreign source. There is evidence also (in Arrian, Strabo and other writers) that the East enjoyed, under the pressure of medical and surgical wisdom at the time of Alexander's invasion. We may give the first place, then, to the Eastern branch of the Indo-European stock in a sketch of the rise of surgery, leaving as insoluble the question of the date of the Sanskrit compendiums or compilations which pass under the names of two representative persons, Charaka and Suśruta (the dates assigned to these ranging as widely as 500 years on each side of the Christian era).

The Suśruta speaks throughout of a single class of practitioners who undertook both surgical and medical cases. Nor were there any fixed degrees or orders of skill within the profession; even lithotomy, which at Alexandria was assigned to specialists, was to be undertaken by any one, the leave of the raja having been first obtained. The only distinction recognized between medicine and surgery was in the inferior order of barbers, nail-trimmers, ear-borers, tooth-drawers and phlebotomists, who were outside the Brahmanical caste.

Suśruta describes more than one hundred surgical instruments, made of steel. They should have good handles and firm joints, be well polished, and sharp enough to divide a hair; they should be perfectly clean, and kept in a box made of wood. They included various shapes of scalpels, bistouries, lances, scarifiers, saws, bone-nippers, scissors, trocars and needles. There were also blunt hooks, loops, probes (including a caustic-holder), directors, sounds, scoops and forceps (for polypus, &c.), as well as catheters, syringes, a rectal speculum and bougies. There were fourteen varieties of bandage. The favourite form of splint was made of thin slips of bamboo bound together with string and cut to the length required. Wise says that he had frequented "this admirable splint," particularly for fractures of the thigh, humerus, radius and ulna, and it was subsequently adopted in the English army under the name of the "patent ratten-cane splint."

Fractures were diagnosed, among other signs, by crepitus. Dislocations were elaborately distinguished and classified, and given the treatment was by traction and countertraction, circumduction and other dexterous manipulations. Wounds were divided into incised, punctured, lacerated, contused, &c. Cuts of the head were particularly recommended. When a patient was about to be operated upon, he was asked whether he knew his disease; and to a great height, the magnet being used for iron particles under certain specified circumstances. Inflammations were treated by the usual antiphlogistic regimen and appliances; venesection was applied in several cases, and antiphlogistic dressings, and leeches were more often resorted to than the lancet; cupping also was in general use. Poulticing, fomenting and the like were done at present. Amputation was done now and then, notwithstanding the want of a good control over the haemorrhage; boiling oil was applied to the stump, with pressure by means of a cup-formed bandage, pitch being sometimes added. Tumours and enlarged lymph glands were cut out, and an arthritic salve applied to the raw surfaces to prevent recurrence. Abdominal dropsy and hydrocele were treated by tapping with a trocar; and varieties of hernia were understood, ventral hernia being removed by operation on the first day, or, if the patient was healthy, two or three days after the operation. The ligature on the continuity of an artery, as well as on the cut end of it in a flap, is the one thing that a modern surgeon will miss somewhat protected, though in the ancient surgery of the Hindus the background to the latter was doubtless their want of familiarity with the arterial circulation and with the arterial ligature. Besides the operation already mentioned, the abdomen was opened by a short incision or by the old operation, which is the middle line for the purpose of removing intestinal concretions or other obstruction (laparotomy). Only a small segment of the bowel was exposed at one time; the concretion when found was removed and the incision was then closed. The intestines were dried and kept up by balsamic and antiphlogistic substances. The tumours, which were considered of no use without experience and manual skill in operations; the different surgical operations were shown to the student upon the skin of a dead cow laid on a table covered with a sheet of calico; tapping and puncturing were practised on a leathen bag filled with water or soft mud; scarifications and bleeding on the fresh hides of animals from which the hair had been removed; puncturing and other operations upon the skin of dead animals; bandaging was practised on flexible models of the human body; sutures on leather and cloth; the plastic operations on dead animals; and the application of caustics and cauteries on living animals. A knowledge of anatomy was held to be necessary, but it does not appear that it was systematically acquired by dissection. Superstitions and theurgical ideas were diligently kept up so as to impress the vulgar. The whole body of teaching, itself the slow growth of much close observation and profound thinking during the vigorous period of Indo-Aryan progress, was given out in later times as a revelation from heaven, and as resting upon an absolute authority. But this authority was in the main derived from a purely arbitrary or conventional physiology (wind, bile and phlegm); and the whole elaborate fabric of rules and directions, great though its utility must have been for many generations, was in the quick succession of reason and freedom, and became inevitably stiff and decrepit.

The Chinese appear to have been far behind the Hindus in their knowledge of medicine and surgery, notwithstanding that China profited at the same time as Tibet by the missionary propagation of Buddhism. Surgery, in particular, had hardly developed among them beyond the merest rudiments, owing to their religious respect for dead bodies and their unwillingness to draw blood or otherwise interfere with the living structure. Their anatomy and physiology have been from the earliest times unusually fanciful, and their surgical practice has consisted almost entirely of external applications. Tumours and boils were treated by scarifications.
or incisions. The distinctive Chinese surgical invention is acupuncturing, or the insertion of fine needles, of hardened silver or gold, for an inch or more (with a twisting motion) into the seats of pain or inflammation. Wise says that "the needle is allowed to remain in that part several minutes, or in some cases of neuralgia for days, with great advantage"; rheumatism and chronic gout were among the localized pains so treated. There are 367 points specified where needles may be inserted without injuring great vessels and vital organs.

Cupping-vessels made of cow-horn were found in ancient Egyptian tombs and the walls of temples are figures of patients bandaged, or undergoing operation at the hands of surgeons. In museum collections of Egyptian antiquities there are lanceets, forceps, knives, probes, scissors, &c. Ebers interprets a passage in the papyrus discovered by him as relating to the operation of cataract. Surgical instruments for the ear are figured, and artificial teeth have been found in mummies. Mummies have also been found with well-set fractures. Herodotus describes Egypt, notwithstanding its fine climate, as being full of medical practitioners, who are called "surgeons." These "surgeons" were celebrated, and practised at the court of Cyrus.

Greek Surgery.—As in the case of the Sanskrit medical writings, the earliest Greek compendiums on surgery bear witness to a long organic growth of knowledge and skill through many generations. In the Homeric picture of society the surgery is that of the battlefield, and it is of the most meagre kind. Achilles is concerned about the restoration to health of Machaon for the reason that his skill in cutting out darts and applying salves to wounds was not the least valuable service that a hero could render to the Greek host. Machaon probably represents an amateur, whose taste had led him, as it did Melampus, to converse with centaurs and to glean some of their traditional wisdom. Between that primitive state of civilization and the date of the first Greek treatises there had been a long interval of gradual progress.

The surgery of the Hippocratic Collection (age of Pericles) bears every evidence of finish and elaboration. The two treatises on fractures and on dislocations respectively are hardly surpassed in some ways by the writings of the present mechanical age. Of the four dislocations of the shoulder the displacement downwards into the axilla is given as the most common. The case are described. The depressed of the femur were backwards on to the dorsal illi and forwards on to the obturator region. Fractures of the spino processes of the vertebræ are described, and caution advised against trusting these fissures not to fracture the spine itself. Tubercles (spathura) are given as one of the causes of spinal curvature, an anticipation of Pott's disease. In all matters of dislocations there is the same fidelity to the true practice; the most noteworthy point is that shortening was by many regarded as inevitable after simple fracture of the femur. Fractures and dislocations were the most complete chapters of the Hippocratic surgery; the whole doctrine and practical art of them had arisen (like sculpture) with no help from dissection, and obviously owed its excellence to the opportunities of the palaestra. The next most elaborate chapter is that on wounds and injuries of the head, which refers them to a minute subdivision, and includes the depressed fracture and the contrecoup. Trephining was the measure most commonly resorted to, even where there was no compression. Nerve injuries and internal and intestinal injuries are among the other parts discussed. Ruptures, piles, rectal polypi, fistula in ano and prolapsus ani were among the other conditions treated. The amputation or excision of tumours does not appear to have been undertaken so freely as in Hindu surgical practice; nor was lithotomy performed except by a specially expert person now and then. The diagnosis of empyema was known, and the treatment of it was by an incision in the intercostal space and evacuation of the pus. Among their instruments were forceps, probes, directors, syringes, rectal speculums, catheter and various kinds of cautery.

Between the Hippocratic era and the founding of the school of Alexandria (about 300 B.C.) there is nothing of surgical progress to dwell upon. The Alexandrian epoch stands out prominently by reason of the enthusiastic cultivation of human anatomy—there are allegations also of vivisection—at the hands of Herophilus (335-280 B.C.) and Erasistratus (280 B.C.). The substance of this movement appears to have been precision of diagnosis (not unattended with pediatric minuteness), boldness of operative procedure, subdivision of practice into a number of specialties, but hardly a single addition to the stock of physiological or pathological ideas, or even to the traditional wisdom of the Hippocratic time. "The surgeons of the Alexandrian school were all distinguished by the nicety and complexity of their dressings and bandages, of which they invented a great variety." Herophilus boldly used the knife even on internal organs such as the liver and spleen, which latter he regarded "as of little advantage in the economy of the body." The retention of urine by a particular kind of catheter, which long bore his name. Lithotomy was much practised by a few specialists, and one of them (Ammonius Lithotomos, 287 B.C.) is said to have used an instrument for breaking the stone in the bladder into several pieces when it was too large to remove whole. A sinister story of the time is that concerning Antiochus, son of Alexander, king of Syria (150 B.C.), who was done to death by the lithotomists when he was ten years old, under the pretense that he had stone in the bladder, the instigator of the crime being his guardian and supplanter Diodotus.

The treatise of Celsus, De re medica (regius of Augustus), reflects the state of surgery in the ancient world in a period of several centuries: it is the best record of the Alexandrian practice itself, and it may be taken to stand for the Roman practice of the period following. Celsus was of a family of physicians of note, and had contact with many of the Romans of the republic, notably by Cato the Elder (235-149 B.C.), who himself practised on his estate according to the medical observations... His medical observations are given in De re medica. In reducing dislocations he made use of the following incantation: "Huat hanat ista pista sista damato damnaestut." The first Greek surgeon who established himself in Rome is said to have been Archagathus, whose fondness for the knife and cautery at length led to his expulsion by the populace. It was in the person of Asclepiades, the contemporary and friend of Cicero, that the Hellenic medical practice acquired a permanent footing in Rome. He confined his practice mostly to medicine, but he is credited with practising the operation of tracheotomy. He is one of those whom Tertullian quotes as practising vivisections for the gratification of the Greeks. The first Roman surgeon whose name is of any repute was Herophilus (De anima, 8th book). The next great name is Celsus, who devotes the 7th and 8th books of his De re medica exclusively to surgery. There is not much in this beyond the precepts of the Brahmanical Sastras and the maxims and rules of Greek surgery. Plastic operations for the restoration of the nose, lips and ears are described at some length, as well as the treatment of hernia by taxis and operation; in the latter it was recommended to apply the actual cautery, and that the operation was attended on by the son of the host. The celebrated description of lithotomy is that of the operation as practised long before in India and at Alexandria. The incision is made in the sinus of the umbilicus or anus, the sinus of the thoracic wall resection of the rib is mentioned. Trephining has the same prominent place assigned to it as in the Greek surgery. The resources of contemporary surgery may be seen in the account in De re medica of the cure of a stricture in the urethra when the urethra was blocked by a calculus. Amputation of an extremity is described in detail for the first time in surgical literature. Mention is made of a variety of ophthalmic operations, which were done by specialists after the Alexandrian fashion.

Galen's practice of surgery was mostly in the early part of his career (b. A.D. 130), and there is little of special surgical interest in his writings, great as their importance is for anatomy, physiology and the general doctrines of disease. Among the operations credited to him are resection of a portion of the sterna for caries and ligature of the temporal artery. It may be assumed that surgical practice was in a flourishing condition all through the period of the empire from the accounts preserved by Orisbasius of the great surgeons Antyllus, Leonides, Rufus and Heliodorus. Antyllus (A.D. 300) is claimed by Häser as one of the greatest of the Alexandrian surgeons of the Roman Empire. Heliodorus (A.D. 300) is attributed to Häser as "a brilliant example of the surgical skill during the empire." The same surgeon treated stricture.
of the urethra by internal section. Both Leonides and Antyllus removed glandular swellings of the neck (strumae); the latter ligatured vessels before cutting them, and gives directions for avoiding the carotid artery and jugular vein. Flap-amputations were practised by Leonides and Heliodorus. But perhaps the most striking illustration of the advanced surgery of the period is the freedom with which bones were resected, including the long bones, the lower jaw and the upper jaw.

Whatever progress or decadence surgery may have experienced during the next three centuries is summed up in the authoritative Byzantine, treatise of Paulus of Aegina (A.D. 650). Of his seven books the sixth is entirely devoted to operative surgery, and the fourth is largely occupied with surgical diseases. The importance of Paulus for surgical history during several centuries on each side of his own period will appear from the following remarks of Francis Adams (1796–1861) in his translation and commentary (ii. 247):—

"This book (bk. vi) contains the most complete system of operative surgery which has come down to us from ancient times . . . Haly Abbas (d. A.D. 904) in the 9th book of his Practica copies almost everything from Paulus. Albucasis [Abulcasir] (10th century A.D.) gives more detailed matter on surgery than any other Arabic author who comes down from ancient times. He dedicates for whole chapters to Paulus. In the Continens of Rhazes, that precious repository of ancient opinions on medical subjects, if there be any surgical matter not to be found in our author it is mostly derived from the Arabic authors. Other authors have, although we will occasionally have to explain their opinions upon particular subjects, no one has treated of surgery in a systematic manner. . . . He who would learn everything else connected with medicine, is defective in his accounts of surgical operations; and the descriptions which he does give of them are almost all borrowed from our author. The accounts of fractures and dislocations given by Hippocrates and his commentator Galen may be pronounced almost complete; but the information which they supply upon most other surgical subjects is scanty."

Paulus’ sixth book, with the valuable commentary of Adams, brings the whole surgery of the ancient world to a focus. Paulus is credited with the principle of local depletions against general, with the lateral operation for stone instead of the mesial and with understanding the merits of a free external incision and a limited internal, with the diagnosis of aneurism by anastomosis, with an operation for aneurism like that of Antyllus, with amputation of the cancerous breast by crucial incision, and with the treatment of fractured patella.

The Arabian have hardly any greater merit in medicine than that of preserving intact the bequest of the ancient world. Arabian.

To surgery in particular their services are small—first, because their religion proscribed the practice of anatomy, and, secondly, because it was a characteristic of their race to accept with equanimity the sufferings that fell to them, and to decline the means of alleviation. The great names of the Arabian school, Avicenna (980–1037) and Averroes (1126–1198), are altogether unimportant for surgery. Their one distinctively surgical writer was Abulcasir (d. 1212), who is chiefly celebrated for his free use of the actual cautery and by cautica. He showed a good deal of character in declining to operate on goitre, in resorting to tractionotomy but sparingly, in refusing to meddle with cancer, and in evacuating large abscesses by degrees.

For the five hundred years following the work of Paulus of Aegina there is nothing to record but the names of a few practitioners at the court and of imitators or compilers. Meanwhile in western Europe (apart from the Saracen civilisation) a medical school had grown up at Salerno, which in the 10th century had already become famous. From them the "Regimen sanitatis," so, a work used by the laity for several centuries, and the Centurie of Soro, which circulated among the profession. The decline of the school dates from the founding of a university at Naples in 1224. In its best period princes and nobles resorted to it for treatment from all parts of Europe. The hôtel dieu of Lyons had been founded in 560, and that of Paris a century later. The school of Montpellier was founded in 1025, and became the rallying point of Arabian and Jewish learning. A good deal of the medical and surgical practice was in the hands of the religious orders, particularly of the Benedictines. The practice of surgery by the clergy was at length forbidden by the Council of Tours (1163). The surgical writings of the time were mere reproductions of the classical or Arabian authors. One of the first to go back to independent observation and reflection was William of Saliceto, who belonged to the school of Bologna; his work (1275) advocates the use of the knife in many places where the actual cautery was used by ancient prescription. A greater name in the history of medieval surgery is that of his pupil Lanfranchi of Montpellier. (e.g., treating of the political troubles) first to Lyons and then to Paris. His distinction between arterial and venous haemorrhage, and is said to have used the ligature for the former. Contemporary with him in France was Henri de Mondeville (hermondeville) of the school of Montpellier, whose teaching is best known through that of his more famous pupil Guy de Chauliac; the Chirurgie of the latter bears the date of 1363, and marks the advance in precision which the revival of anatomy by Mondino had made possible. Eighteen years before Lanfranchi came to Paris a college of surgeons was founded there (1170) by Pithard, who had accompanied St Louis to Palestine and was his surgeon. The college was under the protection of St Cosmas and St Damianus, two practitioners of medicine who suffered martyrdom in the reign of Diocletian, and it became known as the Collège de St Côme. From the time that Lanfranchi joined it it attracted many pupils. It maintained its independent existence for several centuries, alongside the medical faculty of the university; the corporations of surgeons in other capitals, such as those of London and Edinburgh, were modelled upon it. The 14th and 15th centuries are almost entirely without interest for surgical history. The dead level of tradition is broken first by two men of originality and genius—P. Paracelsus (1493–1541) and Paré, and by the revival of anatomy at the hands of Andreas Vesalius (1514–1564) and Gabriel Fallopius (1523–1562), professors at Padua. Apart from the mystical form in which much of his teaching was cast, Paracelsus has great merits as a reformer of surgical practice. Paracelsus.

"The high value of his surgical writings," says Häszer, "has been recognized at all times, even by his opponents." It is not, however, an innovator in operative surgery, but rather as a direct observer of natural processes, that Paracelsus is distinguished as an "hospitals gangrene," for example, is perfectly true to nature; his numerous observations on syphilis are also sound and sensible; and he was the first to point out the connexion between cretinism of the offspring and goitre of the parents. He gives most prominence to the healing of wounds. His special surgical treatises are Die kleine Chirurgie (1528) and Die grosse Wand-Arcei (1536–1537)—the latter being the best known of his works. Somewhat later in date, and of much greater concrete importance for surgery than Paracelsus, is Ambroise Paré (1510–1590). He began life as an apprentices to a barber-surgeon in Paris and as a pupil at the hôpital dieu. His earliest opportunities were in military surgery during the campaign of Francis I in Piedmont. Instead of treating gunshot wounds with hot oil, according to the practice of the day, he had the temerity to trust to a simple bandage; and from that beginning he proceeded to many other developments of rational surgery. In 1545 he published at Paris La Méthode de traiter les plaies faites par hâquebude et autres bastons à feu. The same year he began to attend the lectures of Sylvius, the Paris teacher of anatomy, to whom he became a protégé, and his next book was an Anatomie (1550). His most memorable service was to get the use of the ligature for large arteries generally adopted, a method of controlling the haemorrhage which made amputation on a large scale possible for the first time. Like Paracelsus, he writes in the language of the people, while he is free from the encumbrance of mystical theories, which detract from the merits of his fellow reformer in Germany. It is only in his book on monsters, written towards the end of his career, that he shows himself to have been by no means free from superstition. Paré was adored by the army and greatly esteemed by successive
The 18th century marked the establishment of surgery on a broader basis than the skill of individual surgeons of the court and army, and on a more scientific basis than the rule of thumb of the multitude of barber-surgeons and other inferior orders of practitioners. In Paris the Collège de St Côme gave way to the Academy of Surgery in 1731, with Petit as director, to which was added at a later date the École Pratique de Chirurgie, with François Chopard (1743–1795) and Pierre Desault (1744–1795) among its first professors. The Academy of Surgery set up a very high standard from the first, and exercised great exclusiveness in its publications and its honorary membership. In London and Edinburgh the development of surgery proceeded less academically, and with greater scope for individual effort. Private dissecting rooms and anatomical theatres were started, of which perhaps the most notable was Dr William Hunter’s (1728–1783) school in Great Windmill Street, London, inasmuch as it was the first perch of his more famous brother John Hunter (1728–1793). In Edinburgh, Alexander Monro (1697–1767), first of the name, became professor of anatomy to the company of surgeons in 1719, transferring his title and services to the university the year after; as he was the first systematic teacher of medicine or surgery in Edinburgh, he is regarded as the founder of the Academic medical school of that city. In both London and Edinburgh a company of barbers and surgeons had been in existence for many years before; but it was not until the association of these companies with the study of anatomy, comparative anatomy, physiology and pathology that the surgical profession began to take rank with the older order of physicians. Hence the significance of the eulogy of a living surgeon on John Hunter: “More than any other man he helped to make us gentlemen” (Hunterian Oration, 1677). The state of surgery in Germany may be inferred from the fact that the long list of distinguished surgeons of the century—of the likes of Albrecht von Haller (1708–1777), whose office was “professor of theoretical medicine”—in the Prussian army it fell to the regimental surgeon to shave the officers. At Berlin a medic chirurgical college was founded by Surgeon-General Ernst von Holtzendorff (1688–1751) in 1714, to which was joined in 1726 a school of clinical surgery at the Charité. Military surgery was the original purpose of the school, which still exists, side by side with the surgical clinics of the faculty, as the Friedrich Wilhelm’s Institut. In Vienna, in like manner, a school for the training of army surgeons was founded in 1785—Joseph’s Hospital for the poor. The first systematic teaching of surgery in the United States was by Dr Shippen at Philadelphia, where the medical college towards the end of the century was largely officered by pupils of the Edinburgh school. A great part of the advance during the 18th century was in surgical pathology, including Petit’s observations on the formation of thrombi in severed vessels, Hunter’s account of the reparative process, Benjamin Bell’s classification of ulcers, the observations of Duhamel and others on the formation of callus and on bone repair in general, Pott’s distinction between spinal curvature from causes or abscess of the vertebrae and kyphosis from other causes, observations by various surgeons on chronic disease of the hip, knee, and other joints, and Cheselden’s description of neuroma. Among the great improvements in surgical procedure we have Cheselden’s operation of lithotomy (six deaths in eighty cases), Sir Caesar Hawkins’s (1711–1786) cutting gorget for the same (1753), Hunter’s operation (1775) for popliteal aneurism by tying the femoral artery in the canal of the triceps where its walls were sound (‘excited the greatest wonder,’ Assalini), Petit’s, Desault’s and Percival Pott’s (1747–1768) treatment of fractures, Gimbernat’s (Barcelona) operation for strangulated femoral hernia, Pott’s history for fistula, Charles White’s (1728–1813, Manchester) and Henry Park’s (1754–1831, Liverpool) excision of joints, Petit’s invention of the screw-tourniquet, the same surgeon’s operation for lacrimal fistula, Chopart’s partial amputation of the foot, Desault’s hangade for fractured clavicle, William Bromfield’s (1712–1792) artery hook, and William Cheselden’s (1688–1752) operation of iridectomy. Other surgeons of great versatility and general merit were Sharp of London, Benjamin Gooch (fl. 1772) of Norwich, William Hey (1736–1819) of Leeds, David and Claude Nicolas Le Cat (1705–1768) of Rouen, Raphaël Sabatier (1732–1811), Georges de La

Two things gave surgical knowledge and skill in the 19th century a character of scientific or possible cumulative truth and a wide diffusion through all ranks of the profession. The one was the founding of museums of anatomy and surgical pathology by the Hunters, Guillaume Dupuytren (1777-1835), Jules Cloquet (1790-1843), J. F. Blumenbach (1752-1840), John Barclay (1758-1826), and a great number of more modern anatomists and surgeons; the other was the method of clinical teaching, exemplified in its highest form of constant reference to principles by Thomas Lawrence (1711-1785) and James Syme (1790-1870).

In surgery the discovery of the anaesthetic properties of ether, chloroform, mephylene, &c., was of incalculable service; while the conservative principle in operations upon diseased or injured parts, and especially what may be called the hygienic idea (or, more narrowly, the antiseptic and aseptic principles) in the conditions governing surgery, were strikingly beneficial.

The following were among the more important additions to the resources of the surgical art: the thin thread ligature for arteries, introduced by Lord Byron (1788-1824); the cannula for the removal of dropsy fluid by Jean Amussat (1796-1856) [1829]; the practice of drainage by Pierre Marie Chassaing (1805-1879) [1859]; aspiration by Philippe Perlecan (1747-1829) and recent improvers; the plaster-of-Paris bandage or other immovable application for simple fractures, club-foot, &c. (an old Eastern practice recommended in Europe about 1814 by the English consul at Basra); the re-breaking of badly set fractures by Jean-Jacques Morelot (1778-1856) [1828]; the generation of resection of joints (Sir William Fergusson (1808-1877), Syme and others); tenotomy by Jacques Delpech (1777-1832) and Louis Strome heterosexuals (1804-1876) [1834]; operation for ophthalmia by Johann Friedrich Gottlob Meckel (1772-1828) [1816]; cure of the subcutaneous abscess by Yon (1806); the adoption of the hot water bag for aneurism by the memorial by John Abernethy (1764-1831) [1806]; ligature of the subclavian in the third portion by Astley Cooper (1768-1841) [1806], and in its first portion by Colles; crushing by dislocation of the olecranon by Dupuytren (1790-1867) [1856]; cure of ovarian dropsy by removing the cyst (since perfectly perfected); discovery of the ophthalmoscope, and many improvements in ophthalmic surgery by Alfred von Graefe (1830-1899) and others; application of the laryngoscope in operations on the larynx by Jean Czermak (1828-1873) [1860] and others; together with the additions to the resources of auricular surgery and dentistry; the discovery of the stethoscope in the first quarter of the 19th century besides those mentioned are: Antonio Scarpa of Italy (1747-1812); Alexis Boyer (1757-1833); Felix Larrey (1766-1842)—to whom Napoleon left a legacy of a hundred thousand francs, with the request that his name be placed on the monuments of Philibert Roux (1780-1854), Jacques Lisfranc (1790-1847), Alfred Louis Velpeau (1795-1868), Joseph Malaga (1806-1865), Auguste Nidalon (1807-1873)—all of the French school; of the British school, John Bell (1753-1820), Charles Bell (1774-1842), Allan Burns (1781-1813), Robert Liston (1794-1847), James Wardrop (1782-1860), Astley Cooper, Henry Clive (1750-1827), Benjamin Travers (1756-1835), Benjamin Breckly (1784-1840), Harward Stanly (1783-1862) and George Guthrie (1785-1856) in the United States, V. Mott, S. D. Gross and others; in Germany, Kern and Schuh of Vienna, Von Walther and Textor of Wurtzburg, Chelius, Hessebach and the two Langenbecks,—Konrad (1776-1851) and Bernhard (1803-1887).


Modern Practice of Surgery. A great change has taken place in the practice of surgery since the middle of the 19th century, in consequence of the new science of bacteriology, and the introduction of aseptic methods, due to the teaching of Lord Lister.

It had long been known that subcutaneous injuries followed a far more satisfactory course than those with wounds, and the history of subcutaneous infections endured was by the use of various dressings, empirically to prevent the evils which were matters of common observation during the healing

1 The Royal College of Surgeons in London was established in 1800, the title being changed in 1843 to Royal College of Surgeons of England.

2 For the surgery of any particular region or organ, reference should be made to the article on that region or organ.
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its irritating properties and the difficulty of finding the exact strength in which to use it; he feared to use it too strong, lest it should impair the vitality of the tissues and thus prevent healing; and he feared to use it too weak, lest its antiseptic qualities should be insufficient for the object in view. As dressings for wounds he used various chemical substances, which, being mixed with carbolic acid, were intended to give off a certain quantity of carbolic acid in the form of vapour, so that the wound might be constantly surrounded by an antiseptic wall. Many organs in the body, however, at the same time, not interfere with its healing. At first, although he prevented pyaemia in a marked degree, he, to a certain extent, irritated the wounds and prevented rapid healing. He began his historic experiments in Glasgow and continued them on his removal to the chair of clinical surgery in Edinburgh. After many disappointments, he gradually perfected his method of performing operations and dressing wounds, which was somewhat as follows.

A patient was suffering, for instance, from disease of the foot necessitating amputation at the ankle joint. The part to be operated on was enveloped in a towel soaked with a 5% solution of carbolic acid. The towel was applied two hours before the operation, with the object of destroying the putrefactive organisms present in the skin. The patient was placed on the operating table, and brought under the influence of chloroform; the limb was then elevated to empty it of blood, and a tourniquet was applied round the limb below the knee. The instruments to be used during the operation had been previously purified by lying for half an hour in a flat porcelain dish containing carbolic acid (1 in 20). The sponges lay in a similar carbolic solution. Towels soaked in the same solution were laid over the table and blankets near the part to be operated upon. The hands of the operator, as well as those of his assistants, were thoroughly cleansed by washing them in carbolic solution, free use being made of a nail brush for this purpose. The operation was performed under a cloud of carbolized watery vapour (1 in 30) from a steam-spray-producer. The visible bleeding points were first ligated; the tourniquet was removed; and any vessels that had escaped notice were secured. The wound was stitched, a drainage-tube made of red rubber being introduced at one corner to prevent accumulation of discharge; a strip of "protective"—oiled silk coated with carbolized dextrin—was washed in carbolic lotion and applied over the wound. A double ply of carbolic gauze was soaked in the lotion laid over the protective, overlapping it freely. A dressing consisting of eight layers of dry gauze was placed over all, covering the stump and passing up the leg for about six inches. Over that a piece of thin mackintosh cloth was placed, and the whole arrangement was fixed with a gauze bandage. The mackintosh cloth prevented the carbolic acid from escaping and at the same time caused the discharge from the wound to spread through the gauze. The wound itself was shielded by the protective from the vapour given off by the carbolic gauze, whilst the surrounding parts, being constantly exposed to its activity, were protected from the intrusion of septic contamination. And these conditions were maintained until sound healing took place. Whenever the discharge reached the edge of the mackintosh the case required to be dressed, and a new supply of gauze was applied round the stump. Whenever the wound was exposed for dressing the stump was enveloped in the vapour of carbolic acid by means of the steam-spray-producer. At first a syringe was used to keep the surface constantly wet with lotion and then a hand-spray. These dressings were repeated at intervals until the wound was healed. The drainage-tube was gradually shortened, and was ultimately removed altogether.

The object Lister had in view from the beginning of his experiments was to place the open wound in a condition as regards the entrance of organisms as nearly as possible like a truly subcutaneous wound, such as a contusion or a simple fracture, in which the unbroken skin acted as a protection to the wounded tissues beneath. The introduction of this practice by Lister effected a complete change in operative surgery. The dark times of suppurring wounds, of foul discharges, of secondary haemorrhage, of pyaemic abscesses and hospital gangrene constitute what is now spoken of in surgery as the pre-Listerian era.

As years went on, surgeons tried to simplify and improve the somewhat complicated and expensive measures and dressings and chemists were at pains to supply carbolic acid in a pure form and to discover new antiseptics, the great object being to get a non-irritating antiseptic which should at the same time be a powerful germicide. Iodoform, oil of eucalyptus, salicylic acid, boracic acid, mercuric iodide, and corrosive sublimate were used.

For some years Lister irrigated a wound with carbolic lotion during the operation and at the dressings when it was exposed, but the introduction of the spray displaced the irrigation method. All these different procedures, however, as regards both the antiseptic used and the best method of its application in oily and watery solutions and in dressings, were subsidiary to the great principle involved—namely, that putrefaction in a wound can be prevented and that, if it is prevented, local irritation, in so far as it is due to putrefaction, is obviated and septicemia and pyaemia cannot occur. Alongside of this great improvement the immense advantage of free drainage was universally acknowledged. Moreover, surgeons at once began to take greater care in securing the cleanliness of wounds, and some of them, Lawson Tait and Bantock, for example, produced such excellent results by the adoption merely of methods of strict cleanliness, and became so aggressive in their championship of them, that many of the older practitioners were bewildered and unable to decide as to where truth began and where it ended in the new doctrine. But though the actual methods, as taught and practised by Lister, have, with the spray-producers, passed away and given place to new, still the great light which he shed in the surgical world burns as brightly as ever it did, and all the methods which are practised to-day are the direct results of his teaching.

By 1885 the carbolic acid spray, which to some practitioners had apparently been the embodiment of the Listerian theory and practice, was beginning to pass into desuetude, though for a good many years after that time certain surgeons continued to employ it during operation, and during the subsequent dressings of the wound. Surgeons who, having had practical experience of the unhappy course which their operation-cases had been apt to run in the pre-Listerian days, and of the vast improvements which ensued on their adoption of the spray-and-gauze method in its entirety, were, not unnaturally, reluctant to operate except in a cloud of carbolic vapour. So, even after Lister himself had given up the spray, its use was continued by many of his disciples. It was in the course of 1888 that operating surgeons began to neglect the letter of the antiseptic treatment and to bring themselves more under the broadening influence of its spirit. Certain adventurous and partially unconvinced surgeons began to give up the carbolic spray gradually, by imparting a smaller percentage of carbolic acid to the vapour, until at last the antiseptic disappeared altogether, apparently without detriment to the excellence of the results obtained. But while some surgeons were thus ceasing to apply the antiseptic spray to the wound during operation, others were pouring mild carbolic lotion, or a very weak solution of corrosive sublimate (an extremely potent germicide) over the freshly-cut surfaces. These measures were in turn given up, to the advantage of the patient; for it was hardly to be expected that a chemical agent which was strong enough to destroy or render inert septic micro-organisms in and about a wound would fail to injure exposed and living tissues. Eventually it became generally admitted that if a surgeon was going to operate upon the depths of an open abdomen for an hour or more, the chilling and the chemical influences of the spray must certainly lower the vitality of the parts exposed, as well as interfere with the prompt healing of the wounded surfaces. With the spray went also the "protective," the paraffin gauze, and the mackintosh sheeting which enveloped the bulky dressing.
Aseptic Surgery.

Years before this happened, in the address on surgery given at the Cork meeting of the British Medical Association, Sir William (then Mr) Savory had somewhat severely criticized the rigid exclusiveness of the members of the spray-and-gauze school; the sum and substance of the address was that every careful surgeon was an anti-septic surgeon, and that the success of the Listerian surgeon did not depend upon the spray or the gauze, or the two together, but upon cleanliness—that the surgeon’s fingers and instruments and the area operated on must be surgically clean. Though precise experiments show that it is impossible for the surgeon to remove every trace of septicity from his own hands and from the skin of the operator, or to use instruments which are certainly germless, and alcohol and turpentine, with possibly the help of some mercuretic germicide, he can, for all practical purposes, render his hands safe. Recognizing this difficulty many surgeons prefer to operate in thin rubber gloves which can, for certain, by boiling, be rendered free of all germs; others, in addition, put on a mask, sterile overalls, and india-rubber shoes. But these excessive refinements do not seem to be generally acceptable, whilst the results of practice show that they are by no means necessary.

The careful, the antiseptic surgeon of 1885 is to-day represented by the careful, the aseptic surgeon. The antiseptic surgeon was wrestling with the Listerian antiseptic system. But though the pendulum has swung so far in the direction of aseptic surgery, a very large proportion of operators still adhere to the antiseptic measures which had proved so highly beneficial. The judicious employment of weak solutions of carbolic acid, or of mercuretic salts, and the application of unirritating dressings of an anti-septic nature cannot do any harm, and, on the other hand, they may be of great service in the case of there having been some flaw in the carrying out of what should have been an absolutely aseptic operation.

A great change has taken place in connexion with the use of soft india-rubber drainage-tubes. In former years most surgeons placed one or more of these in the dependent parts of the area of operation, so that the blood or serum oozing from the injured tissues might find a ready escape. But to-day, except in dealing with a large abscess or other septic cavity, many surgeons make no provision for drainage, but, bandaging the part beneath a pad of aspetic wool, put on so much pressure that any little leakage into the tissues is quickly absorbed. If a drainage-tube can be dispensed with, so much the better, for if it is not actually needed its presence keeps up irritation and delays prompt healing. But inasmuch as a tube if rightly placed in a deep wound is an insur- ance against the occurrence of "tension," and as it can easily be withdrawn at the end of twenty-four hours (even if it has served no useful purpose), it is improbable that the practice of drainage of freshly made cavities will ever be entirely given up. If the tube is removed after twenty-four hours its presence can have done no harm and sometimes the large amount of fluid which it has drained from the wound affords clear evidence that its use has saved the patient discomfort and has probably expedited his recovery. For septic cavities drainage-tubes are still used, but it must be remembered that the tube cannot remain long in position without causing and keeping up irritation; hence, even in septic cases, the modern surgeon discards the tube at the earliest possible moment. If after he has taken it out septic fluids collect, and the patient’s temperature rises, it can easily be taken out. But it is better to take out the tube too soon than to leave it in too long; this remark applies with special force to the treatment of abscess of the pleural cavity (Bier’s treatment) in the case of which a drainage-tube has almost certainly to be employed.

Poultices are now never used: they were apt to be foul and offensive, and were certainly septic and dangerous. If moisture and warmth are needed for a wound they can be obtained by the use of a fold of clean lint, or by some aseptic wool which has been wrung out in a hot solution of boracic or carbolic acid, and applied under some waterproof material, which effectually prevents evaporation and chilling. There was no special virtue in poultices made of linseed meal or even of scraped carrot: they simply stored up the moisture and heat. They possessed no possible advantage over the modern fomentation under oil-silk.

Much less is heard now of so-called "bloodless" operations. The bloodlessness was secured by the part to be operated on—an arm, for instance—being raised and compressed from the fingers to the shoulder by successive turns of an india-rubber roller-bandage (Esmarch’s), the main artery of the limb being then compressed by the application of an elastic cord above the highest turn of the bandage. The bandage being removed, the operation was performed through bloodless tissues. But when it was completed the elastic cord removed from around the upper part of the limb, a reactionary flow of blood took place into every small vessel which had been previously squeezed empty, so that though the operation itself had actually been bloodless, the wound could not be closed because of the occurrence of unusually free haemorrhage or troublesome oozing. A further objection to the application of such an elastic roller-bandage was that septic or tuberculous material might by chance be squeezed from the tissues in which it was perhaps harmlessly lying, forced into the blood vessels, and so widely disseminated through the body. Esmarch’s bandage is therefore but little used now in operative surgery. Instead, each bleeding point at an operation is promptly secured by a small pair of nickel-plated clip-forceps, which generally have the effect, after being left on for a few minutes, of completely and permanently arresting the bleeding. These clips were specially introduced into practice by Sir Spencer Wells, and it is no unusual thing for a surgeon to have twenty or thirty pairs of them at hand during an extensive operation. Seeing how convenient, not to say indispensable, they are in such circumstances, the surgeon of to-day wonders how he formerly managed to get on at all without them.

A great change in the treatment of pressure congestion is carried out by gently assisting the return of venous blood from a part of the body without in any way checking the arterial flow. In the case of tuberculous disease of the knee-joint, for instance, an elastic band is gently placed round the thigh for several hours a day, and in disease of the wrist or elbow the girth is applied round the arm. The skin below becomes flushed, and the arterial blood which, as shown by the pulse, is still flowing into the affected part, is compelled to linger in the affected tissues, giving the serum and the white corpuscles time to exert their beneficial influence upon the disease. In the case of tuberculosis, or, septic, affections of the lymphatic glands of the neck, or of other parts where the constriction cannot be conveniently obtained, effective congestion can be secured by the use of cupping glasses. And if so be that suppuration is taking place in the interior of an inflamed gland, the cupping-glasses can be applied after a small puncture has
been made into the softened part of the gland. In this way the whole of the broken-down material can be got away without the necessity of making an actual incision or of resorting to scraping. The method of inducing hyperaemia should be so conducted as to give the patient no pain whatever; it must not be carried on an extirpative surgery.

By means of the Röntgen or X-rays (see X-Ray Treatment) the surgeon is able to procure a distinct shadow-portrait of deeply-placed bones, so that he can be assured as to the presence or absence of fracture or dislocation, or of outgrowth of bone, or of bone-containing tumours. By this means also he is able to locate with absolute precision the situation of a foreign body in the tissues—of a coin in the windpipe or gullet, of a broken piece of a needle in the hand, of a splinter cf glass in the foot, or of a bullet deeply embedded in soft tissues or bone. This effect may be obtained upon a fluorescent screen or printed in a permanent form upon glass or paper. The shadow is cast by a 10- or 12-in. spark from a Crookes vacuum tube. The rays of Röntgen find their way through dead and living tissues which are far beyond the reach of the rays of ordinary light, and they are thus able even to reveal changes in the deeply placed hip-joint which have been produced by tuberculous disease. In examining an injured limb it is not necessary to take off wooden splints or bandages except in cases where the latter have been treated with plaster of paris, or where fragments of bone or other foreign bodies obstruct the rays and throw a shadow. Thus the rays may pass through an ordinary uric acid calculus in the kidney or bladder; but if it contains salts of lime, as does the mulberry calculus (oxalate of lime), a definite shadow is cast upon the screen. The value of the X-rays is not limited to the elucidation of obscure problems such as those just indicated: they are also of therapeutic value; for example, in the treatment of certain forms of skin disease, as well as of cancer.

Too much, however, must not be expected from them. For the treatment of a patch of tuberculous ulceration (lupus), or for a superficial cancerous sore (epithelioma), they may be of service, but in the treatment of a deeply-seated malignant growth—as a cancer of the breast—they have not proved of value. Moreover, the X-rays sometimes cause serious burns of the skin; and although this happens less often now than was previously the case, still the frequent application of the rays is apt to be followed by cutaneous warty growths which are apt in turn to develop into cancer. In many cases in which the X-rays are used a more prompt and efficient means of treatment would probably be by excision. One great advantage which operative treatment by the knife must always have over the treatment by X-rays is that the secondary implication of the lymphatic glands can be dealt with at the same time. And this, in many cases, is a matter of almost equal importance to that of removal of the cancer itself.

The employment of radium in surgery is still in its infancy. Doubtless radium is a very powerful agent, but even if it were found of peculiar value in treatment its cost would, for the present, put it out of the reach of most practitioners. Probably it will be found useful in the treatment of naevus, rodent ulcers and superficial malignant growths. As to what influence radium may have in the treatment of deeply-seated cancers it is as yet impossible even to guess. For those sad cases, however, which the practical surgeon is reluctantly compelled to admit as being beyond the reach of his operative skill, the influence of radium should be tried with determination and thoroughness. The therapeutic influence of radium may eventually be found to be great, or it may be disappointing. The fact that under direct royal patronage an institution has been established in London for the investigation of the physical and therapeutic value of this newly discovered agent should satisfy every one that its properties will be duly inquired into and made known without mystery or charlatanism and absolutely in the interest of the people. But in the meanwhile too much must not be expected from it as a surgical agent.

(E. O. *)

SURGICAL INSTRUMENTS AND APPLIANCES. The purpose of this article is to give an account of the more important surgical Instruments that are now in general use, and to show by what modifications, and from what discoveries in science, the present methods of an operation have come to be what they are. The good surgeon is careful to use the right sort and pattern of instrument, and the chief fact about the surgery of the present day, that it is aseptic or antiseptic, is recorded in the make of surgical instruments and in all the installation of an operating-theatre. Take, for instance, a scalpel and a saw that are figured in Ambroise Paré's (1570-1596) surgical writings. The scalpel folds into a handle like an ordinary pocket-knife, which alone was enough in those days to keep it from being aseptic. The handle is most elegantly adorned with a little winged female figure, but it does not commend itself as likely to be surgically clean. The saw, after the same fashion, has a richly chased metal frame, and, at the end of the handle, a lion's head in bold relief, with a ring through its mouth to hang it up by. It may be admirable art, but it would harbour all sorts of germs. If one contrasts with these artistic weapons the instruments of 1850, one finds no such adornment, and for general finish Savigny's instruments would be hard to beat; but the wooden or ivory handles, cut with finely scored lines like the cross-hatching of an engraving, are not more likely to be aseptic than the handles of Paré's instruments. At the present time, instead of such handles as these, with blades riveted into them, scalpels are forged out of one piece of steel, their handles are nickel-plated and perfectly smooth, that they may afford no crevices, and may be boiled and immersed in carbolic lotion without tarnishing or rusting; the scalpel has become just a single, smooth, plain piece of metal, having this one purpose that it shall make an aseptic wound. In the same way the saw is made in one piece, if this be possible; anyhow, it must be, so far as possible, a simple, smooth, unrusting metal instrument, that can be boiled and laid in lotion; it is a foreign body that must be introduced into tissues susceptible of infection, and it must not carry infection with it.

Or we may take, at different periods of surgery, the various kinds of ligature for the arrest of bleeding from a divided blood-vessel. In Paré's time (he was the first to use the ligature in amputation, but the existence of some sort of ligature as
old as Galen) the ligature was a double thread, *bon fil qui soit en double;* and he employed a forceps to draw forward the cut end of the vessel to be ligatured. From the time of Ambroise Paré to the time of Lord Lister no great improvement was made. In the middle of last century it was no uncommon thing for the house-surgeon at an operation to hang a leash of waxed threads, silk or flax, through his button-hole, that they might be handy during the operation. Then came Lord Lister's work on the absorbable ligature; and out of this and much other experimental work has come the present use of the ligature in its utmost perfection—a thread that can be tied, cut short, and left in the depth of the wound, with absolute certainty that the wound may at once be closed from end to end and nothing more will ever be heard of the ligatures left buried in the tissues. The choice of materials for the ligature is wide. Some surgeons prefer catgut, variously prepared; others prefer silk; for certain purposes, as for the obliteration of a vessel not divided but tied in its course for the cure of aneurism, use is made of kangaroo-tendon, or some other animal substance. But whatever is chosen is made aseptic by boiling, and is guarded vigilantly from contamination on its way from the sterilizer into the body of the patient. The old ligatures were a common cause of suppuration. Therefore the wound was not closed along its whole length, but the ligatures were left long, hanging out of one end of the wound, and from day to day were gently pulled until they came away. Certainly they served thus to drain the wound, but they were themselves a chief cause of the suppuration that required drainage.

Sutures, like ligatures, were a common cause of suppuration in or around the edges of the wound. Therefore, in the hope of avoiding this trouble, they were made of silver wire, which was inconvenient to handle, and gave pain at the time of removal of the sutures. At the present time they are of silkworm-gut, catgut, silk or horsehair; they are made aseptic by boiling, and can be left any number of days without causing suppuration and can then be removed without pain.

Next may come the consideration of surgical dressings. In the days when inflammation and suppuration were almost inevitable, the dressings were usually something very simple, that could be easily and frequently changed—ointments, or wet compresses, to begin with, and poultices when suppuration was established. It is reported of the great Sir William Fergusson that he once told his students, "You may say what you like, gentlemen, but after all, there's no better dressing than cold water." This is not the place to try to tell the long history of the quest after a perfect surgical dressing, and the advance that was begun when Lord Lister invented his carbolic paste. The work was done slowly in the international unity of science during many years. The perfect, antiseptic dressing must fulfill many requirements: it must be absorbent, yet not let its medicament be too quickly soaked out of it; and it must be antiseptic, yet not virulent or poisonous. Of the many gauzes now available, that which is chiefly used is one impregnated with a double cyanide of zinc and mercury. Its pleasant amethystine tint has no healing virtue, but is used to distinguish it from other gauzes—carbized gauze, tinted straw-colour; iodoform gauze, tinted yellow; sublituate, blue; chinosol, green. The chinosol gauze is especially used in ophthalmic surgery; for general surgery the cyanide gauze is chiefly employed. The various preparations of absorbent wool (i.e. wool that has been freed of its grease, so that it readily takes up moisture) are used not only for outside dressings, but also as sponges at the time of operation, and have to a great extent done away with the use of real sponges. The gauzes in most cases are used not dry, but just wrung out of carbolic lotion, that their antiseptic influence may act at once.

The whole subject of surgical instruments may be considered in more ways than one. It may be well, for the sake of clearing the ground, to take first some of the more common instruments of general surgery, and then to note the working out, in the operations of surgery, of the three great principles—the use of anaesthetics, the use of antiseptic or aseptic methods, and the surgical uses of electricity.
on one side, near the point. Thus they enter the skin very easily, like a miniature knife, and the minute wound they make is not a hole, but a tiny slit that is at once drawn together and, as it were, obliterated by the tying of the suture. Or, for another simple instrument in universal use, take the catch-forceps that is used for taking hold of a bleeding point till it is ligatured. This forceps is as old as the time of Paré, but he made use of a very heavy and clumsy pattern. Up to the last few years the artery-forceps was made with broad, curved, fenestrated blades, with the catch set close to the blades. At the present time the forceps in general use, named after Dr Féau in France and after Sir Spencer Wells in England, is made with very narrow grooved blades, and the catch is placed not near the blades, but near the handles; thus it takes a surer hold, and can be set free when the ligature is tied by a moment’s extra pressure on the handles.

Among other instruments in universal use are divers forms of retractors, for holding gently the edges of a wound: the larger patterns are made with broad, slightly-concave, highly-polished surfaces, that they may, so far as possible, reflect light into the wound. Among tourniquets, the old and elaborate Petit’s tourniquet, which was a band carrying a pad screwed down over the main artery of the limb, has given place to the elastic tourniquet with Esmarch’s bandage. For example, in an amputation, or in an operation on a joint or on a vessel or a nerve in a limb, the limb is raised, and the Esmarch’s elastic bandage is applied from below upward till it has reached a point well above the site of the operation; then an elastic tourniquet is wound round the limb at this point, the bandage is removed, and the limb is thus kept almost bloodless during the operation.

It is not possible to describe here the many forms of other ordinary instruments of general surgery—probes, directors, scissors, forceps, and many more—nor those that are used in operations on the bones. Nor again can the numerous instruments used in special departments of surgery be discussed in detail. But, with regard to the special surgery of the eye, and of the throat and ear, it is to be noted that the chief advance in treatment arose from the invention of the present instruments of diagnosis, and that these are of comparatively recent date. The ophthalmoscope was the work of Helmholtz. The laryngoscope was invented by Manuel Garcia in the middle of the 19th century; and the use of a frontal mirror, for focussing a strong light on the membrana tympani, in the examination of the ear, was in use somewhat earlier. Before the ophthalmoscope it was impossible to study the internal diseases of the eye; before the laryngoscope the diseases of the larynx were invisible, and were mainly a matter of guess-work, and of vague and often futile treatment. Before the use of the frontal mirror the diseases of the ear were hardly studied, in that sense in which they are studied now. The wonderful advance of the special departments of surgery was, of course, the result of many forces, but one of the chief of these forces was the invention of proper instruments of diagnosis. The textbooks that were written immediately before those instruments became available were not far in advance of Ambrose Paré, so far as these special departments are concerned.

It may be well next to consider in what ways the conduct of an operation is influenced by those two great discoveries of anaesthetics, and the more gradual development of the principles of antisepsic and aseptic surgery; with special reference to the use of the instruments of surgery. The jubilee year of anaesthesia was 1896; the first use of nitrous oxide was on the 11th of December 1844; the first operation under ether was on the 30th of September 1846; the first use of chloroform was on the 4th of November 1847. The choice of the anaesthetic, or of some combination of anaesthetics, that is best suited to each particular case, is a matter of careful consideration; but, on the whole, the tendency in England is to keep to the use media between the more general use of chloroform in Scotland and the more general use of ether in the United States. Of the methods of administering chloroform there is no need to say much; by some anaesthetists no instrument is used save a fold of lint or some such stuff, or a piece of flannel made into a sort of cone or mask. Use is generally made of a modification of "Junker’s inhaler," whereby the vapour of chloroform is administered by means of a hand-ball. For the administration of ether some form of Clover’s inhaler is generally used, whereby the ether in a small metal chamber passes as vapour into an indiarubber bag, and there is combined with the patient’s breath in proportions determined by the anaesthetist throughout the operation. The metal chamber is so designed that by turning it the exact proportion of ether to air is fixed in accordance with the requirements of the case. Of late years, by the use of an iron cylinder of nitrous oxide, connected by a tube with a Clover’s inhaler, it is possible to begin with nitrous oxide, and to go on, without interruption, with ether. More recently an admirable method has been devised of administering nitrous oxide with the admixture of air or of oxygen in such a way that the anaesthesia produced by the gas may be maintained for time enough to allow of an operation of some length.
The series of discoveries which, in its application to surgery, has brought about the present antiseptic and aseptic methods of operation, is concerned both with the sterilization of instruments, water, and with their preparation for use. The mere sterilization, by boiling or by steaming, of all instruments and dressings, is enough to ensure their freedom from the ordinary micro-organisms, but the surgeon cannot boil or steam either himself or his patient. The preparation, therefore, of the surgeon's hands, and of the skin over the area of operation, is made not only by scrubbing with soap and hot water, but by careful use of antiseptic lotions. Again, ligatures and sutures, which must be kept in stock ready for use, are kept, after careful sterilization, in antiseptic lotion, or are again sterilized immediately after an operation. Again, all towels used at an operation must be prepared, either by sterilization or by immersion in antiseptic lotion.

Beside anaesthetics and antiseptics, there is a third series of discoveries that has profoundly influenced surgery—the use of the forces of electricity. The uses of electricity are fivefold.

1. The Galvano-Cautery.—The original form of the cautery, the fer ardent of Paré's time, for the arrest of haemorrhage after amputation, was a terrible affair. Happily for mankind, his invention of the ligature put an end to this use of the cautery, but it was still used in a small number of other cases. Subsequently André Paquelin (b. 1836) invented a very ingenious form of cautery, a series of metal blades or points of different shapes and sizes, that could be fitted to a handle: these points were hollow inside, and were filled with fine platinum gauze, and, by means of a bottle and hand-bellows, they could be kept heated with benzene-vapour. Thus, when they had once been raised to a glowing heat by holding them over a spirit-lamp, they could be kept at any desired heat. This instrument is still in use for a few cases where very rapid and extensive cauterization is necessary. But for all finer use of actual heat the galvano-cautery alone is needed. It consists of very minute points of platinum, with a suitable trigger-handle, connected with a battery or (by means of a converter) with the ordinary house supply of electricity. In this way it is possible to apply a glowing point with a fineness and accuracy of adjustment that were wholly impossible with Paquelin's cautery.

2. Electrolysis.—This method is of great value, in suitable cases, for the arrest or obliteration of small growths. The passage of the electric current between needles introduced into the skin brings about a gradual shrinking or cicatrization of the tissues subjected to it, without the production of any unsightly scar.

3. Electro-Motor Power.—During recent years the use of a small electro-motor machine has come into the practice of surgery for certain operations on the bones; especially for the operation for disease involving the mastoid bone. It is, of course, a better method for the use of a fine drill or burr, for example, than the "dental engine," where the power is generated by a pedal演员 wheel, and it will probably come into wide use both for dental surgery and for those operations of general surgery that require very gradual and delicate removal of small circumscribed areas of bone, especially of the cranial bones.

4. The X-Rays.—This was the most unexpected and, as it were, the most sensational discovery that has been bestowed on physicians and surgeons since the discovery of anaesthetics, is now used over a very wide and varied field of practice. Its value does not stop at the detection and localization of foreign bodies; indeed, this is but a small part of its work. It is used constantly for cases of actual or suspected fracture or dislocation; for cases of congenital or acquired deformity: for cases involving difficulties of diagnosis between a swelling of the bone due to inflammation and a swelling due to a fungus; and for the observation of cases of spinal disease, hip disease and the like. Moreover, it has been found possible, by Dr Hugh Walsham, and others to obtain pictures of the thoracic organs that are a very valuable guide in many obscure cases of disease of the lungs or of the heart, and in many cases of thoracic aneurism or of intra-thoracic tumour. Every year the number and the range of the uses where the X-rays are helpful for diagnosis and for treatment become greater; and it is impossible to say at what point the surgical value of this discovery will find its limits. Beyond these uses, it is probable that the X-rays will maintain and extend the importance and value that they already have in the direct treatment of certain cases of disease of the skin (see X-Ray Treatment).

5. The Electric Light.—The use of this to light up the field of operation is of the greatest importance. It is especially valuable in those operations in the eye, nose, and throat, where the light has to be brought to a very delicate point. The Oleophot is the most convenient for this purpose. With it, in the hands of a skilled operator, it is possible to inspect the interior of the bladder, and in many cases to make an exact diagnosis under circumstances where otherwise it would be impossible. Another instance of the value of the electric light in diagnosis is given by the trans-illumination of the facial bones in cases of suspected disease of the central cavity of the superior maxillary bone. A small glow-lamp is held in the opened mouth, in a darkened room, and by a comparison of the shadows on the two or under the face, thus trans-illuminated, an exact diagnosis can often be obtained as to the presence or absence of pus in this central cavity. Again, a small glow-lamp, duly sterilized, is often of great value in deep operations on the abdominal cavity.

The bactericidal properties of light have long been demonstrated by Bisé and others. Professor Niels Finsen of Copenhagen first used the ultra-violet rays of solar light in the treatment of skin diseases,
notably of lupus. He later invented the lamp which bears his name. The original Finsen lamp comprised a volatile arc of 60 to 80 amperes round which four tubes collected the light by quartz lenses, the light being cooled by passing through water and the tubes being surrounded by a water-jacket. The usual exposure was one hour. In the Finsen-Reyn modification now used, a single collecting tube fitted on an adjustable stand is placed in front of a scissors arc lamp consuming 20 amperes. The rays are cooled and water-jacketed as in the original. A suitable quartz compressor with a chamber containing circulating water is pressed upon the skin of the part to be treated and held at right angles to the impinging rays. The time of exposure is now reduced to forty-five minutes.

Radium when used in surgery is applied by means of applicators, either having the fixed salts on square or oblong metallic plates or cloth or by applicators having free radium in sealed metal tubes. These tubes are sometimes buried in the tissues. Sometimes a method of "screening" is adopted in order to modify the intensity of the radiation. This is done by enveloping the tubes containing the radium in cases of silver, lead or nickel of various thicknesses. In this, known as the method of Dr Dominici, the α and β rays are intercepted by the metal screens and the highly penetrative rays only applied to the morbid tissues.

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SURIFICATE, or MEERKAT (Suricata tetradactyla), a small South African mammal of the civet family, ranging from Cape Colony to Algoa Bay. The head and body are about 14 in. long, and the tail half as much; the fur is long and soft, light grazed grey in colour, and banded with black on the lower part of the back. Meerkats are sociable animals, living in holes in the rocks on the mountains, and burrowing in the sandy soil of the plains. They form amusing pets, and in a wild state, writes Mrs A. Martin, they feed chiefly on "succulent bulbs, which they scratch up with the long, curved, black claws on their fore-feet. They are devoted sun-worshippers and in the early morning, before it is daylight, they emerge from their burrows and walk in rows till their divinity appears, when they bask joyfully in his beams."

SURINAM TOAD (Pipa americana), an agnostic tailless Batrachian, rendered famous by its mode of reproduction, first observed in 1710 by the Dutch anatomist F. Rinicus. It inhabits South America and the west coast of the Amazon, and is thoroughly aquatic. In its extremely flattened head it is paralleled by two other vertebrates only, which, curiously, inhabit the same parts of South America, viz. the Silurid fish Aspredo batracus and the Chelonian Chelys matamata; the end of the snout and the angles of the jaws bear several lappets, the fingers terminate in a star-shaped appendage, the toes are very broadly webbed and the eyes are minute and without lids.

The eggs are carried on the back by the mother, and the skin thickens and grows around the egg until each is enclosed in a dermal cell, which is finally covered by a healthy lid believed to be formed by a secretion of the skin or else to represent the remains of the gelatinous capsule which at first surrounded the eggs. These, which may number about one hundred and measure five to seven millimetres in diameter, develop entirely within these pouches, and the young hop out in the perfect condition, without a vestige of a tail. Pairing takes place in the water, the male clasping the female round the waist. The way in which the eggs reach the back of the female has been observed in specimens kept in the London Zoological Gardens. During oviposition the cloacas projects from the vent as a bladdery-like pouch, which is inverted forwards, between the back of the female and the breast of the male, and by means of this ovi-POSITOR the eggs are evenly distributed over the whole back. How the eggs are fertilized has not been ascertained.


SURMA, or BARAK, a river of Assam, India. It is one of the two chief rivers of the province, watering the southern valley of the Brahmaputra waters the northern and larger valley. It rises in the Barall range to the north of Manipur, its sources being among the southern spurs of Tripo. Thence its course is south with a slight westerly bearing, through the Manipur hills to British territory. The name of Barak is given to this part of the river, in Manipur and Cachar. A short distance below Badarpur in Cachar it divides into two branches. One of these, which passes Syhet, is called Surma. The other is called Kusira till it subdivides into (a) a branch called Bhitiana Kahnì, which joins the Surma near Ajimganji, and (b) a branch which resumes the name of Barak and joins the Surma near Habiganj. At Bhairab Bazar in Mymensingh the Surma unites with the old Brahmaputra and becomes known as the Meghna. The river is navigable by steamers as far as Silchar in the rains. Total length about 500 m.

The SURMA VALLEY AND HILL DISTRICTS DIVISION is a division of the province of Eastern Bengal and Assam. It includes the five districts of Syhet Cachar, Lushai hills, Naga hills, and Khasi and Jaintia hills, with a total area of 25,481 sq. m. and a population in 1901 of 3,084,527.

SURFACE-WATER (Latin: superficium), is the part of a watercourse, lake, river, or standing water, which is exposed at low water; the part below the surface, yet above the bed of the stream and often covered with water, is called the sub-surface.

SURPLICE—SURPlice.

Fig. 19.—Radium Applicators.
SURRENDER—SURRENTUM

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that this was, in all main particulars, the custom so early as the 14th century.

The older history of the surplice is obscured by lack of exact information. Its name is derived, as Durandus and Gerland also affirm, from the fact that it was formerly put on over the fur garments which used to be worn in church and at divine service as a protection against the cold. It has been maintained that the surplice was known in the 5th century, the evidence being the garments worn by the two clergies in attendance on Bishop Maximian represented in the mosaics of S. Vitale at Ravenna; in this case, however, the dalmatic has been confused with the surplice. In all probability the surplice is no more than an expansion of the ordinary liturgical alb, due to the necessity for wearing it over thick furs. It is first mentioned in the 12th century, in a canon of the synod of Coyaza in Spain (1090) and in an ordinance of King Edward the Confessor. In Rome it was known at least as early as the 12th century. It probably originated outside Rome, and was imported thence into the Roman use. Originally only a choir vestment and peculiar to lower clergy, it gradually—certainly no later than the 13th century—replaced the alb as the vestment proper to the administering of the sacraments and other sacerdotal functions.

In the Oriental rites there is no surplice, nor any analogous vestment. Of the non-Roman Churches in the West the surplice has continued in regular use only in the Lutheran churches of Denmark, Norway and Sweden, and in the Church of England (see below).

Church of England.—The surplice was prescribed by the second Prayer-Book of Edward VI., as, with the tippet or the acedemical hood, the sole vestment of the minister of the church at “all times of their ministration,” the rochet being practically regarded as the episcopal surplice. Its use was furiously assailed by the extemore Reformers but, in spite of their efforts, was retained by Elizabeth’s Act of Uniformity, and enforced by the advertisements and injunctions issued under her authority, which ordered the “massing vestments”—chasubles, albs, stoles and the like—to be destroyed. It has since remained, with the exception of the cope (q.v.), the sole vestment authorized by law for the ministers, other than bishops, of the Church of England (for the question of the vestments prescribed by the “Ornaments Rubric” see VESTMENTS). Its use has never been confined to clerics in holy orders, and it has been worn since the Reformation by all the “ministers” (including vicars-choral and choristers) of cathedral and collegiate churches, as well as by the fellows and scholars of colleges and choirs. The distinctive mark of the clergy (at least of the more dignified) has been the tippet or scarf above mentioned, a broad band of black silk worn stole-wise, but not to be confused with the stole, since it has no liturgical significance and was originally no more than part of the clerical outdoor dress (see STOLE). The surplice was formerly only worn by the clergy when conducting the service, being exchanged during the sermon for the “black gown,” i.e. either a Geneva gown or the gown of an academic degree. This custom has, however, as a result of the High Church movement, fallen almost completely obsolete. The “black gown,” considered wrongly as the ensign of Low Church views, survives in comparatively few of even the “evangelical” churches; it is still, however, the custom for preachers of university sermons to wear the gown of their degree.

The traditional form of the surplice in the Church of England is that which survived from pre-Reformation times, viz. a wide-sleeved, very full, plain, white linen tunic, pleated from the yoke, and reaching almost, or quite, to the feet. Towards the end of the 17th century, when large wigs came into fashion, it came for convenience to be constructed gown-wise, open down the front and buttoned at the neck, a fashion which still partially survives, notably at the universities. In general, however, the tendency has been, under continental influence, to curtail its proportions. The ample vestment with beautiful falling folds has thus in many churches given place to a scanty, unplasted garment scarce reaching to the knee. In the more “extreme” churches the surplices are frank imitations of the Roman cassock (W. A. P.)

SURRENDER, in law, a mode of alienation of real estate.

It is defined by Lord Coke to be “the yielding up of an estate for life or years to him that hath an immediate estate in reversion or remainder” (Coke upon Littleton, 337 b). It is the converse of release, which is a conveyance by the reversoner or remainderman to the tenant of the particular estate. A surrender is the usual means of effecting the alienation of copyholds. The surrender is made to the lord, who grants admissitance to the purchaser, an entry of the surrender and admittance being made upon the court rolls. Formerly a devise of copyholds could only have been made by surrender to the use of the testator’s will followed by admittance by the devisee. The Wills Act of 1837 now allows the devisee of copyholds without surrender, though admissitance of the devisee is still necessary. A surrender must, since the Real Property Act 1845, be by deed, except in the case of copyholds and of surrender by operation of law. Surrender of the latter kind generally takes place by merger, that is, the combination of the greater and less estate by descent or by other means without the act of the party (see REMAINDER). In Scots law surrender in the case of a lease is represented by renunciation. The nearest approach to surrender of a copyhold is resignation in remanentiam (to the lord) or resignation in faveore (to a purchaser). These modes of conveyance were practically superseded by the simpler form introduced by the Conveyancing Act 1874.

SURRENTUM (mod. Sorrento, q.v.), an ancient town of Campania, Italy, situated on the N. side of the promontory which forms the S.E. extremity of the Bay of Naples. The legends indicate a close connexion between Lipara and Surrentum, as though the latter had been a colony of the former; and even through the Imperial period Surrentum remained largely Greek. Before the Roman supremacy it was one of the towns subject to Surrentum, and shared its fortunes (to the Social War; it seems to have joined in the revolt of 90 B.C. of the Stabiae; and was reduced to obedience in the following year, when it seems to have received a colony. Its prosperity dates from the imperial period, when Capreae was a favourite residence of Augustus and Tiberius. Numerous sepulchral inscriptions of Imperial slaves and freedmen have been found at Surrentum. An inscription shows that Titus in the year after the earthquake of A.D. 79 restored the horologium of the town and its architectural decoration. A similar restoration of an unknown building in Naples in the same year is recorded in an inscription from the last-named town (cf. A. Sogliano in Notizie degli Scavi, 1904, p. 363). The most important remains of Surrentum are those of Athena and of the Sirens (the latter the only one in the Greek world in historic times); the former gave its name to the promontory. In antiquity Surrentum was famous for its wine (oranges and lemons which are now so much cultivated there not having been introduced into Italy in antiquity), its fish, and its red Campanian vases; the discovery of coins of Massilia, Gaul and the Balearic Islands here indicates the extensive trade which it carried on. The position of Surrentum was very secure, it being protected by deep gorges, except for a distance of 300 yds. on the south-west where it was defended by the walls, and the north-west by those of Athena and of the Sirens. The arrangement of the modern streets preserves that of the ancient town, and the disposition of the walled paths which divide the plain to the east seems to date in like manner from Roman times. No ruins are now preserved in the town itself, but there are many remains in the villa quarter to the east of the town on the road to Stabiae, of which traces still exist, running much higher than the modern road, across the mountain; the site of one of the largest (possibly belonging to the Imperial house) is now occupied by the Hotel Victoria, under the terrace of which a small theatre was found in 1855; an ancient rock-cut tunnel descends hence to the shore. Remains of other villas may be seen, but the most important ruin is the reservoir of the (subterranean) aqueducts just outside the town on the east, which had no less than twenty-seven chambers each about 90 ft. by 20 ft. Greek and Oscan tombs
have also been found. Another suburb lay below the town and on the promontory on the west of it; under the Hotel Sirena are substructions and a rock-hewn tunnel. To the north-west on the Cape, the Sorrento has been built, the so-called Regina Giovanna, with baths, and in the bay to the south-west was the villa of Polluis Felix, the friend of Statius, which he describes in Silvae ii. 2, of which remains still exist.

Farther west again are villas, as far as the temple of Athena on the promontory named after her at the extremity of the peninsula (now Punta Campanella). Neither of this nor of the famous temple of the Sirens are any traces existing.

See J. Beloch, 


SURREY, EARLDOM OF. There is some doubt as to when this earldom was created, but it is unquestionably of early origin. A Norman count, William de Warenne (c. 1030–1088), is generally regarded as its first holder and is thought to have been made an earl by William II. about 1088. William and his successors were styled earls of Surrey or Ears Warenne indifferently, and the family became extinct when William, the 3rd earl, died in 1148. The second family to hold the earldom of Surrey was descended from Isabel de Warenne (d. 1190), daughter and heiress of Earl William, and her second husband Hamelin Plantagenet, d. 1216, and his brother Richard de Warenne, 2nd Earl of Surrey. Hamelin took the name of Warenne and was recognized as earl of Surrey or Earl Warenne, and his descendants held the earldom until Earl John died without legitimate issue in 1347.

The earldom and estates of the Warennes now passed to John's nephew, Richard Fitzalan, earl of Arundel (c. 1307–1376), being forfeited when Richard's son, Richard, was beheaded for treason in 1307. Then for about two years there was a duke of Surrey, the title being borne by Thomas Holand, earl of Kent (1374–1400), from 1397 until his deposition in 1399. In 1400 Richard Fitzalan's son, Sir Thomas Fitzalan (1381–1415), was restored to his father's honours and became earl of Arundel and earl of Surrey, but the latter earldom reverted to the Crown when he died. In 1415 John Mowbray (1444–1476), afterwards duke of Norfolk, was created earl of Surrey, but the title became extinct on his death.

The long connexion of the Howards with the earldom of Surrey began in 1483 when Thomas Howard, afterwards duke of Norfolk, was created earl of Surrey. Since that time, with the exception of brief periods when some of its holders were under arrest, the earldom of Surrey was always held by the dukes of Norfolk. The courtesy title of the duke's eldest son is earl of Surrey.

See the articles WARENNE, EARLS; and ARUNDEL, EARLS OF; also G. E. C. (okayne), Complete Peerage, vol. vii. (1896).

SURREY, HENRY HOWARD, EARL OF (1518–1547). English poet, son of Lord Thomas Howard, afterwards 3rd duke of Norfolk, and his wife Elizabeth Stafford, daughter of the duke of Buckingham, was born probably in 1518. He succeeded to the courtesy title of earl of Surrey in 1524, when his father became duke of Norfolk. His early years were spent in the various houses belonging to the Howards, chiefly at Kennington, in the county of Oxford. This was concluded at the earliest possible date, in February 1532, but in consequence of the extreme youth of the contracting parties, Frances did not join her husband until 1535. In October Surrey accompanied Henry VIII. to Boulogne to meet Francis I., and, rejoining the duke of Richmond at Calais, he proceeded with him to the French court, where the two Englishmen were lodged with the French royal princes. Surrey created for himself a reputation for wisdom, soberness and good learning, which seems curious in view of the events of his later life.

In 1535, while in Spain, he made the project of a contract between him and the princess Mary was revived in a correspondence between Pope Clement VII. and the emperor Charles V., but definitely rejected by the latter. Surrey only returned to England in the autumn of 1535, when the duke of Richmond was recalled to marry his friend's sister, Mary Howard. Surrey made his home at his father's house of Kenninghall, and here was a witness of the final separation between his parents, due to the duke's relations with Elizabeth Holland, who had been employed in the Howards' nursery. Surrey took his father's side in the family disputes, and when Kenninghall was purchased for him in 1535. In May 1536, he discharged his father's functions of earl marshal at the trial of his cousins Anne Boleyn and Lord Rochford. In the autumn of that year he took part with his father in the bloodless campaign against the rebels in Yorkshire and Lincolnshire, in the "Pilgrimage of Grace." Although he had supported the royal cause, insinuations were made that he secretly favoured the insurgents. Hasty in temper, and by no means friendly to the Seymour faction at court, he struck a man who repeated the accusation in the park at Hampton Court. For breaking the peace in the king's domain he was arrested in 1541, but released in time to exchange for the petition of the young man's father, he was not compelled to appear before the privy council, but was merely sent to reside for a time at Windsor. During this imprisonment and the subsequent retirement at Kenninghall, he had leisure to devote himself to poetry. He was again received into favour. In May 1540 he was one of the champions in the jousts celebrated at court. The fall of Thomas Cromwell a month later increased the power of the Howards, and in August Henry VIII. married Surrey's cousin, Catherine Howard. Surrey was knighted early in 1541, and soon after he received the order of the Garter, made a grand councilor of the realm, and re-formed his connection with his father, grand seneschal of the university of Cambridge. He apparently preserved the royal favour after the execution of Catherine Howard (at which he was present), for in December 1541 he received the grant of certain manors in Norfolk and Suffolk. In 1542 he was imprisoned in the Fleet for a quartar with a certain John Leigh, but on appeal to the privy council he was sent to Windsor Castle, and, after being bound over to keep the peace with John Leigh under a penalty of 10,000 marks, he was soon liberated.

Shortly after his release he joined his father on the Scottish expedition. They laid waste the country, but retreated before the earl of Huntly, taking no part in the victorious operations that led up to Solway Moss. To this year no doubt belong the poems in memory of Sir Thomas Wyatt. His ties with Wyatt, who was fifteen years his elder and of opposite politics, seem to have been rather literary than personal. He appears to have entered into closer relations with the younger Wyatt. In company with "Mr Wyatt," he amused himself by breaking the windows of the citizens of London on the 2nd of February 1543. For this he was accused by the privy council, a second charge being that he had been present at the meet in Lent. In prison probably he wrote the satire on the city of London, in which he explains his escapade by a desire to rouse Londoners to a sense of their wickedness. In October he joined the English army co-operating with the imperial forces in Flanders, and on his return in the next month brought with him a letter of high commendation from Charles V. In the campaign of the next year he served as field marshal under his

1 The only authority for the date of his birth is the legend Salt. superest. Aetatis XXIX. on a portrait of Henry Howard at Arundel Castle.
father, and took part in the unsuccessful siege of Montreuil. In August 1545 he was sent to the relief of Edward Paynings, then in command of Boulogne, and was made lieutenant-general of the English possessions on the Continent and governor of Boulogne. Here he gained considerable successes, and insisted on the retention of the town in spite of the desire of the privy council that it should be surrendered to France. A reverse on the 7th of January at St Étienne was followed by a period of inaction, during which Suffolk was in the Dutch service.

Suffolk had always been an enemy to the Seymours, whom he regarded as upstarts, and when his sister, the duchess of Richmond, seemed disposed to accept a marriage with Sir Thomas Seymour, he wrote to her insinuating that this was a step towards becoming the mistress of Henry VIII. By his action in thwarting this plan he increased the enmity of the Seymours and added his sister to the already long list of the enemies which he had made by his haughty manner and brutal frankness. He was now accused of quartering with his own the arms of Edward the Confessor, a proceeding which, if true, was, only permissible for the heir to the crown. The details of this accusation were false; moreover, Suffolk had long quartered the royal arms with his own without offence. The charge was a pretext covering graver suspicions. Suffolk had asserted in the presence of a certain George Blage, who was inclined to the reforming movement, that on Henry’s death, his father, the duke of Norfolk, as the premier duke in England, had the obvious right of acting as regent to Prince Edward. He also boasted of what he would do when his father had attained that position. All of this was construed into a plot on the part of his father and himself to end in March Suffolk and the prince. The duke of Norfolk and his son were sent to the Tower on the 12th of December 1546. Every effort was made to secure evidence. The duchess of Richmond was one of the witnesses (see her depositions in Herbert of Cherbury, Life and Reign of Henry VIII., 1649) against her brother, but her statements were too doubtful to add anything to the formal indictment. On the 25th of January 1547 Suffolk defended himself at the gaolhall on the charge of high treason for having illegally made use of the arms of Edward the Confessor, before judges selected for their known hatred of himself. He was condemed by a jury, packed for the occasion, to be hanged, drawn and quartered at Tyburn. This sentence was commuted to transportation to Tower Hill on the 19th of the month, and was buried in the church of All Saints, Barking. His remains were afterwards removed by his son the earl of Northampton to Framlingham, Suffolk. His father, who was charged with complicity in his son’s crime, was, as a peer of the realm, not amenable to a common jury. The consequent delay saved his life. He was imprisoned during the whole of the reign of Edward VI., but on Mary’s accession he was set free, by an act which also assured the right of the Howards, as descendants of the Mowbray family, to bear the arms of the Confessor.

Surrey’s name has been long connected with the “Fair Geraldine,” to whom his love poems were supposed to be addressed. The story is recorded in the last section of Thomas Nashe, The Unfortunate Traveller, or Life of Jack Wilton (1594), according to which Surrey saw a magic glass in the Netherlands the face of Geraldine, and then traced those features to the challenge placed by a woman in one of the fields of the lady. At Florence he held a tournament in her honour, and was to do the same in other Italian cities when he was recalled by order of Henry VIII. The legend, deprived of its more glaring discrepancies with Surrey’s life, and revived by Drayton’s England’s Heroicall Epistles (1598). Geraldine was the daughter of the earl of Kildare, Lady Elizabeth Fitzgerald, who was brought up at the English court in company with the princess Elizabeth, afterwards Mary, Queen of Scots (see Lives of the Fitzgeralds, 1874). She was ten years old when in 1537 Surrey addressed to her the sonnet “From Tuscanie came my ladies worthy race,” and another one “And游击队 in your pleasures in exile,” are addressed to her wife, to whom, at any rate in his later years, he seems to have been sincerely attached.

His poems, which were the occupation of the leisure moments of his short and crowded life, were first printed in Songs and Sonettes written by the right honorable Lord Henry Howard late Earl of Surrey, and afterwards (another collection followed) in July 1557, and others in 1559, 1565, 1567, 1570, 1580, and 1587. Although Surrey’s name, probably because of his rank, stands first on the title-page, Wyatt was the earlier in point of time and more original. The courtiers, who had stuck close to the king’s contributions are distinguished by their impetuous eloquence and sweetness. He revived the principles of Chaucer’s versification, which his predecessor had allowed to fall on a weak syllable, nor did he permit weak syllables as rhymes. His chief innovation as a poet lies outside the form, for the earlier volumes of his Poetical Works, the first and fourth books of the Aenidae into blank verse—the first attempt at blank verse in English—was published separately by Tottel in the same year with the title of Certain Bookes of Virgiles Aenidae turned into English meter. It has been suggested that in this matter Surrey was influenced by the translation of Virgil published at Venice by Ippolito de’ Medicis in 1541, but there is no direct evidence that such was the case. His sonnets are in various schemes of verse, and are less correct in form and more loosely constructed than those of Wyatt. They commonly consist of three quatrains with independent rhymes, terminating with a rhyming couplet. But his sonnets, which had the least value of the poems left to him, are still more free from the form, and his lyrics in various measures, served as models to more than one generation of court poets. Both in form and substance Surrey and his fellow poets were largely indebted to Italian predecessors of his, but the English were the first in originals. The tone of the love sentiment was new in English poetry, very different in its earnestness, passion and fantastic extravagance from the lightness and gaiety of the Chaucerian school.

SURREY, a south-eastern county of England bounded N. by the Thames, separating it from Buckinghamshire and Middlesex, E. by Kent, S. by Sussex, and W. by Hampshire and Berkshire. The county Northemlyly includes the tidal portion of the Thames (south of the Thames) on the north-east. The area is 758 sq. m. The north Downs are a picturesque line of hills running east and west through the county somewhat south of the centre (see Downs). Leith Hill, south-west of Dorking (805 ft.), is the highest summit, and commands a prospect unrivalled in the south of England; Holmbury Hill close by reaches 857 ft., and the detached summit of Hindhead above Haslemere in the south-west reaches 895 ft. At Guildford the Wey breaches the hills; and at Dorking the Mole. These are the chief rivers of the county; they reach the Thames near Weybridge and at East Molesey respectively. The county is divided into two districts, the north and south respectively, the latter including the largest part of the county. Surrey is thus almost entirely in the Thames basin. In the south-east it includes headstreams of the Eden, a tributary of the Medway; and in the south a small area drains to the English channel. Three types of scenery appear—that of the hilly southern district; that of the Thames, with its richly-wooded banks; and, in the north-west, that of the sandy heath-covered district, abundant in conifers, which includes the healthy open tracts of Bagshot Heath and other commons, extending into Berkshire and Hampshire. Possessing these varied attractions, Surrey has become practically a great residential district for those who must live in the neighbourhood of London.

Geology.—The northern portion of the county, in the London basin elevation, belongs to the London Clay, with its Upper Eocene deposits, the London Clay, the lowest of which is generally the London Clay of the Lower Eocene, stretching (with interruptions) from London to Farnham; this is fringed on its southern edge by the underlying Woolwich beds of the same group,

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which also appear in isolated patches at Headley near Leatherhead; and the thatchets at the base crop out between Beddington, Banstead and Leatherhead. The north-western portion of the county, which is called the South Surrey or South-West area, is in the Upper Eocene, Bagshot Sands: the Fox hills and the black Chobham Ridges are formed of the upper series of the group, which rests upon the Wey valley clay. The district has been called the Bagshot Heath by Blaisey and Firbright commons, while eastwards the commons of Chobham, Woking and Esher belong to the lower division of the group. To the south of the Eocene formations the smooth rounded outliers of the clay hills extend to and surround the centre of the county from Farnham to Westerham (Kent). From Farnham to Guildford they form a narrow ridge called the Hog’s Back, about half a mile in breadth with a higher northern escarpment embracing the towns of Barnet and Harrow. Between East and Guildford the northern dip decreases and the outcrop widens, throwing out picturesque summits, frequently partly wooded, and commanding wide and beautiful views of the Weald. The Wealden clay is well known as firestone, and quarried and mined for this purpose and for hearthstone near Godstone, crops out underneath the Chalk along the southern escarpment of the Downs. The Gault, a dark blue sandy clay, rests beneath the Upper Greensand and is the bottom of the long narrow valley which separates the chalk Downs from the well-marked Lower Greensand hills. The Lower Greensand includes the subordinated diatomaceous beds of the Folkestone that here are lavishly near the claystone for commercial purposes; the Sandgate beds, to which the well-known fuller’s earth of Nutfield belongs, and the Hythe beds, which contain the Kentish Rag, a sandy chloritic limestone used for building purposes. This formation is comical of this series locally called Bargete stone. To this formation belong the heights of Leith Hill, Hindhead and the Devil’s Punchbowl, Holmbury Hill. Between the Lower Greensand and the Wealden clay the Weald clay is frequently covered with a few feet of loam. The Weald Clay itself consists of a blue or brown shaly clay, amid which are deposited river shels, plants of tropical origin and reptilian remains. The Weald Clay is much worked for clay pitting by the Wealden Sandstone, 90 ft. thick, is a small area in the south-eastern corner of the county. Bordering the Thames there are terraced deposits of gravel and loam.

Agriculture.—Between one-half and three-fifths of the area of the county, a low proportion, is under cultivation, and of the land that is in permanent pasture there are considerable varieties of soil, ranging from plastic clay to calcareous earth and bare rocky heath. The plastic clay is well adapted for wheat, but only extensively grown on the London Clay. A considerable area is occupied by market gardens on the alluvial soil along the banks of the Thames, especially in the vicinity of London. In early times the market gardeners were Flemings, who introduced the culture of asparagus at Ruislip and of carrots at Chertsey. Rhodendrons and azaleas are largely grown in the north-western district of the county. In the neighbourhood of Mitcham various medicinal plants are cultivated, especially lavender, marjoram, rosemary, liquorice, hyssop, &c. The calcareous soil in the neighbourhood of Farnham is well adapted for hops, but this crop in Surrey is of minor importance. There is a large market for hops at Woking. Such crops as oak, chestnut, ash, beech, sycamore, birch are extensively planted; alder and willow plantations are common; and the Scotch fir propagates naturally from seed on the commons in the north-west. The extent of pasture land is not great, with the exception of the Isle of Wight, which is entirely devoted to pasturage. Dairy-farming is a more important industry than cattle-rearing, large quantities of milk being sent to London.

Manufactures and Communications.—The more important manufactures are chiefly confined to London and its immediate neighbourhood. The rivers Mole and Wandle, however, supply power for a variety of manufactures, such as oil, paper and sheet-iron mills. Communications include the navigation of the Thames and the Medway, and the Basingstoke canal, communicating with the Wey from Frimley and Woking. Owing to its proximity to London the county is served by many lines of railway, the companies being the London & South Western, London Brighton & South Coast and the South-Eastern & Chatham.

Population and Administration.—The area of the ancient county is 485,122 acres, with a population in 1901 of 2,012,774. The population of the counties of Surrey and Middlesex (1,698,032) is equal to 13 per cent. of the population of England and Wales, as also in 1841. The population of the county has doubled between 1871 and 1901. Under the provisions of the Local Government Act 1888, part of the county was transferred to the county of London. Thus the area of the ancient county remains 55,461 acres, with a population in 1901 of 675,774. The area of the administrative county is 461,807 acres. The county contains 14 hundreds. Croydon (pop. 133,895) is a county borough, and the ancient city of London (pop. 1,325,098) is a Metropolis County Borough. The counties of Croydon, Epsom (109,915), Esher and The Dittons (94,899), Farnham (91,377), Frimley (84,094), Hambledon (146,094). The following are urban districts: Barnes (17,668), Carshalton (67,576), Caterham (64,906), Chertsey (12,762), Effingham (8,783), Egham (7,249), Ewell (10,915), Esher (15,958), Kingston (34,475), Reigate (25,906), Richmond (31,672), Wimbledon (41,652). The following are rural districts: Barnes, Carshalton, Leatherhead, Malden and Morden. There are six parliamentary divisions—North Western or Chertsey, Mid or Epsom, Kingston, North Eastern or Woking, South Eastern or Croydon, South Western or Guildford, and West or Woking. The borough of Croydon returns one member. Surrey is in the south-eastern circuit, and assizes are held at Guildford and Kingston alternately. The administrative county has one court of quarter sessions, but the liberty of Chertsey has a separate court of sessions. The county is divided into 10 hundreds, and the hundreds of Croydon, Godalming, Guildford, Kingston, Reigate and Richmond have separate commissions of the peace, and Croydon and Guildford have in addition separate courts of quarter sessions. The county is constituted of fourteen hundreds, and has jurisdiction over certain parishes adjacent to London. All those civil parishes within the county of Surrey, of which any part is within 12 m. of, or of which no part is within 12 m. from, Charing Cross, are in the metropolitan police district. The total number of civil parishes is 144. The ancient county contains 230 ecclesiastical parishes or districts, wholly or in part situated in the dioceses of Rochester, Winchester, Canterbury, Oxford, and Chichester.

History.—The early history of this county is somewhat uncertain. Ethelward, in the Anglo-Saxon Chronicle for 823, places it in the "Medii Angli" or "Medii Saxones." Its position between the Weald and the Thames decided its northern and southern borders, and the Kentish boundary probably dates from the battle of Wibbandune between Ethelbert of Kent and Cæwan of Wessex, which traditionally took place at Wimborne, though this is disputed. The western border, like the southern, was a wild uncultivated district; no settled boundary probably existing at the time of the Domesday Survey. The number of hundreds at that time was fourteen as now, but the hundred of Farnham was not so called till the time of Wim- bledon. "The hundred of Wimborne" is one of the largest; and the present hundred of that name. There is no record of Surrey ever having been in any diocese but Winchester, of which it was an archdeaconry in the 12th century. At the time of the Domesday Survey there were four deaneries: Croydon, Southwark, Guildford and Ewell. Croydon was a peculiar of Canterbury, in which diocese it was included in 1291. In the time of Henry VIII., Croydon was comprehended in the deanery of Ewell, some of its rectories being included in the deanery of Southwark. The old deanery of Guildford was included in the modern one of Stoke. In 1577, Southwark, with some parishes, was transferred to the diocese of Rochester. In the 17th century Surrey was under the overlordship of Wulfhere, king of Mercia, who founded Chertsey abbey, but in 823, when the Mercians were defeated by Egbert of Wessex, it was included in the kingdom of Wessex, as the Anglo-Saxon Chronicle relates.

Surrey was constantly overrun by Danish hordes in the 9th century and until peace was established by the accession of Canute. In 857 a great national victory over the Danes took place at Ockley near Leith Hill. Surrey is not of great historical importance, except its northern border, the southern part having the forest of Weybridge and the Thankful, impassable for an army. Guildford, though the county town, and often the seat of the court under John and Henry III., was of little importance beside Southwark, the centre of trade and commerce, the residence of many ecclesiastical dignitaries, a frequent point of attack on London, and a centre for rebellions and riots. The Norman army traversed and ravaged the county in their march on London, a large portion of the county having been in the hands of Edward and Harold, fell to the share of William himself; his most important tenants in chief being Odo of Bayeux and Robert of Gloucester. At the time of the Barons’ War the bishopric was divided—de Clare marching with Montfort, and de Warenne supporting the king. In the Peasants’ Rising of 1381,
and during Jack Cade's Rebellion in the next century, Southwark was invaded, the prisons broken open and the bridge into London crossed. London was unsuccessfully attacked from the Surrey side in the Wars of the Roses; and was held for three days and pillaged during a rising of the southern counties under Mary. During the fears of invasions from Spain, levies were held in readiness in Surrey to protect London; and it was an even more important bulwark of London in the Civil War, on account of the powder mills at Chilworth and the cannon foundries of the Weald. In common with the southern counties, a distinctively Surrey accent still is in sympathetic use. Sir Richard Onslow and Sir Poyning's More were the most prominent local leaders. Farnham Castle and Kingston, with its bridge, were several times taken and held during the war by the opposing parties, and in the later part of the war, when the parliament and army were treating, three of the line of forts defending London were on the Surrey side, from which the army entered London.

The last serious skirmish south of the Thames took place near Ewell and Kingston, where the earl of Holland and a body of the Royalists were routed. This was the last real fighting in the county, though it was often a centre of riot; the most serious being those of 1830, and of the Chartists in 1848, who chose Kennington Common as their meeting-place. The Moors of Loselay and the Onsloes were among the most famous county families under the Tudors, as at the time of the Civil War; the Onsloes being even better known later in the person of Sir Arthur Onslow, Speaker of the House under George I.

The earliest industries in Surrey were agricultural. The stone quarries of Limpsfield and the chalk of the Downs were early used, the latter chiefly for lime-making. Fuller's earth was obtained from Reigate and Nutfield; and the facilities afforded by the many small streams, and the excellent sheep pasture, made it of importance in the manufacture of cloth, of which Guildford was a centre. Glass and iron were made in the Weald district, whose forests produced the necessary charcoal for smelting. Chiddingfold is mentioned in 1266 for its glass-making, and was one of the chief glass-producing districts in late Tudor times. The iron-works of Surrey were of less importance, and much later in development than those of Kent and Sussex, owing to the want of good roads or waterways, but the increasing demand for ordnance in the 16th century led to the spread of iron industry northward; the most considerable works in Surrey being those of Viscount Montague at Haslemere. Chilworth, which was famous for its powder mills in the 16th century, remains a seat of the industry. Southwark and its neighbouring hood early became a suburb of London and a centre of trades which were crowded out of London. The earliest Delft ware manufactary in England was at Lambeth, which maintains its fame as a centre of earthenware manufacture. The beautiful encaustic tiles of Chertsey Abbey are thought to have been made in English monasteries and date from the 13th century. Although the county was doubtless represented in the representative councils of the reign of Henry III., the first extant returns of two knights of the shire are for the parliament of 1290. The Reform Bill of 1832 gave Surrey four members; dividing the county into east and west divisions. Several boroughs were disfranchised then and in 1867, when East Surrey was again divided into east and mid divisions, on account of the growth of London suburbs, two more members being added at the same time. In 1855 all old boroughs and divisions were superseded; the county being divided into the electoral divisions of Chertsey, Guildford, Reigate, Epsom, Kingston and Wimbledon, each returning one member. Finally, in 1888, the new county of Surrey annexed large portions of Surrey along the northern border.

Antiquities.—The only ecclesiastical ruins worthy of special mention are the picturesque walls of Newark Priory, near Woking, founded for Augustinians in the time of Richard Coer de Lion; and the Early English crypt and part of the refectory of Waverley Abbey, the earliest house of the Cistercians in England, founded in 1128. The church architecture is of a very varied kind, and has no peculiarly special features. Among the more interesting churches are Albury (the old church), near Guildford, the tower of which is of Saxon or very early Norman date; Beddington, a fine example of Perpendicular, containing monuments of the Carew family; Chaldon, remarkable for its fresco wall-paintings of the 12th century, discovered during restoration in 1870; Compton, which, though mentioned in Domesday, possesses little of its original architecture, but is worthy of notice for its two-storeyed chantry and its carved wooden balustrade surmounting the pointed transitional Norman arch which separates the nave from the chancel. Leigh, Perpendicular, possessing some very fine brasses of the 13th century; Lingfield, Perpendicular, containing ancient tombs and brasses of the Cobhams, and some fine stalls (the church was formerly collegiate); Ockham, chiefly Decorated, with a lofty embattled tower, containing the mausoleum of Lord Chancellor King (d. 1754), with full-length statue of the chancellor by Rysbrack; Stoke d'Abernnon, Early English, with the earliest extant English brass, that of Sir John d'Abernnon, 1277, and other fine examples. Churches at Guildford, Reigate and Woking are also noteworthy. A few early examples are Farnham, occupied as a palace by the bishops of Winchester; the most interesting of Blois, and restored by Henry III.; and Guildford, with a strong quadrangular Norman keep. Of ancient domestic architecture examples include Beddington Hall (now a female orphan asylum), the ancient mansion of the Carews, rebuilt in the reign of Queen Anne, and in modern times, but retaining the hall of the Elizabethan building; Crowhurst Place, built in the time of Henry VII., the ancient seat of the Gaynesfords, and frequently visited by Henry VIII.; portions of Croydon Palace, an ancient seat of the archbishops of Canterbury; the gate tower of Esher Place, built by William of Wykeham, bishop of Winchester, and repaired by Cardinal Wolsey; Archbishop Abbot's hospital, Guildford, in the Tudor style; the fine Elizabethan house of Losley near Guildford; Smallsfield Place near Reigate, now a farmhouse, once the seat of Sir Edward Bysse (c. 1615–1679), garter king-at-arms; Sutton Place near Woking, dating from the time of Henry VIII., possessing curious mouldings and ornaments in terra-cotta; and Ham House, of red brick, dating from 1610.


SURROGATE (from Lat. surrogare, to substitute for), do a deputy of a bishop or an ecclesiastical judge, acting in the absence of his principal and strictly bound by the authority of the latter. Canon 32 of the canons of 1603 lays down the qualifications necessary for the office of surrogate and canon 127 the regulations for the appointment to the office. At present the chief duty of a surrogae is in England is the granting of marriage licences, but judgments of the arches court of Canterbury have been delivered by a surrogae in the absence of the official principal. The office is unknown in Scotland, but is of some importance in the United States as denoting the judge to whom the jurisdiction of the probate of wills, the grant of administration and of guardianship is confined. In some states he is termed surrogae, in others judge of probate, register, judge of the orphans' court, &c. His jurisdiction is local, being limited to his county.

SURTEES, ROBERT (1734–1814), antiquary and topographical historian, was the son of Robert Surtees of Mainsforth, Durham. He was educated at Christ Church, Oxford, and after studying law without being called to the bar he settled on the family estate at Mainsforth, which he inherited on his father's death in 1802, and where he lived in retirement for the rest of his life, devoting himself to the study of local antiquities and collecting materials for his History of Durham. This
book was published in four volumes, the first of which appeared in 1816, and the last in 1840, after the author’s death. The work contains a large amount of an episcopal and antiquarian information; it is written in a readable style, and its learning is enlivened by humour. Surtees had also a gift for ballad writing, and he was so successful in imitating the style of old ballads that he managed to deceive Sir Walter Scott himself, who gave a place in his Minstrelsy of the Scottish Border to a piece by Surtees called “The Death of Featherstonehaugh,” under the impression that it was ancient. Surtees, who in 1807 married Anne Robinson, died at Mainsforth on the 11th of February 1834. As a memorial of him the Surtees Society was founded in 1834 for the purpose of publishing and collecting unedited manuscripts bearing on the history of the border country.


SURTEES, ROBERT SMITH (1803–1864), English novelist and sporting writer, was the second son of Anthony Surtees of Hamsterley Hall, a member of an old Durham family. Educated to be a solicitor, Surtees soon began to contribute to the Sporting Magazine, and in 1831 he published a treatise on the law relating to horses and particularly the law of warranty, entitled The Horseman’s Manual. In 1832 and 1833, he helped to found the Horseman’s Journal, of which he was the editor for the next five years. To this periodical he contributed between 1832 and 1834 the papers which were afterwards collected and published in 1838 as Jorrocks’s Jaunts and Jollities. This humorous narrative of the sporting experiences of a cockney grocer, which suggested the more famous Pickwick Papers of Charles Dickens, is the work by which Surtees is chiefly remembered, though his novel Handley Cross, published in 1843, in which the character of “Jorrocks” is re-introduced as a master of fox-hounds, also enjoyed a wide popularity. The former of these two books was illustrated by “Thix” (H. K. Browne), and the latter, as well as most of Surtees’s subsequent novels, by John Leech, whose pictures of “Jorrocks” are everywhere familiar and were the chief means of ensuring the lasting popularity of that humorous creation. In 1838, on the death of his father, Surtees, whose elder brother had died in 1831, inherited the family property of Hamsterley Hall, where he lived for the rest of his life. The later novels by Surtees included Hildesdon Hall (1849), in which “Jorrocks” again appears; Hawbuck Grange (1847); Mr sponge’s sporting tour (1853); ask mamma (1859); Mr facey Romford’s hounds (1863). The last of these novels appeared after the author’s death, which occurred on the 16th of March 1864. In 1841 he married Elizabeth Jane, daughter of Addison Fenwick of Bishopwearmouth, by whom he had one son and two daughters, the younger of whom, Eleanor, in 1855 married John Prenedest Vereker, afterwards 5th Viscount Gort.


SURVEYING, the technical term for the art of determining the position of prominent points and other objects on the surface of the ground, for the purpose of making therefrom a graphic representation of the area surveyed. The general principles on which surveys are conducted and maps computed from such data are in all instances the same; certain measures are made on the ground, and corresponding measures are projected on paper on whatever scale may be a convenient fraction of the natural scale. The method of surveying varies with the magnitude of the survey, which may embrace an empire or represent a small plot of land. All surveys rest primarily on linear measurements for the direct determination of distances; but linear measurement is often supplemented by angular measurement which enables distances to be determined by principles of geometry over areas which cannot be conveniently measured directly, such, for instance, as hilly or broken ground. The nature of the survey depends on the proportion which the linear and angular measures bear to one another and is almost always a combination of both.

History.—The art of surveying, i.e. the primary art of map-making from linear measurements, has no historical beginning. The first rude attempts at the representation of natural and artificial features on a ground plan based on actual measurements of which any record is obtainable were those of the Romans, who certainly made use of an instrument not unlike the plane-table for determining the alignment of their roads. Instruments adapted to surveying purposes were in use many centuries earlier than the Roman period. The Greeks used a form of log line for recording the distances from point to point along the coast, while making their slow voyage from the Indus to the Persian Gulf three centuries B.C.; and it is improbable that the adaptation of this form of linear measurement was confined to the sea alone. Still earlier (as early as 1600 B.C.) it is said that the Chinese knew the value of the loadstone and possessed some form of magnetic compass. But there is no record of their methods of linear measurements, or that the distances and angles measured were applied to the purpose of map-making (see COMPASS and MAP). The earliest maps of which we have any record were based on inaccurate astronomical data; and it was not till several centuries, when the Arabs made use of the Astrolabe (q.v.), that nautical surveying (the earliest form of the art) could really be said to begin. In 1450 the Arabs were acquainted with the use of the compass, and could make charts of the coast-line of those countries which they visited. In 1498 Vasco da Gama saw a chart of the coast-line of India, which was shown him by a Gujarati, and there can be little doubt that he benefited largely by information obtained from charts which were of the nature of practical coast surveys. The beginning of land surveying (apart from small plan-making) was probably coincident with the earliest attempts to discover the size and figure of the earth by means of exact measurements, i.e. with the inauguration of geodesy (see GEODESY and Earth, Figure of the), which is the fundamental basis of all scientific surveying.

Classification.—For convenience of reference surveying may be considered under the following heads—involving very distinct branches of the art dependent on different methods and instruments:

1. Geodetic triangulation.
2. Levelling.
3. Nautical surveys.

1. Geodetic Triangulation

Geodesy, as an abstract science dealing primarily with the dimensions and figure of the earth, may be found fully discussed in the articles GEODESY and Earth, Figure of the; but, as furnishing the basis for the construction of the first framework of triangulation on which all further surveys depend (which may be described as its second but most important function), geodesy is an integral part of the art of surveying, and its relation to subsequent processes requires separate consideration. The part which geodetic triangulation plays in the general surveys of civilized countries which require closely accurate and various forms of mapping to illustrate their physical features for military, political or fiscal purposes is best exemplified by reference to some completed system which has already served its purpose over a large area. That of India will serve as an example.

The great triangulation of India was, at its inception, calculated to satisfy the requirements of geodesy as well as geography, because the latitudes and longitudes of the points of the triangulation had to be determined for future reference by process of calculation combining the results of the triangulation with the elements of the earth’s figure. The latter were not then known with much accuracy, for so far geodetic operations had been mainly carried on in Europe, and additional operations nearer the equator were much wanted; the survey was conducted with a view to supply this want. The necessity for accuracy in the triangulation was therefore great.

Primarily a network was thrown over the southern peninsula. The triangles on the central meridian were measured with extra care and checked by base-lines at distances of about 2° apart in
latitude in order to form a geodetic arc, with the addition of astronomically determined latitudes at certain of the stations. The base-lines were measured with chains and the principal angles with a 3-ft. theodolite. The signals were carried of stones or poles. The chains were somewhat rude and their units of length had not been determined originally, and could not be afterwards ascertained. The results were good of their kind and sufficient for geographical purposes; but the central meridional arc—the 'great arc'—was eventually deemed inadequate for geodetic requirements. A superior instrumental equipment was introduced, with an improved

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**Trigonometrical Survey of India**

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**GEODETIC**

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**FIG. 1.**

**modus operandi**, under the direction of Colonel Sir G. Everest in 1832. The network system of triangulation was superseded by meridional and longitudinal chains taking the form of gridirons and resting on base-lines at the angles of the gridirons, as represented in fig. 1. For convenience of reference and nomenclature the triangulation west of meridian 92° E. has been divided into five sections—the lowest a trigon, the other four quadrilaterals distinguished by cardinal points which have reference to an observatory in Central India, the adopted origin of latitudes. In the north-east quadrilateral, which was first measured, the meridional chains are about one degree apart; this distance was latterly much increased and eventually certain chains—as on the Malabar coast and on meridian 84° in the south-east quadrilateral—were dispensed with because good secondary triangulation for topography had been accomplished before they could be begun.

All base-lines were measured with the Colby apparatus of compensation bars and microscopes. The bars, 10 ft. long, were set up horizontally on tripod stands; the microscopes, 6 in. apart, were mounted in pairs revolving on a vertical axis and were set up on tripods fitted to the ends of the bars. Six bars and five central and two end pairs of microscopes—the latter with their vertical axes perforated for a look-down telescope—constituted a complete apparatus, measuring 63 ft. between the ground pins or registers. Compound bars are more liable to accidental changes of length than simple bars; they were therefore tested from time to time by comparison with a standard simple bar; the microscopes were also tested by comparison with a standard 6-in. scale. At the first base-line the compensated bars were found to be liable to sensible variations of length with the diurnal variations of temperature; these were supposed to be due to the different thermal conductivities of the brass and the iron components. It became necessary, therefore, to determine the mean daily length of the bars precisely, for which reason they were systematically compared with the standard before and after, and sometimes at the middle of the base-line measurement throughout the entire day for a space of three days, and under conditions as nearly similar as possible to those obtaining during the measurement. Eventually thermometers were applied experimentally to both components of each compound bar, when it was found that the diurnal variations in length were principally due to difference of position relatively to the sun, not to difference of conductivity—the component nearest the sun acquiring heat most rapidly or parting with it most slowly, notwithstanding that both were in the same box, which was always sheltered from the sun's rays. Happily the systematic comparisons of the compound bars with the standard were found to give a sufficiently exact determination of the mean daily length. An elaborate investigation of theoretical probable errors (p.e.) at the Cape Comorin base showed that, for any base-line measured as usual without thermometers in the compound bars, the p.e. may be taken as \( \pm 0.5 \) millionths of the length, excluding unascertainable constant errors, and that on introducing thermometers into these bars the p.e. was diminished to \( \pm 0.55 \) millionths.

In all base-line measurements the weak point is the determination of the temperature of the bars when that of the atmosphere is rapidly rising or falling; the thermometers acquire and lose heat rapidly, and thus much more accurately than the chain or their bulbs are outside, and more slowly if inside the bar. Thus there are always errors and its effects are only eliminated when the rises and falls are of equal amount and duration; but as a rule the rise generally predominates on the first day of the station and is less on the second; but lagging may cause more error in a base-line measured with simple bars than all other sources of error combined. In India the probable average lagging of the standard-bar thermometer was estimated as \( \pm 0.01 \) degree centigrade, corresponding to an error of 0.0001 in the length of a base-line measured with iron bars. With compound bars lagging would be much the same for both components and its influence would consequently be eliminated. Thus the iron perfect base-lines seem to require compensation bars with thermometers attached to each component; then the comparisons with the standard need only be taken at those times when the temperature is constant, and there is no lagging.

**The plan of triangulation** was broadly a system of internal meridional and longitudinal chains with an external border of oblique curves, following the well-known course of the primary geodetic base lines. The design of each chain was necessarily much influenced by the physical features of the country over which it was carried. The most difficult tracts were plains, devoid of any commanding points of view; in some parts covered with forests and jungles almost impenetrable, in other parts covered with towns and villages and unobstructed trees. In such tracts triangulation was impossible except by the use of theodolites, raising them to a sufficient height to overtop at least the earth's curvature, and then either increasing the height to surmount all obstacles to mutual vision, or clearing the lines. Thus in hilly and mountainous country the largest possible geodetic chain was made "double" throughout, i.e. formed of polygonal and quadrilateral figures to give greater breadth and accuracy; but in forest and close country they were carried out as series of single triangles, to give the maximum of labour and expense. Syntheses were carried out by restricting the angles between the limits of 30° and 90°. The average side length was 30 m. in hill country and 11 in the plains; the principal length of the chain from the Malabar coast to the Himalayan peaks was 10,000 ft., and the triangulation to the Himalayan peaks there were sides exceeding 200 m. Long sides were at first considered desirable, on the principle that the fewer the links the greater the accuracy of a chain of triangulation, but this did not hold true, for the triangles on long sides could only be obtained under exceptionally favourable atmospheric conditions. In plains the length was governed by the height to which towers could be conveniently raised to surmount all obstacles on the ground. In Indian plains refraction is much more frequent than in European countries, and a simple matter in hills and close country, is often difficult in plains and close country. In the early operations, when the great arc was being carried across the wide plains of the Gangetic valley, which are covered with villages and hamlets and other object of interest, there was no need for the support of the small reconnaisance theodolites, with a sufficiency of poles and bamboo to form a scaffolding of the same height for the observer. Other masts 70 ft. high, with arrangements for displaying blue lights by night at 90 ft. were erected at the spots where station sites were wanted. But the cost of transport was great, the rate of progress was slow, and the results were unsatisfactory. Eventually a method of touch rather than sight was adopted, feeling the ground to search for the obstacles to be avoided, rather than attempting to look over them: the "rays" were traced either by a minor triangulation, or by a traverse through the station, the theodolite was carried up under such conditions that the "rays" could be put to the sides of the station, the "rays" being indicated by red flags. The first method gives the direction of the new station most accurately; the second searches the ground most closely; the third is suited for tracks of uninhabited forest in which it is the practice to put a party of soldiers in advance. Any points may be built at the intersection of the two trial rays leading up to it. As a rule it has been found most economical and expeditious to search for obstacles at a distance, and to store the theodolite on the height, to survey the curvature, and to remove the trees and other obstacles on the line.

Each principal station has a central masonry pillar, circular and 3 ft. high, in diameter, in which are housed the theodolite and level, and around it a platform 14 to 16 ft. square for the observatory tent, observer and signalers. The pillar is isolated from the platform, and when solid carries the station mark—a dot surrounded by a circle—on the upper surface at the very top, on a vertical stone or the rock in situ, in the normal of the upper mark; but, if the height is considerable and there is a liability to deflection, the pillar is constructed with a central vertical shaft to enable the
SURVEYING

Theodolite to be plumbwed over the ground level mark, to which access is gained by means of a ladder in the theodolite shed. An extra precaution against deflection was neglected and the pillars were built solid throughout, whatever their height; the surveying platforms, being usually constructed of sun-dried bricks or stones and then left to harden during the hot days of the summer season, which thus became deflected during the rainy seasons that intervened between the periods during which operations were arrested or were temporarily suspended. Large theodolites were invariably employed. Repeating circles were highly thought of by French geodesists at the time when the operations in India were begun; but they were not used in the surveys of the turbid atmosphere. In the latter theodolites, the heads were somewhat similar to the astronomer's alt-azimuth instrument, but with larger azimuthal and smaller vertical circles, also with a greater base to give stability. Theodolites were also employed with two and four horizontal arcs.

The azimuthal circles had mostly diameters of either 36 or 24 in., the vertical circles having a diameter of 15 in. In all the theodolites the base was a triform tripod resting on three levelled foot-screws, and the circles are read by microscopes; but in different instruments the fixed and the rotatory parts of the body varied. In some the vertical axis was fixed on the tripod and projected upwards; in others it revolved in the tripod and projected downwards. In the former the azimuthal circle was fixed to the triform, while the theodolite pillars, the microscopes, the clamps and the tangent screws were attached to the tripod, while in the latter the microscopes, clamps and tangent screws were fixed to the triform, while the telescope pillars and the azimuthal circle were attached to a plate fixed at the head of the rotary vertical axis.

Cairns of stones, poles or other opaque signals were primarily employed, the angles being measured by day only; eventually it was found that the atmosphere was often more favourable for observing at night, and by the former methods signals were readily visible well into view by refraction by night which might be invisible or only seen with difficulty by day. Lamps were then introduced of the simple open type, atmospheric conditions allowing. But the stones, which have been discarded, were sometimes used for the purpose of checking the accuracy of the opposed angles. The introduction of luminous signals not only rendered the night more accessible to the observer, but made it possible to check the accuracy of the operations, enabling work to be done during the dry and healthy season of the year, when the atmosphere is generally hazy and dusty laden, instead of being restricted as formerly to the rainy and unhealthy season, when distant opaque objects are best seen. A higher degree of accuracy was also secured, for the luminous signals were invariably displayed through diaphragms of appropriate aperture, truly centred over the station mark; and, being seen in parallactic refraction, the observer could give his attention to the azimuth, whereas opaque signals are always dim in comparison and are liable to be seen extinguently when the light falls on one side. A signal-lining instrument, which usually consisted of two opal glass discs, was sometimes used, and a pair of heliottopes—one for single, two for double refraction—according to the sun's position—and a lamp, throughout the night and day. Heliottopes were also employed at the observing stations for checking the observations. The theodolites were invariably set up under tents for protection against sun, wind and rain, and centred, levelled and adjusted for the runs of the microscopes. Then the signals were observed in regular rotation round the horizon, alternately from right to left and vice versa; after the prescribed minimum number of rounds, either two or three, had been thus measured, the telescope was turned 180°, both in altitude and azimuth, changing the position of the face of the vertical circle relatively to the observer, and further rounds were measured; additional measures of single angles were taken at each interval of 90°, and of double refractions at intervals of 36°.

As the microscopes were invariably equidistant and their number was always odd, either three or five, the readings taken on the azimuthal circle during the telescope pointings to any object in the two positions of the vertical circle were made on twice as many equidistant graduations as the number of microscopes. The theodolite was then shifted bodily in azimuth, by being turned on the ring on the head of the stand, which would be sufficient, and new graduations under the microscopes at the telescope pointings; then further rounds were measured in the new positions, face right and vice versa. This process was repeated as often as had been previously prescribed. The operation of obtaining the position angles by equal arcues bringing equidistant graduations under the microscopes during the successive telescope pointings to one and the same object. By means of all the microscopes the instrumental error of graduation was eliminated, the numerous graduations that were used tending to eliminate accidental errors of division, and the numerous rounds of measures to minimize the errors of observation arising from atmospheric irregularities.

Under this system of procedure the instrumental and ordinary errors are practically cancelled and any remaining error is most probably due to refraction, measurement inaccuracy and to light grazing the surface of the ground. The three angles of every triangle were always measured.

The apparent altitude of a distant point is liable to considerable variations in the course of the day, due to the influence of changes in the density of the lower strata of the atmosphere. Terrestrial refraction is capricious, more particularly when one is concerned with higher objects, such as hill tops and the tops of buildings, where the light is divergent to the horizon, passing through a medium which is liable to extremes of refraction and condensation, under the alternate influence of the sun's heat radiated from the surface of the ground and of chilled atmospheric vapour. When the back and forward vertical angle of a pair of stations are equidistantly refraacted, their difference gives an exact measure of the difference of height. But the atmospheric conditions are not uniform, and the earth's atmosphere is a sphere on long rays which graze the surface of the ground, and the ray between two reciprocating stations is liable to be differently refraacted at its extremities, each end being influenced in a greater degree by the conditions prevailing around it, and by the height at a distance; thus instances are on record of a station A being invisible from another B, while B was visible from A.

When the great arc was entered the plains of the Gangetic valley, simultaneous reciprocal verticals were at first adopted with the hope of eliminating refraction; but it was soon found that they did not do so sufficiently to justify the expenditure of the time involved. Vertical Angles.

Afterwards the back and forward verticals were observed as the stations were visited in succession, the back angles at as nearly as possible the same time of the day as the forward angles, and always during fine weather. "Time" refers to the mean sun's motion, which begins about an hour after apparent noon and lasts from two to three hours. The apparent zenith distance is always greatest then, but the refraction is a minimum only at stations which are situated between Tropic of Cancer and 20° of latitude. The refraction is liable to pass through zero and attain a considerable negative magnitude during the heat of the day, for the lower atmosphere is then less dense and the rays are refracted straighly above and the rays are refracted downwards. On this account the greatest positive refractions are also obtained—maximum values, both positive and negative, usually occurring, the former by the inverse method of observing. The time of day at which the refraction is zero varies during the seasons; during the months of March and April, 18,000 ft., broadly varying inversely as the temperature and directly as the pressure, but much influenced also by local climatic conditions.

In measuring the vertical angles with the great theodolites, graduation errors were regarded as insignificant compared with errors arising from uncertain refraction; thus no arrangement was put forward for correcting out the errors in the vertical angles that were undertaken. The values actually met with were found to range from +1·21 down to −0·09 parts of the contained arc on plains; the normal "coefficient of refraction" for free rays between hill stations 800 ft. above the level of the sea, which diminished to 0·08 above 18,000 ft., broadly varying inversely as the temperature and directly as the pressure, but much influenced also by local climatic conditions.

In the ordnance and other surveys the bearings of the surrounding stations are determined by visual observations, but from the "included angles" in the Indian survey. Triangulation observations of every angle are tabulated vertically in as many columns as the number of circle settings face left and face right, and the mean for each setting is taken. For several years the general mean of these was adopted as the final result; but subsequently a "concluded angle" was obtained by combining the angle means with weights inversely proportional to \(\beta + \delta^2 - \gamma\), being a value of the e.m.t.\(^1\) of graduation derived empirically from the difference between the general mean and the mean for each setting, \(o\) the e.m.t. of observation deduced from the differences between the theoretical and the observed values for the respective means, and \(n\) the number of measures at each setting. Thus putting

\[
C = M + \left(\varphi + \varphi_0\right) + \left(\varphi + \varphi_0\right)
\]

and

\[
\varphi = \varphi_0 + \varphi_0
\]

\(C - M\) vanishes when \(n\) is constant; it is inapplicable when \(g\) is much larger than \(\varphi\); it is significant only when the graduation errors are more minute than the errors of observation; but it was always good enough not to exceed \(0·14\) with the system of two rounds of measures and 0·05° with the system of three rounds.

The weights of the concluded angles thus obtained were employed in the primary reductions of the angles of single triangles and poligons which were made to satisfy the geometrical conditions

1 The theoretical "error of mean square" = 1·48 X "probable error."
of each figure, because they were strictly relative for all angles measured with the same instrument and under similar circumstances, and conditions. In these cases it was not always the case that the angles were original, but in the final reductions, when numerous chains of triangles composed of figures executed with different instruments and under different circumstances, it may become necessary to modify the original weights, on such evidence of the precision of the angles as might be obtained from other and more reliable sources than the actual measures of the angles. This treatment will now be described.

Values of theoretical error for groups of angles measured with the same instrument and under similar conditions may be obtained in three ways: (1) from the squares of the reciprocals of the weights as deduced as above from the measures of such angle, (ii) from the magnitudes of the excess of the sum of the angles of each triangle above 180° + the spherical excess, and (iii) from the magnitude of the corrections which it is necessary to apply to the angles of polygonal figures and networks to satisfy the several geometrical conditions.

Every figure, whether a single triangle or a polygonal network, was made consistent by the application of corrections to the observed angles to satisfy its geometrical conditions. The three angles of every triangle having been observed, their sum had to be made 180° ± the spherical excess of the triangle. The angles should be identical, whatever the route through which it was computed. These are called the triangular, central, tolo-partial and side conditions; they present n geometrical equations, which contain t unknown quantities, the excesses of the observed angles, t being always >n. When these equations are satisfied and the deduced values of errors are applied as corrections to the observed angles, the figure becomes consistent. Primarily the equations were treated by a method of successive approximations; but afterwards they were all solved simultaneously by the so-called method of minimum squares, which leads to the most probable of any system of corrections.

The angles having been made geometrically consistent inter se in each figure, the side-lengths are computed from the base-line onwards by Legendre's theorem, each angle being diminished by one half the spherical excess of the triangle to which it appertains. The theorem is applicable without sensible error to triangles of a much larger size than any that are ever measured.

A station of origin being chosen of which the latitude and longitude are known astronomically, and also the azimuth of one of the stations in succession, for all the stations of the triangulation, Azimuth of

Sides of

Triangles.

Longitude of latitude and the reverse azimuths are calculated in Stations: for determining the triangulation, Azimuth of by Puissant's formulae (Traité de géodésie, 3rd ed., Paris, Sides.

1842).

Problem.—Assigning the earth to be spheroidal, let A and B be two stations on its surface, and let the latitude and longitude of A be known, also the azimuth of B at A, and the distance between A and B at the mean sea-level; we have to find the latitude and longitude of B.

The following symbols are employed: a the major and b the minor semi-axis; e the excentricity, \( \frac{c^2-a^2-b^2}{a^2} \); p the radius of curvature to the meridian in latitude \( \lambda \), \( d(1-e) \) ; \( \frac{\pi}{2} \) the normal to the meridian in latitude \( \lambda \), \( a(1-e^2) \); \( \lambda \) and L the given latitude and longitude of A; \( \lambda + \Delta \lambda \) and \( L + \Delta L \) the required latitude and longitude of B; A the azimuth of B at A; B the azimuth of A at B; \( \Delta L = B = (\lambda + \Delta \lambda) - \Delta L \) the distance between A and B. Then, all azimuths being measured from the south, we have

\[ \Delta \theta = \cos A \tan \lambda \cos 1'' \]

\[ \frac{\cos^2 A \sin A \tan \lambda \cos 1''}{\cos^2 A \sin A \tan \lambda \cos 1''} \]

where \( \Delta \theta \) is the algebraic difference of the angles of the triangles, \( A \) is the angle at A, and \( \lambda \) is the latitude of the station. The values of the angles of the triangles are computed for the given latitudes and longitudes of the stations, and are used in the following manner:

1. \( \frac{\cos^2 A \sin A \tan \lambda \cos 1''}{\cos^2 A \sin A \tan \lambda \cos 1''} \)
2. \( \frac{\cos^2 A \sin A \tan \lambda \cos 1''}{\cos^2 A \sin A \tan \lambda \cos 1''} \)
3. \( \frac{\cos^2 A \sin A \tan \lambda \cos 1''}{\cos^2 A \sin A \tan \lambda \cos 1''} \)
4. \( \frac{\cos^2 A \sin A \tan \lambda \cos 1''}{\cos^2 A \sin A \tan \lambda \cos 1''} \)

By means of these equations, the azimuths of the stations are computed from the given latitudes and longitudes.

Each \( \Delta \) is the sum of four terms symbolized by \( \delta_{1,2}, \delta_{3}, \delta_{4}, \delta_{5}, \delta_{6}, \delta_{7}, \delta_{8}, \delta_{9}, \delta_{10}, \delta_{11} \), the calculations are so arranged as to produce these terms in the order \( \delta_{1}, \delta_{2}, \delta_{3}, \delta_{4} \), each term entering as a factor in calculating the following term. The arrangement is shown below in equations in which the symbols \( P, \cos, \cot, \tan, \sec \), \( \Delta, \delta \) represent the factors which depend on the adopted geodetic constants, and vary with the latitude; the logarithms of their numerical values are tabulated in three auxiliary tables for Further calculations, see the Appendix Surveying.

\[ \delta_{1} = \frac{P \cos \lambda \cot \lambda \sec \lambda}{2} \tan \lambda \sin 2A \cos A \cos 1'' \]

\[ \delta_{2} = \frac{P \cos \lambda \cot \lambda \sec \lambda}{2} \tan \lambda \sin 2A \cos A \cos 1'' \]

\[ \delta_{3} = \frac{P \cos \lambda \cot \lambda \sec \lambda}{2} \tan \lambda \sin 2A \cos A \cos 1'' \]

\[ \delta_{4} = \frac{P \cos \lambda \cot \lambda \sec \lambda}{2} \tan \lambda \sin 2A \cos A \cos 1'' \]

The calculations described so far suffice to make the angles of the several trigonometric figures consistent inter se, and to give preliminary values of the lengths and azimuths of the sides, and the latitudes and longitudes of the stations, Reduction of the results are amply sufficient for the requirements of the topographer and land surveyor, and they are published in preliminary charts, which give full numerical details of latitude, longitude, azimuth and side-length, and of height also, for each portion of the triangulation—secondary as well as principal—as executed year by year. But on the completion of the several chains of triangles further reductions became necessary, to make the triangulation everywhere consistent inter se and the verificatory base-lines, so that the lengths and azimuths of common sides and the latitudes and longitudes of common stations should be identical at the junctions of chains and that the measured and computed lengths of the base-lines should also be identical.

As an illustration of the problem for treatment, suppose a triangulation of two dimensional and two dimensional consisting of seventy-two single triangles with a base-line at each corner as shown in the accompanying diagram (fig. 2); suppose the angles of elevation of each triangle to have been measured and made consistent. Let A be the origin, with its latitude and longitude given, and also the length and azimuth of the adjoining base-line. With these data processes of calculation are carried through the triangulation to obtain the lengths and azimuths of the other stations from the latitudes and longitudes of the stations, say in the following order: from A through B to E, through F to E, through F to D, through F and E to C, and through D and C. Then there are two values of side, azimuth, latitude, and longitude of each base-line, right and left, or right and left, and are verified by the left-hand chain via F; similarly there are two sets of values at C; and each of the base-lines at B, C and D has a calculated as well as a measured value. This is the most important absolute errors are present for dispersion over the triangulation by the application of the most appropriate correction to each angle, and, as a preliminary to the determination of these corrections, equations must be constructed between each of the absolute errors and the unknown errors of the angles from which they originated. For this purpose we have the equation:

\[ D = \delta_{1} + \delta_{2} + \delta_{3} + \delta_{4} + \delta_{5} + \delta_{6} + \delta_{7} + \delta_{8} + \delta_{9} + \delta_{10} + \delta_{11} \]

where \( \delta_{1} \) is the angle at A, \( \lambda \) and \( \lambda' \) be the most probable values of the angles of the triangles, \( \Delta \lambda = \lambda' - \lambda \) the difference between A and B, and \( \Delta L = \lambda' - \lambda \) the difference between A and B. Then, all azimuths being measured from the south, we have

\[ D = \delta_{1} + \delta_{2} + \delta_{3} + \delta_{4} + \delta_{5} + \delta_{6} + \delta_{7} + \delta_{8} + \delta_{9} + \delta_{10} + \delta_{11} \]

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SURVEYING

ii. One of the unknown quantities in every triangle, as \( x \), may be eliminated from each of the three circuits, and base-line equations be substituted in the analogous \(-y\) for the difference \(-y\) for the difference between \( x \) and \(-y\). This process being made the minimum. Then the equations take the form \((a-b)+x=(a-b)+x\) for the minimum which involves becomes
\[
\begin{align*}
0 & = 
\sum_{n} \left( y_n + z_n \right) - \sum_{n} \left( y_n + z_n \right) + \sum_{n} \left( y_n + z_n \right) - \sum_{n} \left( y_n + z_n \right)
\end{align*}
\]
Thus we have now to find only eleven values of \( x \) by a simultaneous solution of so many equations, instead of thirty-one from eight equations; but we arrive at more complex expressions for the angular errors as follows:
\[
\begin{align*}
y_n & = y_n + \theta_n + \phi_n - \left( y_n + \theta_n + \phi_n \right)
\end{align*}
\]

The second method has invariably been adopted, originally because it was supposed that, the number of the factors \( \lambda \) being reduced by about \( n \) of the straight-line equations, a great saving of labour would be effected. But subsequently it was ascertained that in this respect there is little to choose between the two methods for the elimination of errors, and as many factors are introduced as there are equations, the factors for the triangular equations may be readily eliminated at the outset. Then the really severe calculations will be restricted to the solution of the simultaneous equations containing the factors for the circuit and base-line equations as in the second method.

In the preceding illustration it is assumed that the base-lines are errorless as compared with the triangulation. Strictly speaking, however, the base-line and the angular errors are in almost all cases of the same order, and it is the former which are due to the summation in forming the coefficient of \( \theta \).

The angular errors \( x \), \( y \), and \( z \) must now be introduced, in place of \( \theta \) and \( \lambda \), into the general expression, which will then take different forms, according as the route adopted for the line of traverse was the zigzag or the direct. In the former, the number of stations on the traverse is obtained by the number of triangles, whether or not a common numerical notation may be adopted for both the traverse stations and the collateral triangles; but the angular errors of every triangle enter the general expression in the form in which \( \mu = \mu \sin \phi \); and the upper signs of \( \phi \) is taken if the triangle lies to the left, the lower it to the right, of the line of traverse. When the direct traverse is adopted, there are only as many Traverse stations as triangles, and therefore only half the number of \( \mu \) and \( \phi \)'s to determine; but it becomes necessary to adopt different numerations for the stations and the triangles, and the form of the coefficients of the angular errors alternates in successive triangles. Thus, the \( p \) th triangle has no side on the line of the traverse but only one angle at the \( p \) th station, the form is
\[
+ \phi_1 x_1 + \gamma_1 x_2 + \cdots + \gamma_{n} x_{n}
\]
If the \( p \) th triangle has a side between the \( p \) th and the \( q \) th stations of the traverse, the form is
\[
+ \phi_1 x_1 + \gamma_1 x_2 + \cdots + \gamma_{n} x_{n} - \theta_1 y_1 - \theta_2 y_2 - \cdots - \theta_{n} y_{n}
\]

The eighteenth century and base-line equations of condition having been duly constructed, the next step is to find values of the angular errors which will satisfy these equations, and be the most probable of any system of values that will do so, and at the same time will not disturb the existing harmony in each of the seventy-two triangles. Harmony is maintained by introducing the equation of condition \( x = y = z = w \) for every triangle. The most probable results are obtained by the method of minimum squares, which may be applied in the following way.

i. A factor \( \lambda \) may be obtained for each of the eighty-three equations under the condition that
\[
\sum_{u} x^2 + \sum_{v} y^2 + \sum_{w} z^2 = E
\]

\[\frac{x}{u} + \frac{y}{v} + \frac{z}{w}\] is made a minimum,
number of "side" and other geometrical equations of condition, which entered irregularly and caused great entanglement. Equations 9 and 10 of the illustration are of a simple form because they have a primary geometric condition to maintain, the triangle, which is not only expressed by the simple and symmetrical equation $x+y+z=\omega$, but—what is of much greater importance—recur in a regular order of sequence that materially facilitates the general solution. Thus, though the calculations must in all cases be very numerous and laborious, rules can be formulated under which they can be well controlled at every stage and eventually brought to a successful issue. The other geometrical conditions of networks are expressed by equations which are not merely of a more complex form but have no regular order of sequence, for the networks present a variety of forms; thus their introduction would cause much entanglement and confusion, and greatly the labour of the calculations and the chances of failure. Wherefore, therefore, any compound figure occurred, only so much of it as was required to form a chain of single triangles was employed. The figure having previously been marked probable errors of the angles, what part was employed, but the selection was usually made so as to introduce the fewest triangles. The triangulation for final simultaneous reduction was thus made to consist of chains of single triangles only; but all the included angles were "fixed" simultaneously. The excluded angles of compound figures were subsequently harmonized with the fixed angles, which was readily done for each figure per se.

This departure from rigorous accuracy was not of material importance, for the angles of the compound figures excluded from the simultaneous reduction had already, in the course of the several independent figural reductions, received their share of influence on the included angles. The figural adjustments had, however, introduced new relations between the angles of different figures, causing their weights to increase aequitas parsibus with the number of geometrical conditions satisfied in each instance. Thus, suppose $w$ to be the average weight of the $i$ observed angles of any figure, and $n$ the number of geometrical conditions presented for satisfaction; then the average weight of the angles after adjustment may be taken as $w_i=\frac{w}{n}$, the factor thus being $1+\frac{i}{n}$ for a triangle, $1+\frac{i}{n}$ for a hexagon, $2$ for a quadrilateral, $2+\frac{i}{n}$ for the network around the Sironj base-line, &c. In framing the normal equations between the indeterminate factors $x$ for the final simultaneous reduction, it would have greatly added to the labour of the subsequent calculations if a separate weight had been given to each angle, as was done in the primary figural reductions; this was obviously unnecessary, for theoretical requirements would now be amply satisfied by giving equal weights to all the angles of each independent figure. The mean weight that was finally adopted for the angles of each group was therefore taken as $w_i=\frac{1}{n}$, $x_i$.

The second of the two processes for applying the method of minimum squares had been adopted, the values of the errors $\varepsilon$ and $\gamma$ in the angles, determining to any, the $i$th triangle were finally expressed by the following equations, which are derived from (10) by substituting $w$ for the reciprocal final mean weight as above determined:—

$$\begin{align*}
\varepsilon &= w_i (2z - a_i - b_i) / n_i \\
\gamma &= w_i (2z - a_i - b_i) / n_i
\end{align*}$$

The following table gives the number of equations of condition and unknown quantities—the angular errors—in the five great sections of the triangulation, which were respectively included in the simultaneous general reductions and relegated to the subsequent adjustments of each figure per se:—

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The corrections to the angles were generally minute, rarely exceeding the probable errors of the angles themselves, and thereby applicable without taking any liberties with the facts of observation.

Azimuth observations in connexion with the principal triangulation were determined by measuring the horizontal angle between a referring mark and a circumpolar star, shortly before and after the close of the triangle, and finally at both stations. In order to eliminate the error of the star's place, systematic changes of "face" and of the zero settings of the azimuthal circle were made as in the measurement of the principal angles; conditions of the reductions referred to the station through the triangulation, for comparison with the principal azimuth. A table was prepared of the differences (observed at the origin—computed from a distance) between the primary and the geodetic azimuths; the differences were assumed to be mainly due to the local deflections of the plumb-line and only partially to error in the triangulation, and each was multiplied by the factor $p$.

The tangent of latitude of comparing station may be taken as $t=\tan \phi$, the factor thus being $1+\frac{i}{n}$ for a triangle, $1+\frac{i}{n}$ for a hexagon, $2$ for a quadrilateral, $2+\frac{i}{n}$ for the network around the Sironj base-line, &c. In framing the normal equations between the indeterminate factors $x$ for the final simultaneous reduction, it would have greatly added to the labour of the subsequent calculations if a separate weight had been given to each angle, as was done in the primary figural reductions; this was obviously unnecessary, for theoretical requirements would now be amply satisfied by giving equal weights to all the angles of each independent figure. The mean weight that was finally adopted for the angles of each group was therefore taken as $w_i=\frac{1}{n}$, $x_i$.

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SURVEYING

cannot be separately ascertained they are always assumed to be equal; the hypothesis is sufficiently exact for practical purposes when both verticals have been measured under similar atmospheric conditions. The refractions being taken equal, the observed value is substituted for the true in (14) to find \( S \), and the difference of height is calculated by (16); the third term within the brackets of (14) is usually omitted. The mean value of the refraction is deduced from the formula

\[
E = \frac{d}{2} - D = \frac{d}{2} - D
\]

An approximate value is thus obtained from the observations between the pairs of reciprocating stations in each district, and the corresponding mean "coefficient of refraction," \( \phi + C \), is computed for the district, and is employed when heights have to be evaluated from observations at a single station only. When either of the vertical angles is an elevation, \( -E \) must be substituted for \( D \) in the above expressions.\(^1\)

2. LEVELLING

Levelling is the art of determining the relative heights of points on the surface of the ground as referred to a hypothetical surface which cuts the direction of gravity everywhere at right angles. When a line of instrumental levels is begun at the foot of a hill, a series of heights is determined corresponding to what would be found by perpendicular measurements upwards from the surface of water communicating freely with the sea in underground channels; thus the line traced indicates a hypothetical prolongation of the surface of the sea inland, which is everywhere conformable to the earth's curvature.

The trigonometrical determination of the relative heights of points at known distances apart, by the measurements of their mutual vertical angles—is a method of levelling. But the method to which the term "levelling" is always applied is that of direct determination of differences of height from the readings of the lines at which graduated staves, held vertically over the points, are cut by the horizontal plane which passes through the eye of the observer. Each method has its own advantages. The former is less accurate, but best suited for the requirements of a general geographical survey, to obtain the heights of all the more prominent objects on the surface of the ground, whether accessible or not. The latter may be conducted with extreme precision, and is specially valuable for the determination of the relative levels, however minute, of easily accessible points, however numerous, which succeed sea-level, at short intervals apart; thus it is very generally undertaken pari passu with geographical surveys to furnish lines of level for ready reference as a check on the accuracy of the trigonometrical heights. In levelling with staves the measurements are always taken from the horizontal plane which passes through the eye of the observer; but the line of levels which it is the object of the operations to trace is a curved line, everywhere conforming to the normal curvature of the earth's surface, and deviating more and more from the plane of reference as the distance from the station of observation increases. Thus, either a correction for curvature must be applied to every staff reading, or the instrument must be set up at equal distances from the staves; the curvature correction, being the same for each staff, will then be eliminated from the difference of the readings, which will thus give the true difference of level of the points on which the staves are set up.

Levelle has to be repeated frequently in executing a long line of levels—say seven times on an average in every mile—and must be conducted with particular attention to the observations of the height of the perpendicular to the instrument. Instrumental errors arise when the visual axis of the telescope is not perpendicular to the axis of rotation, and when the focusing tube does not move truly parallel to the visual axis on a change of focus. The latter may be corrected, and the former avoided, by placing the instrument at equal distances from the staves; and as this procedure has also the advantage of eliminating the corrections for both curvature and refraction, it should invariably be adopted.

Errors of staff readings should be guarded against by having the staffs graduated on both faces, but differently figured, so that the observer may not be biased to repeat an error of the first reading in the second. Accurate sightings are taken both when the spirit-level and applying corresponding corrections to the staff readings, or be eliminated by setting the bubble to the same position on its scale at the readings of the second staff as at that of the first, or by correcting the instrument from the observer.

Certain errors are liable to recur in a constant order and to accumulate to a considerable magnitude, though they may be too minute to be noticed, provided that any single station, as a rule, contains only one face painted white with black divisions; feet, tenths and hundredths—from 0 to 10, the other black with white divisions from 55 to 75. Deflection from horizontality may either be measured and allowed for, or be eliminated by making the instrument and the spirit-level uniform; or the instrument, or the line of observation, or both, may be carried over a land crossing from one district, to another, the levelling in each being independently from the same line of survey, or from the same reference staffs stationary. In levelling, the right hand side of the staff is always taken to the east, and the observer, when at a considerable distance, will often fall endwise on the bubble of the level, illuminating the outer edge of the rim at the nearer end and the inner edge at the farther end, and so biasing the observations. When levels of this kind are taken, the observer should be a little more distant from the centre of the bubble, which will introduce a tendency to raise the south or depress the north ends of lines of level in the northern hemisphere. On long lines, therefore, a measurement of a line can be made, and the latter is carried over to the next line, or over the right hand side of the staff, from coast to coast in such a manner that the level of any common crossing point may be found by several independent lines. These points there are 166 in England, Scotland and Wales; the discrepancies found with them were adjusted simultaneously by the method of minimum squares.

The sea-level is the natural datum plane for levelling operations, more particularly in countries bordering on the ocean. The earliest surveys of coasts were made for the use of navigators and, as it was considered very important that the charts should everywhere show the minimum depth of water which a vessel would meet with, low water of spring-tides was adopted as the datum. But this does not answer the requirements of a land survey, because the tidal range between extreme high and low water differs greatly at different points on coast-lines. Thus the generally adopted datum plane for land surveys is the mean sea-level, which, if not absolutely uniform all the world over, is much more nearly so than low water. Tidal observations have been taken at nearly fifty points on the coasts of Great Britain, which were connected by levelling operations; the local levels of mean sea were found to differ by larger magnitudes than could fairly be attributed to errors in the lines of level, having a range of 12 to 15 in. above or below the mean of all points on the open coast, and more in tidal rivers.\(^2\) But the general mean of the coast stations for England and Wales was practically identical with that for Scotland. The observations, however, were seldom of longer duration than a fortnight, which is insufficient for an exact determination of even the short period components of the tides, and ignores the annual and semi-annual components, which occasionally attain considerable magnitudes. The mean sea-levels at Port Said in the Mediterranean and at Suez in the Red Sea have been found to be identical, and a similar identity is said to exist in the levels of the Atlantic and the Pacific Oceans; on the opposite coasts of the Isthmus of Panama. This is in favour of a uniform level all the world over; but, on the other hand, lines of level carried across the continent of Europe make the mean sea-level of the Mediterranean at Marseilles and Trieste from 2 to 5 ft. below that of the North Sea and the Atlantic at Amsterdam and Brest—a result which is in tidial estuaries and rivers the mean water-level rises above the mean sea-level as the distance from the open coast-line increases; for example, in the Mississippi River, which has a fall of 10 in. in 42 m. between Sagar (Saugor) Island at the mouth of the river and Diamond Harbour, and a further rise of 20 in. in 43 m. between Diamond Harbour and Kidderpore.

\(^1\) In topographical and levelling operations it is sometimes convenient to apply small corrections to the formula \( S = \frac{d}{2} - D \) for the precision of the instrument, \( \phi + C \), and the correction for curvature, and also for deflection from horizontality. Putting \( d \) for the distance, \( r \) for the earth's radius, and \( \kappa \) for the coefficient of refraction, and expressing the distance and radius in miles and the correction to height in feet, the correction for curvature is \( \frac{1}{2} k r^2 \); the correction for deflection from horizontality is \( \frac{1}{2} k r^2 \); the correction for both curvature and refraction is \( \frac{1}{2} k r^2 \).

\(^2\) In tidal estuaries and rivers the mean water-level rises above the mean sea-level as the distance from the open coast-line increases; for example, in the Mississippi River, which has a fall of 10 in. in 42 m. between Sagar (Saugor) Island at the mouth of the river and Diamond Harbour, and a further rise of 20 in. in 43 m. between Diamond Harbour and Kidderpore.
it is not easy to explain on mechanical principles. In India various tidal stations on the east and west coasts, at which the mean sea-level has been determined from several years' observations, have been connected by lines of level run along the coasts and across the continent; the differences between the results were in all cases due with greater probability to error generated in levelling over lines of great length than to actual differences of sea-level in different localities.

The sea-level, however, may not coincide everywhere with the geometrical figure which most closely represents the earth's surface, but may be raised or lowered, here and there, under the influence of local and atmospheric conditions, presenting an equipotential surface—an ellipsoid or spheroid of revolution slightly deformed by bumps and hollows—which II. Bruns calls a `geoid.' Archdeacon Pratt has shown that, under the combined influence of the positive attraction of the Himalayan Mountains and the negative attraction of the Indian Ocean, the sea-level may be some 500 ft. higher at Karachi than at Cape Comorin; but, on the other hand, the Indian pendulum operations have shown that there is a deficiency of density under the Himalayas and an increase under the bed of the ocean, which may wholly compensate the effect of the mountain masses and deficiency of the ocean, and leave the surface undisturbed. If any bumps and hollows exist, they cannot be measured, instrumentally; for the instrumental levels will be affected by the local attractions precisely as the sea-level is, and will thus invariably show level surfaces even if considerable deviations from the geometrical figure.

3. Topographical Surveys

The skeleton framework of a survey over a large area should be triangulation, although it is frequently combined with traversing. The method of filling in the details is necessarily influenced to some extent by the nature of the framework, but it depends mainly on the magnitude of the scale and the requisite degree of minutiae. In all instances the principal triangles and circuit-traverses have to be broken down into smaller ones to furnish a sufficient number of fixed points and lines for the subsequent operations. The filling in may be performed wholly by linear measurements or wholly by direction intersections, but is most frequently effected by both linear and angular measures, the former taken with chains and tapes and offset poles, the latter with small theodolites, sextants, optical squares or other reflecting instruments, magnetized needles, prismatic compasses and plane tables. In the scale of a large and local triangulation, linear and angular measures are usually recorded on the spot in a field-book and afterwards plotted in office; when small they are sometimes drawn on the spot on a plane table and the field-book is dispensed with.

In every country the scale is generally expressed by the ratio of some fraction or multiple of the smallest to the largest national units of length, but sometimes by the fraction which indicates the ratio of the length of a line on the paper to that of the corresponding line on the ground. The latter form is obviously preferable, being international in character and dependent on the various units of length and planes of the nation's survey. The survey of Great Britain and Ireland and the Indian survey the double unit of the foot and the Gunter's link ( = 0.066 of a foot) are employed, the former invariably in the triangulation, the latter generally in the traversing and filling in, because of its convenience in calculations and measurements of area, a square chain of 100 Gunter's links being exactly one-tenth of an acre.

In the ordnance survey all linear measures are made with the Gunter's chain, all angular with small theodolites only; neither magnetized nor reflecting instruments nor plane tables are ever employed, except in hill sketching. As a rule the filling in is done by triangle-chaining only; traverses with theodolite and chain are occasionally resorted to, but only when it is necessary to work round woods and hill tracts across which right lines cannot be carried. Detail surveying by triangles is based on the points of the minor triangulation. The sides are first chained perfectly straight, all the points where the lines of interior detail cross the sides being fixed; the alignment is effected with a small theodolite, and marks are established at the crossing points and at any other points on the sides where they may be of use in the subsequent operations. The surveyor is given a diagram of the triangulation, but no side lengths, as the accuracy of his chaining is tested by comparisons with the triangulation. All the operations are carried across the intermediate detail between the points established on the sides; they constitute the principal "cutting up or split lines"; their crossings of detail are marked in turn and the process is repeated until a sufficient number of lines and marks have been established on the ground to enable all houses, roads, fences, streams, railways, canals, rivers, boundaries and other details to be conveniently and economically represented. The total length of the lines laid out and the number of points marked is a sufficient number of lines and bars have been established on the ground to enable all houses, roads, fences, streams, railways, canals, rivers, boundaries and other details to be conveniently and economically represented. The total length of the lines laid out and the number of points marked is.

As when a trinomontational station, the theodolite is set for the reading of with the telescope pointing to the north, and at every "forward" station of the traverse the circle is set to the same reading when the telescope is pointed at the back station as when the telescope is pointed at the back.

3. Topographical Surveys

The plotting is done from the field-books of the surveyors by a separate agency. Its accuracy is tested by examination on the ground of all the necessary addenda are made. The examiner— who should be surveyor, plotter and draughtsman—verifies the accuracy of the detail by intersections and productions and occasional direct measurements, and generally endeavours to cause the detailed work to be done in the field to a higher standard of accuracy than might be obtained by direct measurement. He fixes conspicuous trees and delineates the roads, footpaths, rocks, precipices, steep slopes, embankments, &c., and supplies the requisite information regarding minor objects to enable a draughtsman to make a perfect representation according to the scale of the map. In examining a coast-line he delineates the foreshore and sketched the structure of the stratified rocks, tidal rivers and estuaries, and marks and points out the highest points to which the ordinary tides flow.

The examiner on the 25 1/44 in. scale ( = 1') is required to give all necessary information regarding the parcels of ground of different character, and the topographical detail itself. It is for the draughtsman to define the limits of each on a separate tracing if necessary. He has also to distinguish between turnpike, parish and occupation roads, to collect all names, and to furnish notes of military, baronial and antiquities, with a map of the civil and ecclesiastical. All the topographical information is drawn in the final maps. The latter are subject to a double examination—first in the office, secondly on the ground; they are then handed over to the officer in charge of the levelling to have the levels and contour lines inserted, and finally to the hill sketchers, whose duty is to make an artistic representation of the features of the ground.

In the Indian survey all filling in is done by plane-tabling on a basis of points previously fixed; the methods differ simply in the extent to which linear measures are introduced to supplement the direction rays of the plane-table. When the scale of the survey is small, no measure is introduced, the filling in is usually done wholly by direction intersections, which fix all the principal points, and by eye-sketching; but as the scale is increased linear measures with chains and offset poles are introduced to supplement the eye, and large objects, such as roads, are represented on the final sheets by linear measurements for the convenience of the draughtsman, when these are more convenient for employment than the spherical, having been first drawn; the plane-table is then ready for use. Operations are begun at a fixed point by aligning with a string fixed to the point, which is a relaying on the line of the table on that of the station. The magnetic needle may now be placed on the table and a position assigned to it for future reference. Rays are drawn from the station point on the table to the object to be represented, the compass being set to the angles and bearings found by the theodolite; the table is then taken to other fixed points, and the process of ray-drawing is repeated at each; thus a number of objects, some of which may become available as stations of observation, are fixed. Additional stations may be established by setting up the
table on a ray, adjusting it on the back station—that from which the ray was drawn—and then obtaining a cross intersection with the sight rule laid on some other fixed point, also by interpolating between three fixed points situated around the observer. The magnetic needle may not be relied on for correct orientation, but is of service in enabling the table to be set so nearly true at the beginning. It is therefore possible, by careful setting, to ensure that in the setting is indicated by the rays from the surrounding fixed points intersecting in a small triangle instead of a point, and a slight change in azimuth suffices to reduce the triangle to a point, which will indicate the position of the station exactly. Azimuthal error being less apparent on short than on long lines, interpolation is best performed by rays drawn from near points, and checked by rays drawn to distant points, as the latter show most strongly any possible error of the primary magnetic setting. In this way, and by self-verificatory traverses on the back ray between fixed points, plane-table stations are established over the ground at the commencement of the traverse. One of the advantages of this method is that ray, from these stations all surrounding objects which the scale permits of being shown are laid down on the table, sometimes by rays only, sometimes by a single ray and a measured distance. The general configuration of the ground is delineated simultaneously. In checking and examination various methods are followed. For large scale work in plains it is customary to run arbitrary lines across it and make an independent survey of the belt of ground to a distance of a few chains on either side for comparison with the original survey; the smaller scale hill topography is checked by examination from commanding points, and also by traverses run across the finished work on the table.

4. GEOGRAPHICAL SURVEYING

The introduction by mechanical means of superior graduation in instruments of the smaller class has enabled surveyors to effect good results more rapidly, and with less expenditure. The introduction of mechanical devices in the field, than was formerly possible. The 12-in. theodolite of the present day, with micrometer adjustments to assist in the reading of minute subdivisions of angular graduation, is found to be equal to the old 24-in. or even 36-in. instruments. New Methods for the measurement of bases have largely superseded the laborious process of measurement by the alignment of "compensation" bars, though not entirely independent of them. The Jäderin apparatus, which consists of a wire 25 metres in length stretched along a series of cradles or supports, is the simplest means of measuring a base yet devised; and experiments with it at the Pulkova observatory show it to be capable of producing most accurate results. But there is a measurable defect in the apparatus, owing to the liability of the wires to change in length under variable conditions of temperature. It is therefore considered necessary, where base measurements for geodetic purposes are to be made with scientific exactness, that the Jäderin wires should be compared before and after use with a standard measurement, and this standard is best attained by the use of the Brunner, or Colby, bars. The direct process of measurement by means of these bars involves errors which are not present when the ends of a shorter line, the length of which has been exactly determined, the base is extended by a process of triangulation.

There are vast areas in which, while it is impossible to apply the elaborate processes of first-class or "geodetic" triangulation, Secondary it is nevertheless desirable that we should rapidly acquire such geographical knowledge as will enable us to lay down political boundaries, to project roads and railways, and to attain such exact knowledge of special localities as will further military ends. Such surveys are called by various names—military surveys, first surveys, geographical surveys, etc., but in practice they are all undertaken with the same end in view, i.e. the acquisition of a sound topographical map on various scales, and as that end serves civil purposes as much as military, it seems appropriate to designate them geographical surveys only.

The governing principles of geographical surveys are rapidity and economy. Accuracy is, of course, a recognized necessity, but the term must admit of a certain elasticity in geographical work which is inadmissible in geodetic or cadastral functions. It is obviously foolish to attempt to meet the requirements of a perfectly accurate geographical survey in the unpeopled sand wastes which border the Nile valley, for instance (albeit those deserts may be full of topographical detail), as in the valley itself—the great centre of Egyptian cultivation, the great military highway of northern Africa. On the other hand, the most careful accuracy attainable in the art of topographical delineation is requisite in illustrating the nature of a district which immediately surrounds what may prove hereafter to be an important military position. And this, again, implies a class of technical accuracy which is quite apart from the rigid attainment of an ideal geographical survey, and demands a much higher intelligence to compass.

The technical principles of procedure, however, are the same in geographical as in other surveys. A geographical survey must equally start from a base and be supported by triangulation, or at least by some process analogous to triangulation, which will furnish the necessary skeleton on which to adjust the topography so as to ensure a complete and homogeneous map.

This base may be found in a variety of ways. If geodetic triangulation exists in the country, that triangulation should of course be used, as it affords a wide extent of secondary determinations, the fixing of peaks and points in the landscape far away to either flank, which will either give the data for further extension of geographical triangulation, or which may even serve the purposes of the map-maker without any such extension at all. In this manner the Indus valley series of the triangulation of India has furnished the basis for surveys across Afghanistan and Baluchistan to the Oxus and Persia.

Should no such preliminary determinations of the value of one or two starting-points be available, and it becomes necessary to measure a base and to work ab initio, the Jäderin wire apparatus may be adopted. It is cheap (cost about £50), and far more accurate than the process of measuring either by any known "subtense" system (in which the distance is computed from the angle subtended by a bar of given length) or by measurement with a steel chain. This latter method may, however, be adopted so long as the base can be levelled, repeated measurements obtained, and the chain compared with a standard steel tape before and after use.

The initial data on which to start a comprehensive scheme of triangulation for a geographical survey are: (1) latitude; (2) longitude; (3) azimuth; and (4) altitude, and this data should, if possible, be obtained pari passu with the measurement of the base.

The transit theodolite, fitted with a micrometer eyepiece and extra vertical wires, is the instrument par excellence for work of this nature; and it possesses the advantages of portability and comparative cheapness.

The method of using it for the purposes of determining values for (1) and (3), i.e. for ascertaining the latitude of one end of the base and the azimuth of the other end from it, are fully explained in Major Talbot's paper on "Military Azimuth and the Principle of the French Chain" (Co. Chief Geographical, 1889), which is not a theoretical treatise, but a practical illustration of methods employed successfully in the geographical survey of a very large area of the Indian trans-frontier districts. It should be noted that these observations are not merely of an initial character. They should be constantly repeated as the survey advances, and under certain circumstances (referred to subsequently) they require daily repetition.

The problems connected with the determination of (2) longitude have of late years occupied much of the attention of scientific surveyors. No system of absolute determination is accurate enough for combination with triangulation, as affording a check on the accuracy of the latter, and the spaces in the world across which geographical surveying has yet to be carried are rapidly becoming more and more subjected to any liability to error so great as is invariably involved in such determinations. It is true that absolute values derived from the observation of lunar distances, or occultations, have often proved to be the highest values, and there remains a degree of uncertainty in the form of triangulation more trustworthy for ascertaining differential longitude than any comparison between the absolute determination of any two points. The system of differential determination is necessary it should be made once, with all possible care, and the value obtained should be carried through the whole scheme of triangulation. It rests with the surveyor to decide at what point of the general survey this value can best be introduced, provided he
can estimate the probable longitudinal value of his initial base within a few minutes of the truth. A final correction in longitude is constant, and can be easily applied. With reference to such determinations of longitude, Major J. S. Goodspeed in 1881 for determining the parallaxes in declination and right ascension of a heavenly body and its application to the prediction of occultations" (Roy. Geog. Soc. Journ. for June 1896) will afford the observant reader ample information.

But the recognized method of obtaining a longitude value in recent geographical fields is by means of the telegraph—a method not only quick and accurate but it so y be applied with advantage even to the checking of long lines of triangulation or triangulation control. No effort should be spared to introduce a telegraphic longitude value into any scheme of geographical survey. One involves a large initial expenditure, but if an instrument is applied to the field in the manner as one by one they are passed by the moving force, it has been found to yield results which are quite sufficiently accurate and would be very serviceable in the absence of any subsequent system of triangulation which may be extended through the country traversed, without serious discrepancies in compilation. It is, however, obvious that as accuracy depends very largely on the exact determination of those points at which the beds are passed through; as for instance, on the route between Seistan and Herat, where the initial data for the Russo-Afghan boundary delimitation was secured with a precision which was not more recently on the boundary surveys of western Abyssinia.

When an active enemy is in the field, and topographical operations are consequently restricted, it is usually possible to obtain the necessary condition without the aid of the ordinary called "military surveyor," and he may, in favourable circumstances, combine his work with that of the topographical engineer. In such circumstances, observations which are fixed, and in a widely extended position held by the enemy. The application of the camera and of telephotography to the evolution of a map of the enemy's position is well understood in Russia's "Photographie Militaire" ("Military Topography"), as it is in Russia, and we must in future expect that all advantages of an expert and professional map of the whole theatre of war will be thrown open to the hands of the general who is best supplied with professional expertise, the deliberate reconnaissance, graphic surveying and military surveying are convertible terms, and it is important to note that both equally require the services of a trained topographer. The combined use of the camera and the telegraph during the war between Russia and Turkey (1877–78) upwards of a hundred professional geographical surveyors were pressed into military service, besides the regular survey staff which is attached to every army corps. The results have been largely compiled from eight different series; every pass and every notable feature of the Balkans and Rhodope Mountains was accurately surveyed, as well as the plains intervening between the Balkans and Constantinople. Surveys on a scale which averaged about 1. m. were carried up to the very gates of the city.

The use of the camera as an accessory to the plane table (i.e., the art of photo-topography) has been applied almost exclusively to geographical or exploratory surveys. The camera is specially prepared, resting on a graduated horizontal plate which is read with verniers, and with a small telescope which is described vertically, is fixed in the local plane of the camera, which is also fitted with a magnetic needle and a scale so placed that the magnetic declination, the declination of the intersection of the cross wires are all photographed on the plate containing the view (slightly overlapping each other) is taken at each station, and the angular distance between each is measured on the horizontal projection from these perspective views involves plotting the skeleton triangulation, as obtained from the primary triangulation, with the theodolite (which precedes the photographic survey), or from the horizontal plate of the camera. With several stations plotted, the view from each of them of a certain portion of the country may be projected on the plane of the map, and salient positions in perspective may be fixed by intersection.

The field work of modern work is primarily in execution of a triangulation by the usual methods which would be adapted to any ordinary topographical survey. To this is added a second and very important operation, which is executed pari passu with the photography for the purpose of the position of the camera stations. From such stations alone the topographical details are finally secured with the aid of the photographs. Great care is taken to bring the camera to the tacheometer at each station, and to the tacheometer with the azimuths. Occasionally a hill can be reached in the course of the day's march, or during a day's halt, which will materially assist to consolidate and strengthen the survey. It may, however, frequently be impossible to maintain a consistent series of triangulation for the "control" (to use an American expression) of the topography, even when the configuration of the land surface is favourable. In such circumstances the method of observing azimuths to points situated approximately in the center of the portion to be triangulated, and of determining the exact position of those points, in latitudes and longitudes, as one by one they are passed by the moving force, has been found to yield results which are quite sufficiently accurate and would be very serviceable in the absence of any subsequent system of triangulation which may be extended through the country traversed, without serious discrepancies in compilation. It is, however, obvious that as accuracy depends very largely on the exact determination of those points at which the beds are passed through; as for instance, on the route between Seistan and Herat, where the initial data for the Russo-Afghan boundary delimitation was secured with a precision which was not more recently on the boundary surveys of western Abyssinia.
of the final topography are drawn. The principal trigonometrical points are plotted on both these boards by their co-ordinates, and the camera stations either by their co-ordinate values or by intersecting two circles that appear on the camera planes, or more rarely, are plotted by intersection. The horizontal projection of a panorama consisting of any given number of plates is a regular geometrical figure. The radius of the inscribed circle whose radius is the focal length of the camera. Having correctly plotted the position of one plate, or view, with reference to the projected camera station by means of the anamorphosed circular coordinate or by intersection of the corresponding circles, it is possible to plot the position of the rest of the series, with reference to the camera station and the orienting triangulation point, by the angular differences which are dependent upon the amount of the horizontal alternations of the figure. Having secured the correct orientation of the horizontal plan, direction lines are drawn from the plotted camera station to points photographed, and the position of the geographical features is fixed by intersection from two or more camera stations.

The plane-table is the instrument, par excellence, on which the geographical surveyor must depend for the final mapping of the physical features of the country under survey. The methods of adapting the plane-table to geographical requirements differ with those varying climatic conditions which characterize the various parts of the world. In the tropics, or in the regions bordering seas and oceans, where the earth's rotation is of great effect, the plane-table is adapted with apparatus which will allow greater accuracy, and the surveyor can work under these conditions with his camera. In the high mountains and in regions with extreme climates, the plane-table is used in a modified form, or with other apparatus for increasing the certainty and the accuracy of observations. Thus, in the Himalayas, the plane-table is adapted to the atmospheric conditions, and it is, therefore, possible to work in the upper regions. The Indian plane-table is the simplest possible construction, and it is never used in connexion with the stadia for ascertaining the distances of points and features of the ground (as is the case in America); and in place of the complicated American alidade, with its telescope and vertical arc, a simple sight rule is adopted, with a clinometer for the measurement of vertical angles. The Indian plane-table approximates closely in general construction to the Compass, or Compass Survey, of America, which is specially constructed for exploratory surveys.

The scale on which geographical surveys are conducted is necessarily small. It may be reckoned at 1 : 500000 to 1 : 125000, or from 1 in. = 8 m. to 1 in. = 2 m. The 1 in. = 1 m. scale is the normal scale for rigorous topography, and although it is impossible to fix a definite line beyond which geographical scales merge into topographical (for instance, the 1 in. scale is classified as geographical in America whenever the continuous line system contour of ground representation gives place to hachuring), it is convenient to assume generally that geographical scales greater than 1 in. = 1 m. are called topographical.

On the smaller scales of 1 : 50000 or 1 : 250000 an experienced geographical surveyor, in favourable country, will complete an area of mapping from day to day which will practically cover a large portion of the surface of the globe. He will, in the course of five or six months of continuous travelling (especially if provided with the necessary "control") cover an area of geographical scale from 1 in. to 10 m., and introduce on the small scale of his survey, which may be reckoned at tens of thousands of square miles. But inasmuch as everything depends upon his range of vision, and the constant occurrence of suitable features from which to extend it, there is obviously no guiding rule by which to reckon his probable out-turn.

The same uncertainty which exists about "out-turn" manifestly exists about "cost." The normal cost of the 1 in. rigorous topographical survey in India, when carried over districts which present an average of hills, plains and forests, may be estimated as between 35 to 40 shillings a square mile. This comparison is not between the rigorous plane-table style of surveying over districts which probably present far more facilities for surveying than India does, but where cheap native labour is unknown. The geographical surveyor is simply a topographer employed on a smaller scale survey. His equipment and staff are somewhat less, but, on the other hand, his travelling expenses are greater. It is found that, on the whole, a fair average for the cost of geographical survey work by applying the square of the unit of scale as a factor to 1 in. survey is 4 shillings per quarter mile of survey (i.e. 4 m. to the in.), should be one-sixteenth of the cost per mile of the 1 in. survey over similar ground. A geographical reconnaissance of the scale of 1 : 500000 is placed in the hands of the topographer, and it is submitted to the surveyor, together with the results of the interferometric photographic work, and is then estimated as a basis for the future survey.
right angles as the figure has sides, less four; the second is linear, viz., the algebraical sum of the $x$ co-ordinates and that of the $y$ co-ordinates above mentioned. The astronomical test is this: at any station of the traverse the azimuth of a referring mark may be determined by astronomical observations; the inclination of the line of the origin is given by the traverse; the two should differ by the convexity of the meridians of the station and the origin. In practice the angles of the traverse are usually adjusted to satisfy their special geometrical and astronomical tests in the first instance, and then the co-ordinates of the stations are calculated and adjusted by corrections applied to the longest, that the angles may be least disturbed, as no further corrections are given them.

The exact value of the convergence, when the distance and azimuth of the second astronomical station from the first are known, is that of $B-(x+\alpha)$ of equation (5); but, as the first term is sufficiently for the traverse, we have

$$\text{convergence} = x \tan \frac{\alpha}{2} \cot \frac{\beta}{2},$$

substituting $x$, the co-ordinate of the second station perpendicular to the meridian of the origin, for $c \sin \alpha$.

The co-ordinates of the principal stations of a trigonometrical survey are usually the spherical co-ordinates of latitude and longitude; those of a traverse survey are always rectangular, plane for a small area but spherical for a large one. It is often, for purposes of comparison and check at stations common to surveys of both descriptions, to convert either rectangular co-ordinates into latitudes and longitudes, or vice versa, in order that the traverse survey may be represented by proportion over the co-ordinates of the traverse stations, if desired, or adjusted in the final mapping. The latter is generally all that is necessary, more particularly when the traverses are referred to successive trigonometrical stations, as origins, as the operations are being extended, in order to prevent any large accumulation of error. Similar conversions are also frequently necessary in map projections.

The method of effecting them will now be indicated.

Let $A$ and $B$ be any two points, $A_d$ the meridian of $A$, $B_d$ the parallel of latitude of $B$; then $A_b$, $B_b$ will be their differences in latitude and longitude; from the line between $A$, $B$, $A_B$, $B_B$ will be the arc $AB$, the difference of longitude, $\omega$; also let $\lambda_A$, $\lambda_B$ and $\lambda_{AB}$ be the latitudes of $A$, $B$, and the point $P$, $\rho_B$ the radius of curvature of the meridian, and $\rho_A$ the normal terminating in the axis minor for the latitude $\lambda_A$; and

$$\begin{align*}
\lambda_{AB} &= \lambda_A + \lambda_{B} - \lambda_{AB} + \lambda_{B}(-\frac{\pi}{2}) + \frac{\pi}{2} \\
\lambda_{AB} &= \lambda_A + \frac{x}{\cos \frac{\beta}{2}} - \frac{\pi}{2} + \frac{\pi}{2}.
\end{align*}$$

(19)

And, when the longitude and latitude are given, we have

$$\begin{align*}
\eta &= \frac{s}{2} \sin 2 \beta \\
y &= \rho_A \cos \eta - \rho_B \sin \eta \\
x &= \cos \cos (\lambda_A + y + y) \cot \frac{\beta}{2}.
\end{align*}$$

(20)

When a hill peak or other prominent object has been observed from a number of stations whose co-ordinates are already fixed, the converging rays may be projected graphically, and from an examination of their several intersections the most probable position of the object may be obtained almost as accurately as by calculations by the method of least squares, which are very laborious and out of place for the determination of a secondary point. The following is a description of the application of this method to points on a plane surface in the calculations of the ordnance survey. Let $s_1$, $s_2$, be stations where the traverses or co-ordinates, $x$, co-ordinates, and $y$, are parallel, to the meridian of the origin are given; let $a_1$, $a_2$, be the bearings of the direction-inclinations with the meridian of the origin of any point $P$, as observed at the several stations; and let $p$ be an approximate position of $P$, with co-ordinates $x_p$, $y_p$, as determined by graphical projection on a district map or by rough calculation. Construct a diagram of the rays converging around $P$, by taking a point to represent $p$ and drawing two lines through at right angles to each other to indicate the directions of north, south, east and west. Calculate the distances $\tan (y_p - y_1)$ and with compare with $x_p - x_1$; the difference will show how far the direction of the ray from $a_1$ falls to the east or west of $p$. Or calculate $x_p - x_2$ and $y_p - y_2$ to find how far the direction falls to the north or south of $p$. Set off the distance on the corresponding axis of $p$, and through the point thus fixed draw the direction $a_1$ with a common protractor. All the other rays around $p$ may be drawn in like manner; they will intersect each other in a number of points, the centre of which may be adopted as the most probable position of $P$. The co-ordinates of $P$ will then be readily obtained from those of the points of the distances on the meridian and perpendicular. In the annexed diagram (fig. 6) $P$ is supposed to have been observed from five stations, giving as many intersecting rays, $(1, 1)$, $(2, 2)$, etc., there are ten points of intersection, the mean point of which gives the true position of $P$, of assumed position being $p$. The advantages claimed for the method are that, the bearings being independent, an erroneous bearing may be redrawn without disturbing those that are correct; similarly new bearings may be introduced without disturbing previous work, and observations from several stations may be readily utilized, whereas, when calculation is resorted to, observations in excess of the minimum number required are frequently rejected because of the labour of computing the authorities.

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6. NAUTICAL SURVEYING

The great majority of nautical surveys are carried out by H.M. surveying vessels under the orders of the hydrographer of the admiralty. Plans of harbours and anchorages are also received from H.M. ships in commission on foreign stations, but surveys of an extended nature can hardly be executed except by a ship specially fitted and carrying a trained staff. The introduction of steam placed means at the disposal of nautical surveyors which largely modified the conditions under which they had to work in the earlier days of sailing vessels, and it has enabled the ship to be used in various ways previously impracticable. The heavy draught of ships in the present day, the growing increase of ocean and coasting traffic all over the world, coupled with the desire to save distance by rounding points of land and other dangers as closely as possible, demand surveys on larger scales and in greater detail than was formerly necessary; and to meet these modern requirements a large number of the vessels which are continually being called for. Nautical surveys vary much in character according to the nature of the work, its importance to navigation, and the time available. The elaborate methods and rigid accuracy of a triangulation for geodetic purposes on shore are unnecessary,
and are not attempted; astronomical observations at intervals in an extended survey prevent any serious accumulation of errors consequent upon a triangulation which is usually carried out with instruments, of which an 8-in. theodolite is the largest size used, whilst 5-in. theodolites generally suffice, and the sextant is largely employed for the minor triangulation. The scales upon which nautical surveys are plotted range from \( \frac{1}{3} \) in. to 2 or 3 in. to the mile in coast surveys for the ordinary purposes of navigation, according to the requirements; for detailed surveys, two scales of from 6 to 12 in. is usually adopted, but in special cases scales as large as 60 in. to the mile are used.

The following are the principal instruments required for use in the field: Theodolite, 5 in., fitted with large telescope of high power, with coloured shades to the eye-piece for observing the sun for true bearings. Sextant, 8 in. observing, stand of brass, eight, box, and two or three pocket, are usually supplied to surveying vessels. Sounding sextants, differing from ordinary sextants in being lighter and handier. The arc is cut only to minutes, reading to large angles of as much as 140°, and fitted with a tube of bell shape so as to include a large field in the telescope, which is of high power. Measuring chains 100 ft. in length. Ten-foot pole for coast-lining, is similar to the foregoing frames, 15 in. by 24 in., covered with canvas painted white, with a broad vertical black stripe in the centre and fixed on the pole 10 ft. apart. Station-pointer, an instrument in constant requisition either for sounding, coast-lining, or topographical plotting, which enables an observer's position to be fixed by taking two angles between three objects suitably situated. The movable legs being set to the observed angles, and placed on the position of the fixed extremities of the three legs are brought to pass through the points observed. The centre of the instrument then indicates the observer's position. Hollows, for reflecting the rays of the sun from distant stations to indicate their position, are invaluable. The most convenient form is Galton's sun-signal; but an ordinary swing mirror, mounted to turn horizontally, will answer the purpose, the flash being directed from a hole in the centre of the mirror for topographical purposes. Prismatic compass, patent logs (taffrail and hawse). Lucas wire sounding machine (large and small size), and James's submarine senery are also required. For chart-room use are provided a graduated brass scale, steel straight-edges and beam compasses of different lengths, rectangular vanecluse or ivory protractors of 6-in. and 12-in. length, and semicircular brass protractors of 10-in. radius, a box of good mathematical drawing instruments, lead weights, drawing boards and mounted paper. Every survey must have fixed objects which are first plotted on the sheet, and technically known as "points." A keen eye is required for natural marks of all kinds, but these must often be supplemented by whitewash marks, cairns, tripods or bushes covered with white canvas or calico, and flags, white or black according to background. On low coasts, flax or seaweed 80 ft. high must sometimes be erected in order to get the necessary range of vision, and thereby avoid the evil of small triangles, in working through which errors accumulate so rapidly. A barling spar 35 ft. in length, securely stayed and carrying as a guide a line of somewhat lighter spar, lengthened by a long bamboo, will give the required height. A fixed beacon can be erected in shallow water, 2 to 3 fathoms in depth, by constructing a tripod of spars about 45 ft. long. The heads of two of them are lashed together, and the heels kept open at a fixed distance by a plank about 27 ft. long, nailed on at about 5 ft. above the heels of the spars. These are taken out by three hooks, and the third tripod leg lashed in position on the boat, the heel in the opposite direction to the other two. The first two legs, weighted, are let go together; using the third leg as a prop, the tripod is secured into position and secured by guys to anchors, and by additional weights slipped down the legs. A vertical pole with bamboo can now be added, its weighted heel being on the ground and lashed to the fork. On this a flag 14 ft. square may be hoisted. Floating beacons can be made by filling up the gaps between two 27-gallon casks, connected by nailing a piece of thick plank at top and bottom. A barling spar passing through holes cut in the planks between the casks, projecting at least 20 ft. below and above 10 ft. above, is tucked in the upper and below the lower plank. To the upper part of the spar is lashed a bamboo, 30 to 35 ft. long, carrying a black flag 12 or 16 ft. square, which will be visible for a quarter of a mile in clear weather. The ends of a span of 3-in. chain are secured round the spar above and below the casks with a long link travelling upon it, to which the cable is attached by a slip, the end being carried up and lightly stopped to the bamboo below the flag. The flag's pole is open by its own stiffening, and is fitted to the casks for convenience in slipping and picking up. The beacon is moored with chain and rope half as long as the depth of water. Beacons have been moored by sounding line in as great depth as 3000 fathoms with a weight of 100 lb.

There is nothing in a nautical survey which requires more attention than the "fix"; a knowledge of the principles involved is essential in order to select properly situated objects. The method of fixing by two angles between three fixed points is generally known as the "two-circle method," but there are really three circles involved. The "station-pointer" is the instrument used for plotting fixes. Its construction depends upon the fact that angles subtended by the chord of a segment of a circle measured from any point in its circumference are equal. The lines joining three fixed points form the chords of segments of three circles, each of which passes through the observer's position and two of the fixed points. The more rectangular the angle at which the circles intersect each other, and the more sensitive they are, the better will be the fix; one condition is useless without the other. A circle is "sensitive" when the angle between the two objects responds readily to any small movement of the observer towards or away from the centre of the circle passing through the observer's position and the two objects. This is most markedly the case when one object is very close to the observer and the other very distant, but not so when both objects are distant. Speaking generally, the sensibility of angles depends upon the relative distance of the two objects from the observer, as well as the absolute distance of the nearer of the two objects. The accompanying diagram A, B, C are the objects, and X the observer. Fig. 7 shows the circle passing through C, B and X, cutting the circle ABX at a good angle, and therefore fixing X independently of the circle CAX, which is less sensitive than either of the other two. In fig. 8 the two first circles are very sensitive, but being nearly tangential they give no cut with each other. The third circle cuts both at right angles; it is, however, far less sensitive, and for that reason if the right and left hand objects are both distant the fix must be bad. In such a case as this, because the angles CXB, BXA are both so sensitive, and the accuracy of the fix depends on the precision with which the angle CAX is measured, that angle should be observed direct, together with one of the other angles composing it. Fig. 9 represents a case where the points are badly disposed, approaching the condition known as "on the circle," passing through the three points. All three circles cut one another at such a fine angle as to give a very poor fix. The centre of the station-pointer could be moved considerably without materially affecting the coincidence of the legs with the three points. To avoid a bad fix the following rules are safe:

1. Never observe objects of which the central is the furthest unless it is very distant relatively to the other two, in which case the fix is admissible, but must be used with caution.

2. Choose objects disposed as follows: (a) One outside object distant and the other two near, the angle between the two near
objects being not less than 30° or more than 140°. The amount of the angle between the middle and distant object is immaterial.

(b) The three objects nearly in a straight line, the angle between any two being not less than 30°. (c) The observer's position being inside the triangle formed by the objects.

A fix on the line of two points in transit, with an angle to a third point, becomes more sensitive as the distance between the transit points increases relatively to the distance between the front transit point and the observer; the nearer the angle to the third point approaches a right angle, and the nearer it is situated to the observer, the better the fix. If the third point is at a long distance, small errors either of observation or plotting affect the result largely. A good practical test for a fix is afforded by noticing whether a very slight movement of the centre of the station-pointer will throw one or more of the points away from the leg. If it can be moved without appreciably disturbing the coincidence of the leg and all three points, the fix is bad.

Tracing-paper answers exactly the same purpose as the station-pointer. The angles are laid off from a centre representing the position, and the lines brought to mark the legs of the triangles, and the angles are not so accurately measured with a small protractor. Nevertheless this has often to be used, as when points are close together on a small scale the central part of the station-pointer will often hide them and prevent the use of the instrument. The use of tracing-paper permits any number of angles to different points to be laid down on it, which under certain conditions of fixing is sometimes a great advantage.

Although marine surveys are in reality founded upon triangulation and measured bases of some description, yet when plotted irregardless of the system of triangles is not always apparent. The triangulation ranges from the rough triangle of a running survey to the carefully formed triangles of detailed surveys. The measured base for an extended survey is provisional only, the scale resting ultimately mainly upon the astronomical positions observed at its extremes. In the case of a plan the base is absolute. The main triangulation, of which the first triangle contains the measured base as its known side, establishes a series of points known as main stations, from which and to which angles are taken to fix other stations. A sufficiency of secondary stations and marks enables the detail of the chart to be filled in between them. The points embracing the area to be worked on, having been plotted, are transferred to field boards, upon which the detail of the work in the field is plotted; when complete the work is traced and re-transferred to the plotting-sheet, which is then inked in as the finished chart, and if of large extent it is graduated on the gnomonic projection on the astronomical positions of two points situated near opposite corners of the chart.

The kind of base ordinarily used is one measured by chain on flat ground, of 3 to 13 m. in length, between two points visible from one another, and so situated that a triangulation can be readily extended from them to embrace other points in the survey forming well-conditioned triangles. The error of the chain is noted before leaving the ship, and again on returning, by comparing its length with the standard length of 100 ft. marked on the ship's deck. The correction so found is applied to obtain the final result. If by reason of water intervening between the base stations it is impossible to measure the direct distance between them, it is permissible to deduce it by traversing.

A Masthead Angle Base is useful for small plans of harbours, &c., when circumstances do not permit of a base being measured on land, or when the visibility between stations is the most favourable condition for employing this method. Theodolite reading of the masthead with its elevation by sextant observed simultaneously at each base station (the mean of several observations being employed) gives the necessary data to calculate the distance between the base stations from the two distances resulting from the elevation of the masthead and the simultaneous theodolite-angles between the masthead and the base stations. The height of the masthead may be temporarily increased by securing a spar to extend 30 ft. or so above it, and the exact height from truck to netting is found by tripping up the end of the measuring chain. The angle of elevation should not be diminished below about 1° from either station.

Base by Sound.—The interval in seconds between the flash and return of the flash or echo, called, when measured with a watch or pocket chronometer, multiplied by the rate per second at which sound travels (corrected for temperature) supplies a means of obtaining a base which is sometimes of great use when other methods are not available. This method is well adapted for ship base, and guns or small brass Cohorn mortars are fired alternately from either end, and repeated several times. The arithmetical mean is not strictly correct, owing to the retardation of the sound on its outward and return journey, but when traveling with it; the formula used is therefore \( T = \frac{2t}{1 + \frac{t}{T}} \), where \( T \) is the mean interval required, \( t \) the interval observed one way, \( r \) the interval the other way. The method is not a very accurate one, but is sufficient so when the scale is finally determined by astronomical observations, or for sketch surveys. The measurement should be taken across the wind if possible, especially if guns can only be fired from one end of the base. Sound travels about 1090 ft. per second at a temperature of 62° F., and increases at the rate of 1.15 ft. for each degree above that temperature, decreasing in the same proportion for the figures below 32°.

Base by Angle of Short Measured Length.—An angle measured by sextant between two well-defined marks at a carefully measured distance apart, placed at right angles to the required base, will give a good for a small and regular base.

Astronomical Base.—The difference of latitude between two stations visible from each other and nearly in the same meridian, which is given approximately by the use of the sextant and extended triangulation; the only drawback to it is the effect of local attraction of masses of land in the vicinity on the pendulum, or, in other words, on the mercury in the artificial horizon. The ship's dead reckoning should be checked to test the effect of any error in the astronomical observations. The observation spots would not necessarily be actually at the base stations, which would probably be situated on summits at some little distance in order to command distant views. In each case each observation spot would be connected with its corresponding base station by a subsidiary triangulation, a short base being measured for the purpose of making the ship at anchor off the observation spot frequently affords a convenient means of effecting the connexion by a masthead angle base and simultaneous angles. If possible, the observation spots should be east or west of the mountain stations from which the true bearings of the stations A and B can be deduced.

If the base stations A and B are so situated that by reason of distance or of high land intervening they are invisible from one another, but both visible from some main station C between them, when the main triangulation is completed, the ratio of the sides AC, BC can be determined. From this ratio and the observed angle ACB, the angles ABC, BAC can be found. The true bearing of the lines AC or BC being known, the true bearing of the base stations A and B can be deduced.

Extension of Base.—A base of any description is seldom long enough to plot directly, and in order to diminish errors of direction, which are necessary, an extension should be worked inwards. A short base measured on flat ground will give a better result than a longer one measured over inequalities, provided that the triangulation is carefully extended by means of judiciously chosen angles, great care being taken to select suitable centres of each station. To facilitate the extension of the base in as few triangles as possible, the base should be placed so that there are two stations, one on each side of it, subtending angles at them of from 30° to 100°, and the distances between which, on being calculated in the triangles of the quadrilateral so formed, will constitute the first extension of the base. Similarly, two other stations placed one on each side of the last two will form another quadrilateral, giving a yet longer side, and so on.

The angles to be used in the main triangulation scheme must be very carefully observed and the theodolite placed exactly over the centre of the station. Main angles are usually repeated several times by resetting the vernier at intervals equidistant along the arc, in order to eliminate instrumental errors as well as errors of observation. The selection of an object suitable for a zero is very important. In plotting the points, if possible, main station at some distance, but not so far or so high as to be easily obscured, well defined, and likely to be permanent. Angles to secondary stations and other marks need not be repeated so many times as the more important angles, but it is well to check all angles once at least. Rough sketches from all stations are of great assistance in identifying objects from different points of view, the angles being entered against each in the sketch.

False Station.—When the theodolite cannot for any reason be placed over the centre of a station, if the distance measured
and the theodolite reading of it be noted, the observed angles may be reduced to what they would be at the centre of the station. For stations derived from the theodolite in practice, a simple rule to meet all cases is of great assistance to avoid the possibility of error in applying the correction with its proper sign. This may very easily be found as follows, without having to bestow a moment's thought beyond applying the rule, which is a matter of no small gain in time, when a large number of angles have to be corrected.

RESULTS.—Put down the theodolite reading which it is required to correct (increased if necessary by 360°), and from it subtract the theodolite reading of the centre of the station. Call this remainder θ. With the angle under construction (the sides of the triangle) it is-as a "course" and the number of feet from the theodolite to the station as a "distance," enter the traverse table and take out the greatest, or least, or lesser of the two (when 225° and 315°, or between 225° and 135°, and the lesser increment for other angles. The accompanying diagram (fig. 10) will assist in referring to the "table of subtended angles by various lengths at different distances" (using the distance of the object observed) and find the corresponding correction in arc, which mark + or − according as θ is under or over 150°. Apply this correction to the observed (corrected) angle. A "table of subtended angles" is unnecessary if the formula

\[ \text{Angle in seconds} = \frac{\text{number of feet subtended} \times 34}{\text{distance of object in sea-miles}} \]

Convergence of Meridians.—The difference of the reciprocal true bearings between two stations is called the "convergence." In Converting the reciprocal bearings in sea-miles to degrees, divide the number by 180. In south latitude the greater of the two, and in south latitudes the northerly bearing. The Mercatorial bearing between two stations is the mean of their reciprocal true bearings.

After a preliminary run over the ground to note suitable positions for main and secondary stations on prominent headlands, islands and summits not too far back from the coast, and, if no former survey exists, to make the same time a rough record of the position and general aspect of the object to be surveyed from the other land and from the short side. In open country the selection of stations is comparatively an easy matter, but in country densely wooded the time occupied by a triangulation is mainly governed by the judicious selection of stations quickly reached, sufficiently elevated to command distant views, and situated on summits capable of being readily cleared of trees in the required direction, an all-round view being, of course, desirable but not always attainable. The positions of secondary stations will also generally be decided upon during the preliminary reconnaissance. The object of these stations is to break up the large primary triangulations into triangles of smaller size, dividing up the distances between the primary stations into suitable lengths; they are selected with a view to greater accessibility than the latter, and should therefore usually be near the coast and at no great elevation. Upon shots from these will depend the position of the greater number of the coast-line marks, to be erected and fixed as the detailed survey of each section of the coast is taken in hand in regular order. The nature of the base to be used, and its position in order to fulfil the conditions specified under the head of Bases must be considered, as otherwise the triangulation may be falsified. It is immaterial at what part of the survey the base is situated, but if it is near one end, a satisfactory check on the accuracy of the triangulation is obtained by comparing the length of a side at the other extreme of the survey, derived by calculation through the whole system of triangles, with its length deduced from a check base measured in its vicinity. It is generally a saving of time to measure the base at some anchorages or harbour that requires a large scale plan. The triangulation involved in extending the base to the station will thus be made from an initial triangulation so as thus to be utilized for both purposes, and the triangulation is being calculated and plotted the survey of the plan can be proceeded with. True bearings are observed at both ends of the survey and the results subsequently compared. Astronomical observations for latitude are obtained at observation spots near the extremes of the survey and the meridian distance run between them, the observation spots being connected with the primary triangulation; they are usually disposed at intervals of from 100 to 150 m., and thus errors due to a triangulation carried out with theodolites of moderate diameter do not accumulate to any serious extent. If the survey is greatly extended, intermediate observation spots afford a satisfactory check, by comparing the positions as calculated in the triangulation with those obtained by direct observation.

Calculating the Triangulation.—The triangles as observed being tabulated, the angles of each triangle are corrected to bring their angles to 180°, using as much as as one minute, but under favourable conditions they may be much less. In distributing the errors we must consider the general skill of the observer, the size of his theodolite relatively to the distance, and the astronomical observations the observer has made; failing any particular reason to assign a larger error to one angle than to another, the error must be divided equally, and we find that a mistake of as much as one minute in the result may be considered as accidental. The bearing of the first side is then compared with the bearing obtained by direct observation at that end of the survey. The difference is principally due to accumulated errors in the triangulation; half of the difference is then applied to the bearing of each side. Convert these true bearings into Mercatorial bearings by applying half the convergence between each pair of stations. With the lengths of the connecting sides found from the measured base and their Mercatorial bearing, the position of a station is determined to a line in the sea. The bearing is then corrected to middle latitude sailing. Taking the observed astronomical positions of the observation spots and first reducing their true difference longitude to departure, as measured on a spheroid from the formula

\[ \text{Dep.} = \text{T. D. long.} \times \text{ft. in } 1 \text{ m. of lat.} \]

and adding the correction for the difference in latitude, then with the d. lat. and dep. the Mercatorial true bearing and distance between the observation spots is calculated by middle latitude sailing, and compared with that by triangulation and measured base. To adjust any discrepancy, it is necessary to consider the probable error of the observations for latitude and meridian distance; within these limits the astronomical positions may safely be altered in order to obtain the results; it is more important to bring the measurements into close agreement than the distance. From the amended astronomical positions the Mercatorial true bearings and distance between them are recalculated. The difference between this true bearing and the bearing derived from the triangulation by middle latitude sailing must be applied to the bearing of each side to get the final corrected bearings, and to the logarithm of each side of the triangulation as originally calculated must be added or subtracted the difference between the logarithms of the distances of the amended positions of the observation spots and the same distance by triangulation.
of the sides and their lengths ultimately depend almost entirely upon the astronomical observations at the extremities of the survey; the observed true bearings and measured base are consequently modified; this is especially true when the survey is altogether a pattern of irregular triangles, for here it is evident that, generally speaking, and therefore, that the nearer together the observation spots, the greater effect will a given error in the astronomical positions have upon the length and direction of the sides of the triangulation and upon all that depends thereon. It is evident, therefore, that the existence of observation spots may cause very false results, which may often account for discrepancies when situated on opposite sides of a mountainous country.

Great care is requisite in projecting on paper the points of a survey. The paper should be allowed to stretch and shrink as it pleases until it comes to a stand, being exposed to the air for four or five hours daily, and finally well flattened before being placed on a table with drawing boards placed over it heavily weighted. If the triangulation has been calculated beforehand throughout, and the lengths of all the different sides have been found, it is more advantageous to begin plotting by distances rather than by chords. The main stations are thus got down in less time and with less trouble, but these are only a small proportion of the points to be plotted, and long lines must be ruled between the stations as zeros for plotting other points by chords. In ruling these lines care must be taken to draw them exactly through the centre of the pricks denoting the stations, but, however carefully drawn, there is liability to slight errors, and these should be as small as they can possibly be, but as a general rule, any error in the absolute bearings of the stations between which the zero line is drawn. In plotting by distances, therefore, all points that will subsequently have to be plotted by chords should lie well within the area covered by the main triangulation. Three distances must be measured to obtain an intersection of the arcs cutting each other at a sufficiently broad angle; the plotting of the main stations once begun must be completed before distortion of the paper can occur from change in the humidity of the atmosphere. Plotting, whether by distance or by chords, must be begun on as long a side as possible, so as to plot forwards, or with decreasing distances. In plotting by chords it is important to remember in the selection of lines of reference or zero lines, that it should be preferred that which makes the smallest angle with the line to be projected from it, and of the angular points those nearest to the object to be projected from them.

Irregular Methods of Plotting.—In surveys for the ordinary purposes of navigation, it frequently happens that a regular system of triangulation cannot be carried out, and recourse must be had to a system of irregular triangulation. This is especially true in determining chartwork in coast survey, where a good deal of accuracy is often essential, and with proper care excellent results may be obtained. A few examples will illustrate some of the methods used, but circumstances vary so much in every survey that it is only possible to state a few general propositions for the guidance of the surveyor, and to improvise methods. Fixing a position by means of the "back-angle" is one of the most ordinary expedients. Angles having been observed at A, B, and C, a station D, and certain other fixed points of the survey, C and D for instance, if A is shot up from B, at which station angles to the same fixed points have been observed, then it is not necessary to visit those points to fix A. For instance, in the triangle ABC, two of the angles have been observed, and therefore the third angle at C is known (the three angles of a triangle being equal to 180°), and it is called the "calculated or back-angle from C." A necessary condition is that the receiving angle at A, between angles at A and B, should be known with sufficient accuracy to give a good cut; also the points from which the "back-angles" are calculated should not be situated at too great distances from A, relatively to the distance between A and B. A station may be plotted by laying down the line to it from some other station, and then placing on tracing-paper a number of the angles taken at it, including the angle to the station from which it has been shot up. If the plotting of the second line has been done in the proper way, the position is obtained, its accuracy being much strengthened by being able to plot on a line to it, which, moreover, forms a good zero line for laying off other angles from the station when plotted. Surveyors refer the known stations to the unknown station on the line to it, which to the other will afford a check. A well-defined mountain peak, far inland and never visited, when once it is well fixed is often invaluable in carrying on an irregular triangulation, as it may remain visible when all other original points of the survey have disappeared, and "back-angles" from it may be continually used for plotting on true bearing lines of it. In plotting the true bearing of such a peak, the convergence must be found and applied to get the reversed bearing, which is also true bearing down through it; or the reversed bearing of any other line already drawn through it, when bearing is known, it may simply be laid down with that at a zero. A rough position of the spot from which the true bearing was taken must be had, and this corrected in the appropriate proportion for the convergence. Fig. 11 will illustrate the foregoing remarks. A and B are astronomical observation spots at the extremities of a survey, with which the high, inaccessible peak C is visible. D, E, F are intermediate stations; A and D, B and C, D and E, E and F, F and B being respectively visible from each other. G is visible from A and D, and C is visible from all stations. The latitudes of A and B, and meridian distance between them being determined, and the true bearing of C being observed from both stations, is projected at all the stations. Calculating the spherical correction (from the formula, correction = d. cos² mid. lat.) and adding it to the true (or chromometric)

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**Fig. 11.** Difference longitude between A and B to obtain the spherical d. long.; with this spherical d. long. and the d. lat., the Mercatorian true bearing and distance is found by middle latitude sailing (which is an equally correct but shorter method than by the foregoing method). The distances usual between observation spots in nautical surveys. The convergency is also calculated, and the true bearing of A from B, B from C, C from D, and A from C, is found. The angle ABC is the difference between the calculated bearing of B and the observed bearing of C from A; similarly angle B is the difference between calculated bearing of A and observed bearing of C from B. Another way is All have been also calculated, the side AC is found. Laying down AC on the paper on the required scale, D is plotted on its direct shot from A, and on the angle back from C, calculated in the triangle ACD. G is plotted on the direct shots from A and D, and the angle between them calculated either in the triangle ACG or GCD. The perfect intersection of the three lines at G assures these four points being correct. E, F and B are plotted then laid down from a meridian drawn and angle ABC is calculated, relying on the angle A the difference between the calculated bearing of B and the observed bearing of C from A; similarly angle B is the difference between calculated bearing of A and observed bearing of C from B. If the discrepancy is but small, it will be a strong presumption in favour of the substantial accuracy of the work. If the calculated true bearing of B from A be now laid down, it is very unlikely that the line will pass through B, but this is due to the discrepancy which must always be expected between astronomical positions and triangulation. If some of the stations between A and B require to be placed somewhat closer to one another, it may be desirable to obtain fresh true bearings of C instead of carrying on the original bearing means of the calculated angle. In all cases of irregular plotting the ship is very useful, especially if an irregular triangle is being run, and angles are observed from the bow. Floating beacons may also assist an irregular triangulation.

Surveys of various degrees of accuracy are included among sketch surveys. The roughest description is the ordinary running survey, when the work is done by the ship steaming along the coast, fixing points, and sketching a coast-line. This is done at a great distance from the coast, and her position upon her courses and distances as registered by patent log, necessarily regardless of the effect of wind and current and errors of steereage. At the other extreme comes the modified running survey, which in point of practical accuracy falls little short of that attained by irregular triangulation. Some of these modifications will be briefly noticed. A running survey of a coast-line between two harbours, that have been surveyed independently and astronomically fixed, may often be carried out
by fixing the ship on the points already laid down on the harbour surveys and shooting up prominent intermediate natural objects, assisted possibly by theodolite lines from the shore stations. Theodolite-lines to the ship at any of her positions are particularly valuable, because the visual angle can be very accurately placed and will increase the value of any such work. A sketch survey of a coast upon which it is impossible to land may be well carried out by dropping beacons at intervals of about 10 m., well out from the land and placed abreast prominent natural objects called the "breemarks," which must be capable of recognition from the beacons anchored off the next "breemark" on either side. The distance between the beacons is found by running a patent log by both ways, noting the time occupied by each run; if the current has remained constant, a tolerably good result can be obtained. At any time between the points of intersection of the second and the two "breemarks," an "intermediate" mark, and any other natural object which will serve as "points." At the second beacon; angles are observed between the first beacon and the same objects as before. Plotting on the line of the two beacons as a base, all the points observed can be pricked in on two shots. At a position about midway between the beacons, simultaneous angles are observed to all the points and laid off on tracing-paper, which will afford the necessary check, and the foundation is thus laid for filling in the detail of coast-line, through angles and soundings only being made to the beacons or shore in any detail desired. Each section of coast is complete in itself on its own base; the weak point lies in the junction of the different sections, as the patent log bases can hardly be expected to agree precisely, and the scales of adjacent sections may thus be slightly different. This is obviated, as far as possible, by fixing on the points of one section and shooting up those of another, which will check any great irregularity of scale creeping in. The bearing is preserved by getting occasional true bearing lines at the beacons of the most distant point visible. Space does not permit this duty to be done upon the coast, and the precautions that are necessary to secure the best results the method is capable of; it can only be stated generally that in all cases of using angles from the ship under weigh, several assistants are necessary, so that the principal angles may be taken simultaneously, the remainder being connected immediately afterwards with zeros involving the smallest possible error due to the ship not being absolutely stationary, these zeros being included amongst the primary angles. When close to a beacon, if its bearing is noted and the distance in feet obtained from its edge, the bathymetrical soundings only are made towards the beacon and the angles are in this manner obtained. Astronomical positions by twilight stars keep a check on the work.

**Sketch Surveys by Compass Bearings and Vertical Angles.**—In the case of an island culminating in a high, well-defined summit visible from all directions, a useful and accurate method is to steam round it at a sufficient distance to obtain a true horizon, stopping to make as many stations as may be desirable, and fixing by compass bearing of the summit and its vertical angle. The height is roughly obtained by shooting in the summit, from two positions on a patent log base whilst approaching it. With this approximate height and Lecky's vertical danger table, each station may be plotted on its bearing of the summit. From these stations the island is shot in by angles between its tangents to the summit, and angles to any other natural features, plotting the work as we go on any convenient scale which must be considered only as provisional. On completing the circuit of the island, the true scale is found by measuring the total distance in miles on the plotting-sheet from the first to the last station, and dividing it by the distance in miles between them as shown by patent log. The final height of the summit bears to the round height used in plotting the direct proportion of the provisional scale to the true scale. This method may be utilized for the sketch survey of a coast where there are well-defined peaks of sufficient height. This method has the advantage of being independent of the soundings and running survey. From positions of the ship fixed by bearings and elevations of one peak, another farther along the coast is shot in and its height determined; this second peak is then used in its turn to fix the position of the next, and so on. The results, however, are not without their limitations; the soundings are liable to error, there is no guarantee that the Lecky's tables will show what effect an error of say 1° in altitude will produce for any given height and distance, and the limits of distance must depend upon this consideration.

**Surveys of Banks out of Sight of Land.**—On striking shoal soundings unexpectedly, the ship may either be anchored at once and the sounding be taken, or the ship may be steered, or the sounding be measured, usingprismatic compass and masthead wheel; or if the shoal is of large extent and may be prudently crossed in the ship, it is a good plan to get two beacons laid down on a bearing from one another and patent log distance of 4 or 5 m. With another beacon (or mark boat, carrying a large black bag on a bamboo 30 ft. high) fixed on this base, forming an equilateral triangle, and the ship anchored as a third, the soundings will be obtained by shooting in succession, working off to the station-pointer. The ship's position is determined by observations of twilight stars.

In a detailed survey the coast is sketched in by walking along it, fixing by theodolite or sextant angles, and plotting by tracing-paper or station-pointer. A sufficient number of fixed marks along the shore afford a constant check on the minor coast-line stations, which should be plotted on, or checked by, lines from one to the other wherever possible to do so. If impracticable to fix in the ordinary way, the ten-foot pole may be used to traverse from one fixed point to another. With a coast fronted by broad drying, coral reef or flats over which it is possible to walk, the distances between any two coast-line stations may be found by measuring at one of them the angle subtended by a known length placed at right angles to the line joining the stations. There is far less liability to error if the work is plotted at once on a spot on field board with the fixed points pricked through and circled in upon it; but if circumstances render it necessary, the angles being registered and sketches made of the bits of coast between the fixes on a scale larger than that of the chart, they may be plotted afterwards; to do this satisfactorily, however, requires the surveyor to appreciate instinctively exactly what angles are necessary at the time. It is with the high-water line that the coast-liner is concerned, delineating its character according to the Admiralty symbols. The officer sounding off the coast is responsible for the position of the dry line at low-water, and on large scales this would be sketched in from a small boat at low-water springs. Heights of cliffs, rocks, islets, &c., must be inserted, either from measurement or from the formula,

\[
\text{height in feet} = \text{angle of elevation in seconds} \times \text{distance in miles} / 34
\]

and details of topography close to the coast, including roads, houses and enclosures, must be shown by the coast-liner. Rocks above water or breaking should be fixed on passing them. Coast-line may be sketched from a boat pulling along the shore, fixing and shooting up any natural objects on the beach from positions at anchor.

The most important feature of a chart is the completeness with which it is sounded. Small scale surveys on anything less than one inch to the mile are apt to be very misleading; sounding, such a survey may appear to have been closely sounded, but in reality the lines are so far apart that they often fail to disclose indications of shoal-water. The work of sounding may be proceeded with as soon as sufficient points for fixing are plotted; but off an intricate coast it is better to get the coast-line done first. The lines of soundings are run by the boats parallel to one another and perpendicular to the coast at a distance apart which is governed by the scale; five lines to the inch is about as close as they can be run without overcrowding; if closer lines are required the scale must generally be increased. The distance apart will vary with the depth of water and the nature of the coast; a rocky coast with shallow water off it and projecting points will need much closer examination than a steep-to coast, for instance. The line of prolongation of a point under water will require special care to ensure that the fathom lines being drawn correctly. If the soundings begin to decrease when pulling off-shore it is evidence of something suspicious, and intermediate lines of soundings or lines at right angles to those previously run should be obtained; whenever possible lines of soundings should be run on transit lines; these may often be picked up by fixing when on the required line, noting the angle on the protractor between the line and some fixed mark on the field board, and then placing the angle on the sextant, reflecting the mark and noting what objects are in line at that angle. On
large scale surveys whitewash marks or flags should mark the ends of the lines, and for the back transit marks natural objects may perhaps be picked up; if not, they must be placed in the required positions. The boat is fixed by two angles, with an occasional third angle as a check; the distance between the fixes is dependent upon the scale of the chart and the rapidity with which the depth alters; the 3, 5, and 10 fathom lines should always be fixed, allowing roughly for the tidal reduction. The nature of the bottom must be taken every few casts and recorded. It is best to plot each fix on the sounding board at once, joining the fixes by straight lines and numbering them for identification. The tidal reduction being obtained, the reduced soundings are written in the field-book. In undercurrents, to prevent the soundings from revolting, a line should be used. The boat is then placed in its proper position on the board between the fixes. Suspicious ground should be closely examined; a small nun buoy anchored on the shoal is useful to guide the boat while trying for the least depth. Sweeping for a reported pinnacle rock may be resorted to when sounding fails to discover it. Local information from fishermen and others is often most valuable as to the existence of dangers. Up to depths of about 15 fathoms the hand lead-line is used from the boats, but beyond that depth the small Lucas machine for wire effects a great saving of time and labour. The deeper soundings of a survey are usually obtained from the ship, but schooners with wire sounding machines may assist very materially. By the aid of a steam winch, which by means of an endless sounding line hauls a 100-lb lead forward to the end of the lower boom rigged out, from which it is dropped by a slipping apparatus which acts on striking the water, soundings of 40 fathoms may be picked up from the sounding platform aft, whilst going at a speed of 4½ knots. In deeper water it is quicker to stop the ship and sound from aft with the wire sounding machine. In running long lines of soundings on and off shore, it is very essential to be able to fix as far as the land as possible. Angles will be taken from aloft for this purpose, and a few floating beacons dredged in judiciously chosen positions will often help to clear the trouble. A single fixed point on the land used in conjunction with two beacons suitably placed will give an admirable fix. A line to the ship or her smoke from one or two theodolite stations on shore is often invaluable; if watches are compared, observations may be made at stated times and plotted afterwards. True bearings of a distant fixed object cutting the line of position derived from an altitude of the sun is another means of fixing a position, and after dark the true bearing of a light may be obtained by the time azimuth and angular distance of a star near the prime vertical, or by the angular distance of the Pole Star from the horizon.

A very large percentage of the bugsbeaws to navigation denoted by vigias1 on the charts eventually turn out to have no existence, but before it is possible to expunge them a large area has to be examined. No-bottom soundings are but little use, but the evidence of positive soundings should be conclusive. Submarine banks rising from great depths necessarily stand on bases many square miles in area. Of recent years our knowledge of the angle of slope that may be expected to occur at different depths has been much extended. From depths of 50 fathoms the slope is so gradual that a bank could hardly approach the surface less than such a sounding; therefore anywhere within an area of at least 150 sq. m. all round a bank rising from these depths, a sounding must show some decided indications of a rise in the bottom. Under such circumstances, soundings at intervals of 7 m., and run in parallel lines 7 m. apart, enclosing areas of only 50 sq. m., between any four adjacent soundings, should effectually clear up the ground and lead to the discovery of any shoal; and in fact the soundings might even be more widely spaced. From depths of 1500 and 1000 fathoms, shoals can scarcely occur within 45 m. and 2 m. respectively; but as the depth decreases the angle of slope rapidly increases, and a shoal might occur within three-quarters of a mile or even half a mile of such a sounding as 500 fathoms. A full appreciation of these facts will indicate the distance apart at which it is proper to place soundings in squares suitable to the general depth of water. These soundings will soon show in which direction to proceed for the search if any irregularity of depth is manifested. When once a decided indication is found, it is not difficult to follow it up by paying attention to the contour lines as developed by successive soundings. Discouraged water, ripplings, fish jumping or birds hovering about may assist in locating a shoal, but the submarine sentry, with a head at a depth of 40 fathoms is here invaluable, and may save hours of hunting. Reports being more liable to errors of longitude than of latitude, a greater margin is necessary in that direction. Long parallel lines east and west are preferable, but the necessity of turning the ship might make this impossible. The wind and wind direction to wind at every sounding makes it desirable to run the line both with the wind abeam, which tends to disturb the dead reckoning least. A good idea of the current may be obtained from the general direction of the ship’s head whilst sounding considered with reference to the strength and direction of the wind, and it should be allowed for in shaping the course to preserve the parallelism of the lines, but the less frequently the course is altered the better. A good position in the morning should be obtained by pairs of stars on opposite bearings, the lines of position of one pair cutting those of another pair nearly at right angles. If the observations of the sun at two sunrises, or any number of observations of the sun about every two hours throughout the day, preferably whilst a sounding is being obtained and the ship stationary, evening twilight stars give another position.

Tides.—The datum for reduction of soundings is low-water ordinary springs, the level of which is referred to a permanent bench mark in order that future surveys may be reduced to the same datum level. Whilst sounding is going on, the position of the survey lines will soon show in which direction to proceed for the search if any irregularity of depth is manifested. When once a decided indication is found, it is not difficult to follow it up by paying attention to the contour lines as developed by successive soundings. Discouraged water, ripplings, fish jumping or birds hovering about may assist in locating a shoal, but the submarine sentry, with a head at a depth of 40 fathoms is here invaluable, and may save hours of hunting. Reports being more liable to errors of longitude than of latitude, a greater margin is necessary in that direction. Long parallel lines east and west are preferable, but the necessity of turning the ship might make this impossible. The wind and wind direction to wind at every sounding makes it desirable to run the line both with the wind abeam, which tends to disturb the dead reckoning least. A good idea of the current may be obtained from the general direction of the ship’s head whilst sounding considered with reference to the strength and direction of the wind, and it should be allowed for in shaping the course to preserve the parallelism of the lines, but the less frequently the course is altered the better. A good position in the morning should be obtained by pairs of stars on opposite bearings, the lines of position of one pair cutting those of another pair nearly at right angles. If the observations of the sun at two sunrises, or any number of observations of the sun about every two hours throughout the day, preferably whilst a sounding is being obtained and the ship stationary, evening twilight stars give another position.

Tidal Streams and Surface Currents are observed from the ship or boats at anchor in different positions, by means of a current log; or the course of a buooy drifted by the current may be followed by sending a boat out at regular intervals. The most noticeable is the high-water at full and change, called the “establishment,” and the heights to which spring and neap tides respectively rise above the datum are also required. It is seldom that a sufficiently long observation is preserved for subsequent harmonic analysis, and therefore the graphical method is preferred; an abstract form provides for the projection of high and low waters, lunar tidal intervals, moon’s meridian passage, declination of sun and moon, apogee and perigee, and mean time of high-water following superior transit, and of the highest tide in the twenty-four hours. A good portable automatic tide gauge suitable for all requirements is much to be desired.

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Deep-sea Current Meter.

The instrument is first lowered to the required depth, and when ready is put into action by means of a heavy weight, or messenger, travelling down the supporting line and striking on a metal plate, thus closing the jaws of the levers and enabling the instrument to begin working. The rudder is then free to revolve inside the framework and take up the direction of the current; the small levers, which revolve on a pin, are operated by the motions, while the compass needle is released and free to take up the north and south line. On the despach of a second messenger, the lever, acting on the lever of the side, opens the jaws of the levers as soon as the machine is open, every part of the machine is simultaneously locked. Having noted the exact time of starting each of the messengers, the time during which the instrument has been working at the required depth, and from this the velocity of the current can be calculated, the number of revolutions having been recorded, while the direction is shown by the angle between the compass needle and the direction of the rudder.

Mark each object in fig. 12. AA are the jaws of the levers through which the first messenger passes and strikes on the metal plate B. The force of the blow is sufficient to press down, thus bringing the jaws close together as possible, and the corresponding direction of the current is marked by B. On the head of the first opens the levers again and prevents their closing, thus keeping all parts of the machine locked. C is the rudder which takes up the direction of the current when the lever is opened. D is a set of small levers on the rudder in connexion with AA. The
outer end on the tail of the rudder fits into the notches on the outer ring of the frame when the machine is locked and thus keeps the rudder fixed, but when the first messenger has started the machine by pressing down B and opening the levers AA, this small lever is raised and the rudder can revolve freely. EE are four small cones which revolve on their axis in a vertical plane, similar to an anemometer; the axis is connected by a worm screw to geared wheels which register the number of revolutions up to 5000, corresponding to about 4 nautical miles. There is a small lever in connection with AA which prevents the cones revolving when the machine is locked, but allows them to revolve freely when the machine is in action. Below the rudder-post is a compass-bowl F, which is hung in gimnals and capable of removal. The needle is so arranged that it can be lifted off the pivot by means of a lever in connection with AA; when the lever is in action the needle swings freely on its pivot, but, when the levers are locked it is raised off its pivot by the inverted cup-piece K placed inside the triple claws on the top of the compass and screwed to the lever, thus locking the needle without chance of moving. The compass bowl should be filled with fresh water before lowering the instrument into the sea, and the top screwed home tightly. The needle should be removed and carefully dried after use, to prevent corrosion. The long arm G is to keep the machine steady in one direction; it works up and down a jackstay which passes between two sheaves at the extremity of the long arm. This also assists to keep the machine in as upright a position as possible, and prevents it from being drifted astern with the current. A weight of as much as 8 or 10 cwt. is required at the bottom of the jackstay in a very strong current. An elongated weight of from 60 to 80 lb. must be suspended from the eye at the bottom of the meter to help to keep it as vertical as possible. On the outer part of the horizontal notched ring forming the frame, and placed on the side of the machine opposite to the projecting arm G, it has been found necessary to bolt a short arm supported by stays from above, from which is suspended a leaden counterpoise weight to assist in keeping the apparatus upright. This additional fitting is not shown in fig. 12. A 4-in. phosphor-bronze wire rope is used for lowering the machine; it is rove through a metal sleeve H and india-rubber washer, and spliced round a heart which is attached to metal plate B. The messengers are fitted with a hinged joint to enable them to be placed round the wire rope, and secured with a screw bolt. To obtain the exact value of a revolution of the small cones it is necessary to make experiments when the actual speed of the current is known, by immersing the meter just below the surface and taking careful observations of the surface-current by means of a current leg or weighted pole. From the number of revolutions registered by the meter in a certain number of minutes, and taking the mean of several observations, a very fair value of a revolution during the day can be deduced. On every occasion of using the meter for under-current observations the value of a revolution should be re-determined, as it is apt to vary owing to small differences in the friction caused by want of oil or the presence of dust or grit; while the force of the current is probably another important factor in influencing the number of revolutions recorded.

The features of the country should generally be delineated as far back as the skyline viewed from seaward, in order to assist the navigator to recognize the land. The summits of hills and conspicuous spurs are fixed either by lines to or by angles at them; their heights are determined by theodolite elevations or depressions to or from stations whose height above high-water is known. As much of the ground as possible is walked over, and its shape is delineated by contour lines sketched by eye, assisted by an aneroid barometer. In wooded country much of the topography may have to be shot in from the ship; sketches made from different positions at anchor along the coast with angles to all prominent features, valleys, ravines, spurs of hills, &c., will give a very fair idea of the general lie of the country.

Circum-meridian altitudes of stars on opposite sides of the zenith observed by sextant in the artificial horizon is the method adopted wherever possible for observations for latitudes. Arranged in pairs nearly the same altitude north and south of zenith, the mean of each pair should give a result from which instrumental and personal errors and errors due to atmospheric conditions are altogether eliminated. The mean of several such pairs should have a probable error of not more than $\pm 1\degree$. As a rule the observations of each star should be confined to within 5 or 6 minutes on either side of the altitude, which will allow of from fifteen to twenty observations. Two stars selected to "pair" should pass the meridian within an hour of each other, and should not differ in altitude more than $2\degree$ or $3\degree$. Artificial horizon roof error is eliminated by always keeping the same end of the roof towards the observer; when observing a single object, as the sun, the roof must be reversed when half way through the observations. The observations are reduced to the meridian by Raper's method. When pairs of stars are not observed, circum-meridian altitudes of the sun alone must be resorted to, but being observed on one side of the zenith only, none of the errors to which all observations are liable can be eliminated.

Sets of equal altitudes of sun or stars by sextant and artificial horizon are usually employed to discover chronometer errors. Six sets of eleven observations, a.m. and p.m., observing both limbs of the sun, should give a result which, under favourable conditions of latitude and declination, might be expected to vary less than two-tenths of a second from the normal personal equation of the observer. Stars give equally good results. In high latitudes sextant observations diminish in value owing to the slower movement in altitude. In the case of the sun the chronometers are compared with the "standard" at apparent noon; the comparisons with the chronometer used for the observations on each occasion of landing and returning to the ship are worked up to noon. In the case of stars, the chronometer comparisons on leaving and again on returning are worked up to an intermediate time. A convenient system, which retains the advantage of the equal altitude method, whilst avoiding the necessity of waiting some hours for the p.m. observation, is to observe two stars at equal altitudes on opposite sides of the meridian, and, combining the observations, treat them as relating to an imaginary star having the mean R.A. and mean declination of the two stars selected, which should have nearly the same declination and should differ from $4\degree$ to $8\degree$ in R.A.

The error of chronometer on mean time of place being obtained, the local time is transferred from one observation spot to another by the ship carrying usually eight box chronometers.

The best results are found by using travelling rates, which are deduced from the difference of the errors found on leaving an observation spot and returning to it; from this difference is eliminated that portion which may have accumulated during an interval between two determinations of error at the other, or any intermediate observation spot. A travelling rate may also be obtained from observations at two places, the meridian distance between which is known; this rate may then be used for the meridian distance between places observed at during the passage. Failing travelling rates, the mean of the harbour rates at either end must be used. The same observer, using the same instrument, must be employed throughout the observations of a meridian distance.

If the telegraph is available, it should of course be used. The error on local time at each end of the wire is obtained, and a number of telegraphic signals are exchanged between the
observers, an equal number being transmitted and received at
either end. The local time of sending a signal from one place
being known and the local time of its reception being noted,
the difference is the meridian distance. The retardation due to the
time occupied by the current in travelling along the wire is elimi-
ated by sending signals in both directions. The relative personal
measurement of the observers at either end, both in their observa-
tions for time, and also in receiving and transmitting signals,
is eliminated by changing ends and repeating the operations.
If this is impracticable, the personal equations should be deter-
mined and applied to the results. Chronometers keeping solar
time at one end of the wire, and sidereal time at the other end,
materially increase the accuracy with which signals can be
exchanged, for the same reason that comparisons between sidereal
clocks at an observatory are made through the medium of a
solar clock. Time bearings are means of the extant to be
readily obtained, and within such small limits of error, by skilled
observers, that in hydrographic surveys it is usually employed;
but if transit instruments are available, and sufficient time
may be devoted to erecting them properly, the value of the
work is greatly enhanced in high latitudes.

True bearings are obtained on shore by observing with theo-
dolite the horizontal angle between the object selected as the
zero and the sun, taking the latter in each quadrant
as defined by the cross-wires of the telescope. The
altitudes may be read on the vertical arc of the theo-
dolite; except in high latitude, where the observer with
sextant and artificial horizon are necessary, unless the
precise errors of the chronometers are known, when the time
may be obtained by carrying a pocket chronometer to the station.
The sun should be near the prime vertical and at a low altitude;
the theodolite must be very carefully levelled, especially in
the position with the telescope pointing towards the sun. To elimi-
nate instrumental errors the observations should be repeated with
the vernier set at intervals equidistant along the arc, and a.m. and
p.m. observations should be taken at about equal altitudes.

An observation is obtained by measuring with a sextant
the angle between the sun and some distant well-defined object
making an angle of from 100° to 120° and observing the altitude
of the sun at the same time, together with that of the terrestrial
object. The sun's altitude should be low to get the best results,
and both limbs should be observed. The sun's true bearing
is calculated from its altitude, the latitude, and its declination;
the horizontal angle is applied to obtain the true bearing of the
zero. On shore the theodolite gives the horizontal angle direct,
but with sextant observations it must be deduced from the
angular distance and the elevation.

For further Information see Wharton, Hydraphical Surveying
(London, 1898); Shortland, Nautical Surveying (London, 1890).

"SURVILLE, CLOTILDE DE," the supposed author of the
Poesies de Clotilde. The generally accepted legend gave
the following account of her. Marguerite Eléonore Clotilde de
Vallon Chalis, dame de Surville, was born in the early years
of the 15th century at Vallon. In 1421 she married Bérenger
de Surville, who was killed at the siege of Orleans in 1428. Her
husband's absence at the war inspired her heroic verses and his
death her elegiac poems. The last of her poems is a chant royal
addressed to Charles VIII.

In 1503 Charles Vanderbourg published as the Poesies de
Clotilde some forty poems dealing with love and war. The
history given in the introduction of the discovery of the manu-
script was evidently a fable, and the poems were set down by
most authorities as forgeries, especially as they contained many
anachronisms and were written in accordance with modern laws
of prosody. The manuscript had been in the possession of
Jean François Marie, marquis de Surville, an émigré who returned
to France in 1795 to raise an insurrection in Provence, and had
paid the penalty with his life. In 1863 Antoine Macé made
further inquiries on the subject, and discovered letters from
Vanderbourg to Surville's widow. This correspondence makes it
clear that Vanderbourg was innocent of forgery and believed that
the poems were of 15th-century date, and that the anachronisms
of matter and form were due to retouching by Surville. But the
researches of M. Macé interested local antiquarians, and
documentary evidence was produced that the wife of Bérenger
de Surville was Marguerite Chalis, not Clotilde, and that the
marriage dated only from 1428. Moreover Bérenger's
white death at the siege of Orleans was one of the leading motives
of the book, lived for twenty years after that date. Friends
of M. de Surville also disclosed the fact that the marquis had
contributed archaic poetry to a Lausanne journal.

See A. Macé, Un procés d'histoire littéraire (1879); A. Mazou,
Marguerite Chalis et la légende de Clotilde de Surville (1875); articles
by Gaston Parisis in the Revue encyclopédique d'histoire et de littérature
(March 1, 1877, the Mistral, 1874), G. M. Faris, and E. C. Chamberlain
(1894); E. C. Chambers, Literary Forgeries (1891); and further
references in the Bibliographie des femmes célèbres (Turin and Paris,
1892, &c.).

SUS, a province of southern Morocco, once an independent
kingdom, and still too unruly to be opened to Europeans, who
have nevertheless for centuries past made efforts to secure a
foothold. Its principal towns are Taradant, Iihig (the old
capital), and Glimin on the Wad Nun. Taradant, the present
capital, flourished in the 12th century on account of the neigh-
bouring copper-mines. Saltpetre is now the only important
product. Forts might be opened at Agadir Ighir (once occupied
by the Portuguese for thirty years as Santa Cruz), Massa, Ifni,
Arkob and Assaka at the mouth of the Wad Nun. As a fortified
district, all kinds of natural riches are attributed to Sus, but
it may be assumed that they are exaggerated. Europeans land
at their peril, since the coast is by imperial order closed to trade,
and custom-house being provided. Most of the business of Sus
is carried on at great fairs lasting eight or fifteen days, during
which time all roads of approach are guaranteed safe by the
tribesmen that trade may be uninterrupted. Caravans from
Sus laden with copper-ware, olive oil, butter, saffron, wax, skins,
dates, dried roses, &c., are sent to Marrakesh, four days' journey
from Taradant. Susa are well known in the north of Morocco
as able tradersmen and clever metal workers. They live frugally,
and are only prodigal in powder and human life. Their language
is almost exclusively Shihah, a dialect of Berber. (K.A.M. *)

SUSA (Biblical, Shashan), the capital of Susiana or Elam
and from the time of Darius I. the chief residence of the Achem-
ianen kings. It had been the centre of the old monarchy of
Elam and had undergone many vicissitudes before it fell into
the hands of the Persians (see ELAM). The site, fixed by the
explorations of W. K. Loftus, lies in the plain, but within sight
of the mountains, between the courses of the Kerka (Chosaepes)
and the Dizful, on the banks of the Tigris. The
Shaur, a small tributary of the Dizful, washes the eastern base
of the mounds of Shush, and seems to be the representative of
the ancient Ulai or Eulaeus. Thus the whole district was fruit-
ful and well watered; the surrounding rivers with their canals
gave protection and a waterway to the Persian Gulf; while
the position of the town between the Semitic and Iranian lands
of the empire was convenient for administrative purposes. Susa
therefore became a vast and populous capital; Greek
writers assign to it a circuit of 15 or 20 m.

The remains include four mounds, of which one is the site of
the citadel called Memnon by the Greeks, while another
(the Apadana to the east of it) represents the palace of Darius I.
and Artaxerxes II. Mmnon. This latter has been excavated by
M. Dieulafoy and the enamelled bricks with which its walls
were adorned are now in the Louvre. South of these two mounds
is the site of the royal Elamite city. The fourth mound, covering
the remains of the poorer houses, is on the right bank of the river
between the Shaur and the Kerka. J. de Morgan's excava-
tions (since 1897) have been principally in the citadel mound,
which measures roughly 1500 ft. by 825 ft. and is 125 ft. high.
The two lowest strata belong to the old town, and the first
is on the Dizful, on the banks of the river, with yellow bricks decora-
ted with geometrical patterns and animal or vegetable figures
in black and brown-red. Some of it is similar to the prehistoric

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pottery of Egypt. The pottery of the second neolithic stratum is much inferior. Above these strata come the remains of Elamite and early Babylonian civilization with inscribed objects, the oldest of which exhibit the pictorial characters out of which the cuneiform were evolved. Under the foundations of the temple of In-Susinak (in the north-west part of the mound) a vast quantity of bronze objects has been discovered, for the most part earlier than the 10th century B.C. Among the monuments brought to light in other parts of the mound are the obelisk of Manisuta (see BABYLONIA), the stela of Naram-Sin and the code of Hammurabi, along with a great number of historically valuable boundary stones. The objects which have yielded, besides Persian remains, Greek pottery and inscriptions of the 4th century B.C., numerous coins of the Kammaskires dynasty and other kings of Elymais in the Seleucid era, and Parthian and Sassanian relics. In the Sassanian period the city was razed in consequence of a revolt, but rebuilt by Sapor (Shapur) II.; the walls were again destroyed at the time of the Mahomedan conquest, but the site, which is now deserted, was a seat of sugar manufacture in the middle ages.

Bibliography.—W. K. Loftus, Travels and Researches in Chaldæa and Susiana (1844); J. D. Dillery, L'Acropole de Suse (1892); A. Billerbeck, Susa (1895); J. de Morgan, Mémoires de la délégation en Perse, vols. i.-viii. (from 1890). See also PERSIA: Ancient History, § v. 2. (A. H. S.)

SUSA (fr. Souse), a city of Tunisia, on the Gulf of Hammatem, in 35° 49' N., 10° 30' E., 36 m. by rail. E. by N. of Kairawan, of which it is the port, and 93 m. S. by E. by rail of Tunis. Susa, which occupies part of the site of the ancient Hadrumetum, is built on the site of a hill sloping seawards, and is surrounded by a crenellated wall, strengthened by towers. Recesses in the inner side of the wall are used as shops and warehouses. The kasbah, or citadel, built on the highest point within the town, was thoroughly restored by the French after their occupation of the country in 1881, and serves as military headquarters for the district, the camp for the troops being outside the walls west of the citadel. The native town has been little changed since the French occupation, but north of the port a European quarter has been created, and here are public buildings such as law courts, a museum and a town-hall. The museum contains many archaeological treasures, notable mosaics and sculptures. The most interesting buildings in the old town are the Kasser-Ribat and the Kaswati-el-Kubbah. The Kasser-Ribat is a square fortress with a high tower and seven bastions. Its date is uncertain, but is not later than the 9th century. The Kaswati-el-Kubbah (Café of the Dome) is a curious house, square at the base, then cylindrical, and surmounted by a fluted dome. It was probably a church during the Byzantine period. Another domed building, now used as oil-mills, dates from Roman and Byzantine times. In the Bab-el-Gharbi (West Gate) a Roman sarcophagus of marble has been built into the wall, and serves as a drinking fountain. The grand mosque is in the north-east part of the town. The ancient harbours are silted up, but vestiges of the Roman breakwaters may be seen. The modern port, completed in 1901, enables steamers drawing 21 ft. to lie at the quays. Exports are chiefly phosphates and other minerals, olive oil, esparto and cereals; imports: cotton goods, building material, &c. The population, less than 10,000 at the time of the French occupation, had increased in 1907 to over 25,000, of whom 1500 were French and 4000 other Europeans, chiefly Italians and Maltese.

Susa, the Arab town which succeeded Hadrumetum (q.v.), was fortified by Aghlabite rulers of Kairawan in the 9th century A.D. It shared the general fortunes of Tunisia and became a noted haunt of pirates, who RAIDed the coast of Italy. In 1537 it was unsuccessfully besieged by the marquis of Terra Nova, in the service of Charles V., but in 1539 was captured for the emperor by Andrea Doria. As soon as the imperial forces were withdrawn it became again the seat of Turkish piracy. The town was attacked by the French and the Knights of St John in 1779, and by the Venetians in 1764. It remained, however, in the possession of the bey of Tunis.

Some 35 m. due south of Susa, and half way on the road to Sfax is El Jem, the site of the city of Thysdrus. Of the ancient city there are scarcely any remains save the amphitheatre—a magnificent ruin which still resembles the theater of Dionysus. The site of the ancient theater is marked by a rock-cut amphitheatre, three open arcades crowned by a fourth storey with windows. The first and second arcades are Corinthian; the middle one Composite. Each of these galleries has sixty-four columns and supports arches. Constantly used as a fortress since the Arab invasion, the amphitheatre suffered much, and in 1697 the bey of Tunis made a great breach in its western end to prevent it being again used for this purpose. The building is now in ruins, but the standing solitary in a desolate district—is grandly impressive. Its major axis is 488 ft., its minor axis 406 ft. (The figures of the Colosseum are 615 and 510 respectively.)

SUSA (anc. Segusio, q.v.), a city and episcopal see of Piedmont, Italy, in the province of Turin, from which it is 33 m. W. by rail. Pop. (1901), 3607 (town); 5023 (commune). It is situated on the Dora Riparia, a tributary of the Po, 1625 ft. above sea-level, and is protected from the northern winds by the Rocciamelone. Among the most important buildings of Susa is the first palace or convent of the Cistercian order, which was founded in 1070 by Oldericus Manfredi II. and the countess Berta, and in 1772 raised to be the cathedral. It has a fine brick campanile and brick decoration, and contains a bronze triptych of 1358 in niello, with the Virgin and Child. In the Valle di Susa, about 14 m. east of it, towards Turin, near S. Ambrogio di Torino, is the monastery of S. Michele with a Romanesque church, situated on a rocky mountain (968-1002).

After the time of Charlemagne a marquisate of Susa was established; and the town became in the 11th century the capital of Adefalda, countess of Savoy, who was mistress of the whole province of Piedmont. On his retreat from Legnano in 1176 Barbarossa set fire to Susa; but the town became more than ever important when Emmanuel Philibert fortified it at great expense in the 16th century. It was, however, dismantled by Napoleon I. in 1796.

SUSARION, Greek comic poet, a native of Tripodiscus in Megaris. About 350 B.C. he transplanted the Megarian comedy (if the rude extempore jests and buffoonery deserve the name) into the Attic dème of Icaria, the cradle also of Greek tragedy and the oldest seat of the worship of Dianysus. According to the Parian Chronicle, there seems to have been a competition on this occasion, in which the prize was a basket of figs and an amphora of wine. Susarian's improvements in his native farces did not include a separate actor or a regular plot, but probably consisted in substituting metrical compositions for the old extempore effusions of the chorus. These were intended for recitation, and not committed to writing. But such performances did not suit the taste of the Athenians, and nothing more is heard of them until eighty years after the time of Susarion. U. von. Wilamowitz-Moellendorf (in Hermes, ix.) considers the so-called Megarian comedy to have been an invention of the Athenians themselves, intended as a satire on Megarian coarseness and vulgarity. The lines attributed to Susarion (in Meineke, Poetarum comicorum graecorum fragmenta) are probably not genuine.

SUSO [SEUSE], HEINRICH (1300-1366), German mystic, was born of good family at Überlingen on Lake Constance on the 21st of March, in all probability in the year 1300; he assumed the name of his mother, his father being a Herr von Berg. He was educated for the Church, first at Constance, then at Cologne, where he came under the influence of the greatest of the German Augustinian mystics, Master Eck. He subsequently entered a monastery in Constance, where he submitted himself to the severest trials of asceticism. In 1335 he wandered through Swabia as a preacher, and won all hearts by his gentle, persuasive eloquence; the effusive lyricism of his language made him an especial favourite among the nuns. About 1348 he seems to have settled in Ulm, where he died on the 25th of January 1366. Suso's first work, Das Büchlein der Wahrheit, was written in Cologne about 1329; setting out from Eckart's doctrines, he presents the mystical faith from its speculative or theoretical side; whereas
in *Das Büchlein der einew Weisheit*, written some years later in Constance, he discusses the practical aspects of mysticism. The latter work, which Suso also translated into Latin under the title of *Horologium sapientiae*, has been called the finest fruit of German mysticism. Suso is the poet of the early mystic movement, "the Minnesinger of Gottessinner." But his faith is purely medieval in tone, inspired by the romanticism of the age of chivalry; the individualism, the philosophic insight and the anti-Catholic tendencies which made the mystic movement in its later manifestations so important a forerunner of the Reformation are absent.

Suso's works were collected as early as 1482 and again in 1512; recent editions: Heinrich Suso's *Leben und Schriften*, ed. by M. Dippel (1854); Suso, *Deutsche Schriften*, F. H. S. Denike (1878-1880, not completed), and Deutsche Schriften, by K. Bihlmeyer (2 vols., 1907). See also W. Preger, *Die Briefe Heinrich Susos* (1867); W. Preger, *Geschichte der deutschen Mystik* (1882), vol. ii.; J. Jäger, *Heinrich Suso aus Schwaben* (1894).

**SUSPENsURA,** the architectural term given by Vitruvius (v. 10) to the hollow space under the floor of a Roman bath, in which the smoke from the furnace passed to the vertical flues in the wall (see HYPOCAUST).

**SUSSEX, EARLS OF.** The early history of the earldom of Sussex, a title that has been borne at different periods by several English families, is involved in some obscurity, owing to the fact that under the Norman kings the titles of earls were often indifferently derived from a county, from its chief town, or from the earl's principal residence, although the distinctive mark of an earldom is the right of war. In 1086, by the charter of H. de Redon, the pleas of a county (see EARL). Thus in the 12th century the same person is sometimes found described as earl of Sussex, sometimes as earl of Chichester, and sometimes as earl of Arundel, while the inclusion of the counties of Sussex and Surrey under the jurisdiction of a single sheriff led at one time, as will be seen, to a further confusion between the earldoms of those counties. The difficulty is, again, increased by the Crown's admission in 1433 that the possession of the castle of Arundel carried with it the right to the title of earl of Arundel, though later investigations have shown that in 1563 this claim was proved the invalidity of the claim, and Mr J. H. Round and other modern authorities maintain that inasmuch as Norman earls were earls of counties, the earldom of Arundel was strictly that of Sussex.

On the other hand G. E. Cockayne (Complete Peerage, i. 138, 139) holds that Roger de Montgomery, who received grants from William the Conqueror of a large part of the county of Sussex, including the city of Chichester and the castle and honour of Arundel, besides lands in Shropshire with the castles of Shrewsbury and Montgomery, but who does not appear to have held "the third penny" of any county, carried the title of earl of Montgomery. This Roger de Montgomery was considered by Dugdale, a 17th-century authority, to have been earl of Sussex.

However Roger's titles may have been, they were forfeited to the Crown when his son Robert was attainted in 1302, and the forfeited estates were conferred by Henry L. on his second wife Adelicia, who after Henry's death married William de Albinia, or d'Aubigny. This Roger was created earl of Sussex by King Stephen, and the "third penny" of that county was confirmed to him by an instrument of the reign of Henry II., in which however, he is styled earl of Arundel, a designation by which he was more generally known. His grandson William, 3rd earl of Sussex, was one of King John's sureties for the observance of Magna Carta; and the earldom remained in his family till 1243, when it reverted to the Crown on the death of Hugh de Albinia, 6th earl of the line (see ARUNDEL, EARLS OF). This Hugh married Isabel, daughter of William de Warenne, earl of Surrey, who was killed by him nearly forty years, during which time she held the estates of the earldom of Surrey in dower; after her death in 1282 her brother John de Warenne, earl of Surrey, was in various writs described as "earl of Surrey and Sussex," the same style being also used by his grandson and successor, another John de Warenne (1286-1347), though it is not clear that either of these Warennes had any right to the Sussex title, the confusion having perhaps arisen through both counties being under the jurisdiction of one sheriff. In any case the earldom of Sussex, if vested in the younger Warenne, reverted to the Crown on his death without legitimate issue in 1347, when his estates devolved on his nephew Richard Fitzalan, earl of Arundel. Since the death of the last earl of the de Albini line in 1343 the earldoms of Arundel and Sussex had been separate.

For nearly two hundred years, from 1347 to 1529, the title of earl of Sussex did not exist in the English peerage. In 1529, however, it was conferred on Robert Radcliffe, Radclyffe or Ratcliffe (c. 1483-1542), who had been made Viscount Fitzwalter in 1525. Radcliffe was a son of John Radcliffe, Baron Fitzwalter (c. 1492-1545), and a grandson of Sir John Radcliffe of Attleborough in Norfolk, who became Baron Fitzwalter by right of his wife Elizabeth. The younger John Radcliffe shared in the conspiracy of Perkin Warbeck and was beheaded for high treason in 1496. The attainer being reversed in 1506, his son Robert became Baron Fitzwalter in 1506 and was soon a prominent person at the court of Henry VIII. In 1529 he was created earl of Sussex and in 1540 he was appointed great chamberlain of England. He died on the 26th of November 1542, when his son Henry (c. 1506-1557) became the 2nd earl. Henry's son, Thomas Radcliffe (see below), became the 3rd earl. Thomas was created Baron Radcliffe in 1583 by his uncle, John Radcliffe, the 5th earl of Sussex, by whom he succeeded, and was assassinated in the murder of his sister-in-law Elizabeth in Ireland. His son Robert (c. 1569-1629), the 5th earl, was a soldier and a patron of men of letters. When Robert's son, Edward, the 6th earl (c. 1592-1641), died, the title became extinct, but the barony of Fitzwalter passed to the family of Mildmay, which held it until 1756, when it fell into abeyance.

In 1644 Thomas Savile (c. 1590-1659), son of John Savile, 1st Baron Savile of Pontefract (1506-1630), was created earl of Sussex. Having been elected to the House of Commons as member for Yorkshire in 1624, Savile became an opponent of King Charles I. In 1634, after the execution of Charles I., the Saviles and the Wentworths having long being a feature of the history of Yorkshire, and attaching himself to the Duke of Buckingham, he was created Viscount Castlebar in the peerage of Ireland in 1628, and two years later succeeded to his father's English peerage. His growing enmity to Strafford led him into violent opposition to the government as the earl's power increased, and in 1640 he entered into correspondence with the Scots, to whom he sent a promise of support to which he forged the signatures of six peers. He was appointed lord president of the council of the north in succession to Strafford in 1642, but in May 1643 he was captured by Lord Byron, and, later, was retained in the Tower, in whose interest he exerted his influence in Yorkshire in a manner that brought upon him the displeasure of the parliament in 1642. His efforts to exonerate himself led to his being suspected by the Royalists, and to his arrest, while his residence, Howley Hall, was sacked by Newcastle, the Royalist general. Having been pardoned by Charles, whom Savile attended at Oxford, he was created earl of Sussex in 1644; but his efforts to promote peace on terms distasteful to the king brought him again into disfavour, and in 1645 he was imprisoned and accused of high treason. Escaping from this charge on the ground of his privilege as a peer, he went to London and again ingratiated himself with the popular party. Intriguing simultaneously with both parties, he continued to play a double game with considerable skill, although he suffered imprisonment in 1645 for accusing Holles and Whitelocke of treachery in negotiations with the king, and was heavily fined. After this he retired into private life at Howley Hall, where he died about 1659.

He was succeeded in the earldom of Sussex by his son James, on whose death without issue in 1671 the title became extinct. It was revived in 1684 in favour of Thomas Lennard, 13th Baron Dacre, whose wife Ann (d. 1722) was a daughter of the famous duchess of Cleveland by King Charles II., and again became extinct at this nobleman's death in 1715.
was next conferred in 1717 on Talbot Vevloton, 2nd Viscount de Longueville and 16th Baron Grey de Ruthyn (c. 1602–1731), from whom it descended to his sons successively, becoming once more extinct on the death of the younger of these, Henry, 3rd earl of Sussex of this creation, in 1799.

In 1801 Prince Augustus Frederick (1773–1843) the sixth son of George III., was created duke of Sussex. Spending his early years abroad, the prince was married in Rome in 1793 to Lady Augusta (d. 1830) daughter of John Murray, 4th earl of Dunmore. The ceremony was repeated in London and two children were born, but under the Royal Marriages Act of 1772 the Court of Arches could not declare them illegitimate. The children took the name of d’Este. The son, Sir Augustus Frederick d’Este (1794–1848), became a colonel in the British army. In 1843 he claimed his father’s honours, but the House of Lords decided against him. He died unmarried. The daughter, Augusta Emma (1801–1866) married Sir Thomas Wilde, afterwards Lord Truro.

Unlike his brothers the duke of Sussex was a man of liberal ideas; he favoured the abolition of the slave trade, the repeal of the corn laws, and the removal of the civil disabilities of Roman Catholics, Dissenters, and Jews. His second wife, Countess of Oxford, his second wife, Sir George Buggin, was created duchess of Inverness in 1840. He died at Kensington Palace on the 21st of April 1843.

The old title of earl of Sussex was revived in 1874 when it was conferred upon Prince Albert, the third son of Queen Victoria, who at the same time was created duke of Connaught and Strathearn.


Sussex, Thomas Radclyffe [or Ratcliffe], 3rd Earl of (c. 1525–1583), lord-tenant of Ireland, eldest son of Henry, 2nd earl of Sussex (see Sussex, Earls of), by his first wife, Elizabeth, daughter of Thomas Howard, 2nd duke of Norfolk, was born at London and afterwards in 1542 was styled Viscount Fitzwalter. After serving in the army abroad, he was employed in 1553 in negotiating a marriage between Edward VI. and a daughter of Henry II., king of France. His prominence in the kingdom was shown by his inclusion among the signatories to the letters patent of the 16th of June 1553 setting the crown on Lady Jane Grey; but he nevertheless won favour with Queen Mary, who employed him in arranging her marriage with Philip of Spain, and who raised him to the peerage as Baron Fitzwalter in August 1555.

Returning to England from a mission to the emperor Charles V. in April 1556, Fitzwalter was appointed lord deputy of Ireland. The prevailing anarchy in Ireland, a country which, nominally subject to the English Crown, was torn by feuds among its practically independent native chieftains, rendered the task of the lord deputy one of no ordinary difficulty; a difficulty that was increased by the ignorance of English statesmen concerning Ireland and Irish conditions, and by their incapacity to devise or to carry into execution any consistent and thoroughgoing policy for bringing the half-conquered island under an orderly system of administration. The measures enjoined upon him by the crown and government, the entire reversal of the partial attempts that had been made during the short reign of Edward VI. to promote Protestantism in Ireland, and the "plantation" by English settlers of that part of the country then known as Offaly and Leix. But before Fitzwalter could give his attention to such matters he found it necessary to make an expedition into Ulster, which was being kept in a constant state of disturbance by the Highland Scots from Kintyre and the Islands who were making settlements along the Antrim coast in the district known as the Gylness (glen), and by the efforts of Shane O'Neill to convert into effective sovereignty the chiefship of his clan which he had recently wrested from his father, Conn, 1st earl of Tyrone. Having defeated O'Neill and his allies the MacDonnells, the lord deputy, who by the death of his father in February 1557 became earl of Sussex, returned to Dublin, where he summoned a parliament in June of that year. Statutes were passed declaring the legitimacy of Queen Mary, reviving the laws for the suppression of heresy, forbidding the immigration of Scots, and vesting in the earl of Sussex all the properties which were now the King's County and Queen's County, which were then so named after Philip and Mary respectively. Having carried this legislation, Sussex endeavoured to give forcible effect to it, first by taking the field against Donough O'Connor, whom he failed to capture, and afterwards against Shane O'Neill, whose lands in Tyrone he ravaged, restoring to their nominal rights the earl of Tyrone and his reputed son Matthew O'Neill, baron of Dunganon (see O'Neill). In June of the following year Sussex turned his attention to the west, where the head of the O'Briens had ousted his nephew Conor O'Brien, earl of Thomond, from his possessions, and was about to pay allegiance to the Crown of Rome in order to open its gates to him, restored Thomond, and proclaimed The O'Brien a traitor. In the autumn of 1558 the continued inroads of the Scottish islanders in the Antrim glens called for drastic treatment by the lord deputy. Sussex laid waste Kintyre and some of the southern Hebridean isles, and landing at Carrickfergus he fired and plundered the settlements of the Scots on the Antrim coast before returning to Dublin for Christmas.

In the metropolis the news reached him of the queen's death. Crossing to England, he took part in the coronation of Queen Elizabeth's coronation in January 1559; and in the following July he returned to Ireland with a fresh commission, now as lord lieutenant, from the new queen, whose policy required him to come to terms if possible with the troublesome leaders of the O'Neills and the MacDonnells. Shane O'Neill refused to meet Sussex without security for his safety, and having established his power in Ulster he demanded terms of peace which Elizabeth was unwilling to grant. Sussex failed in his efforts to bring Shane to submission, either by open warfare or by a shameful attempt to procure the Irish chieftain's assassination. He was preparing for a fresh invasion at the request of the earl of Kildare, who was commissioned by Elizabeth to open negotiations with O'Neill, the result of which was that the latter repaired to London and made formal submission to the queen. Shane's conduct on his return to Ireland was no less rebellious than before, and energetic measures against him became more imperative than ever. Having obtained Elizabeth's sanction, Sussex conducted a campaign in the summer of 1563 with Armagh as his temporary headquarters; but except for some indecise skirmishing and the seizure of many of O'Neill's cattle, the operations led to no result and left Shane O'Neill with his power little diminished. His continued failure to effect a purpose for the accomplishment of which he possessed inadequate resources led Sussex to pray for his recall from Ireland; and his wish was granted in May 1564. His government of Ireland had not, however, been wholly without fruit. Sussex was the first representative of the English Crown who enforced authority to any considerable extent beyond the limits of the Pale; the policy of planting English settlers in Offaly and Leix was carried out by him in 1562 with a certain measure of success; and although he fell far short of establishing an English garrison in Ulster, the expedition of 1566 made its influence felt in remote parts of the island, such as Thomond and the Glynnes of Antrim, where the independence of the native septs had hitherto been subjected not even to nominal interference. His letters from Ireland display a just conception of the problems with which he was confronted, and of the methods by which their solution should be undertaken; and his failure was due, not to lack of statesmanship or of executive capacity on his own part, but to the insufficiency
of the resources placed at his command and want of insight and persistence on the part of Elizabeth and her ministers.

On his return to England, Sussex, who before leaving Ireland had to endure the indignity of an inquiry into his administration instigated by his enemies, threw himself into opposition to the earl of Leicester, especially in regard to the suggested marriage between that nobleman and the queen. He does not appear to have on that account incurred Elizabeth's displeasure, for in 1566 and the following year she employed him in negotiations for bringing about a matrimonial alliance which he warmly supported, namely, the proposal that she should bestow her hand on the archduke Charles. When this project fell to the ground Sussex returned from Vienna to London in March 1568, and in July he was appointed lord president of the north, a position which threw on him the responsibility of dealing with the rebellion of the earls of Northumberland and Westmorland in the following year. The weakness of the force at his disposal rendered necessary at the outset a caution which engendered some suspicion of his loyalty; and this suspicion was increased by the counsel of moderation which he urged upon the queen; but in 1570 he laid waste the border, invaded Scotland, and raided the country round Dumfries, reducing the rebel leaders to complete submission. In July 1572 Sussex became lord chamberlain, and he was henceforth in frequent attendance on Queen Elizabeth, both in her progress through the country and at court, until his death on the 9th of June 1583.

The earl of Sussex was one of the great nobles of the Elizabethan period. Though his loyalty was questioned by his enemies, it was as unwavering as his patriotism. He was a courtier; he excelled in diplomacy; he was a man of cultivation and even of scholarship, a patron of literature and of the drama on the eve of its blossoming into the glory it became soon after his death. He was twice married: first to Elizabeth, daughter of Thomas Wriothesley, earl of Southampton; and secondly to Frances, daughter of Sir William Sidney. His second wife was the foundress of Sidley Sussex College at Cambridge, which she endowed by her will, and whose name commemorates the father and the husband of the countess. The earl left no children, and at his death his titles passed to his brother Henry (see Sussex, Eares, 09).


SUSSEX, a southern county of England, bounded N. by Surrey, N.E. by Kent, S. by the English Channel, and W. by Hampshire. The area is 1,459-2 sq. m. The extreme length from E. to W. is 78 m., while the breadth never exceeds 28 m., but the county is not wholly on the southward slope, for in the middle northern district it contributes a small drainage area to the Thames basin, and the river Medway rises in it. A line of hills known as the Forest Ridges forms the watershed. Its direction is E.S.E. from the northern part of the county to the coast at Fairlight Down east of Hastings, and it reaches a height of about 800 ft. in the neighbourhood of Crowborough. The salient physical feature of the country, however, is the hill range called the Downs (see Downs). Entering in the west, where its summit is about 80 m. from the sea, and extending for some 50 m., gradually approaching the coast, and terminating in the bold promontory of Beachy Head near Eastbourne. The average height is about 500 ft., though some summits exceed 700, and Ditchling Beacon is over 800. The portion of the county north of the South Downs is called the Weald (q.v.). It was formerly covered with forest, and this part of the county is still well wooded. About 1660 the total area under forest was estimated to exceed 200,000 acres, but much wood was cut to supply the furnaces of the ironworks which formed an important industry in the county down to the 17th century, and survived even until the early years of the 19th.

The rivers wholly within the county are small. All rise in the Forest Ridges, and all, except the Rother, which forms part of the boundary with Kent, and falls into the sea below Rye, breach the South Downs. From east to west they are the Cuckmere, rising near Heathfield; the Ouse, Adur and Arun, all rising in the district of St. Leonard's Forest; and having at their mouths the ports of Newhaven, Shoreham and Littlehampton respectively. The natural trench known as the Devil's Dike is a point greatly favoured by visitors from Brighton. The coast-line is practically coextensive with the extreme breadth of the county, and its character greatly varies. The sea has done great damage by incursion at some points, and has receded in others, within historic times. Thus what is now marshland or "Levels" round Pevensey was formerly an island-studded bay. In the east Winchelsea and Rye, members of the Cinque Ports, and great medieval towns, are deprived of their standing, the one wholly and the other in part, since a low flat tract interposes between their elevated sites where formerly was a navigable inlet. Yet the total submergence of the site of Old Winchelsea was effected in the 13th century. The site of the ancient cathedral of Selsey is a mile out at sea. Between 1292 and 1340 upwards of 5500 acres were submerged. In the early part of the 14th century Pagham Harbour was formed by a sudden irruption of the sea, devastating 2700 acres, since reclaimed. There is reason to believe that the whole coast-line has subsequently been slightly raised. These changes are reflected in the numerous alterations recorded in the course of time in the rivers passing through the county. Thus the Adur was diverted by a great storm on the 12th of October 1250, before which date it entered the sea 12 m. to the east. The outlet of the Ouse was at Seaford until 1570, and that of the Adur formerly shifted from year to year, ranging east and west over a distance of 2 m. Submerged forests are found off the shore and eastward points. Long stretches of firm sand, and the mild climate of the coast, sheltered by the hills from north and east winds, have resulted in the growth of numerous watering-places, of which the most popular are Brighton, Hastings, Eastbourne, Bexhill, Seaford, Shoreham, Worthing, Littlehampton, Saltdean and Bognor.

Geology.—The disposition of the rock formations of Sussex is simple. The South Downs consist of chalk, which extends from Beachy Head by Seaford, Brighton, Lewes, Steyning and Goodwood to the western border. The dip of the chalk is southerly, while a more or less escarpment faces the north. From the summit of the elevated area to the northern limit of the district the chalk is low; and here it is occupied mainly by the Wealden Beds and the Weald Clay; at the foot of the escarpment it constitutes the Gault and Upper Greensand, while between these formations and the more elevated area to the south, the Chalk is usually represented by the Greensand. The southern and eastern portion of this latter district is particularly remarkable; for at one time there is no doubt that the Chalk, Greensand and Gault covered the entire area in the form of an uplifted dome, but denudation has removed the Chalk and most of the other formations as far as the North Downs; exposing the under strata of the Old Red Sandstone, and the Wealden Beds, which are of very different character. The oldest rocks thus brought to light along the crest of the anticline are the Purbeck Beds, small patches of shale and limestone, with flints, which are partly covered by the Wealden Beds. A deep boring (909 ft.) at Netherfield, passed through Portlandian Beds and Kimmeridge Clay into Oxford Clay, but these do not appear anywhere at the surface. Above the Purbeck Beds, and covering all the modern portion of the county from the coast at Bexhill and Rye to Horsham, are sands and clays of the Lower Wealden or Hastings Beds. This includes the following local subdivisions, in ascending order; the Fairlight Clay, Ashdown Sand, Wadhurst Clay, Tunbridge Wells Sand, Greensand Clay and Upper Tunbridge Wells Sand (with Tilgate stone at the top and Cuckfield Clay at the base). The Weald Clay occupies a belt of lower ground
on the south and west of the Hastings Sands, it consists of blue and mottled clays with thin sand layers and beds of hard limestone, the "Sussex marble" with the shells of Paludina. The Horsham Stone is another local hard bed. Near Tilgate the remains of Ignavodon have been found. The oldest formation. Bordering the outcrop of the Weald Clay is the Lower Greensand; it appears a little north of Eastbourne and passes thence through Ringmer, Storrington, Pulborough, Petworth, Midhurst and Lindrum. It contains the following well-marked divisions: Upper Weald Beds (sandstone, sandstone and chert), Sandgate Beds and Folkestone Beds. The Eocene strata slanting south of the Downs and west of Brighton—with the exception of some outliers of Reading Beds, known as the Chalk—extend the Weald Clay as far west as the Hampshire border. London Clay (with hard "Boghor Rock"), the Bagshot and Bracklesham Beds; the last-named formation is very fossiliferous in the bay of Wadhurst. The Serpentinite on the Weald is quite distinct from the much of the low ground west of Brighton; these include glacial deposits with large boulders, raised beaches, brick earth and gravels, marine and estuarine, and the interesting Coombe rock or Brighton Elephant Bed, a coarse rubble of chalk waste formed late in the Glacial period, well exposed in the cliff at Black Rock east of Brighton, where it rests on a raised beach. The natural gas of Heathfield comes from the Lower Wealden and Purbeck Beds. The Weald Clay was formerly iron ore.

Climate and Agriculture.—The climate of the coast district is mild, equable and dry, while that of the Wealden shows greater extremes of temperature, and is rather wetter. The mean daily range at Heathfield in the Weald is 18°F. in summer and 2°F. on the coast. The influence of the sea in modifying the temperature of the coast district is specially noticeable in the autumn months, when the temperature is higher than in the Weald and other parts of the county. The districts are not very suitable for market gardens and for growing fruit trees. The fig gardens of West Tarring are celebrated. About seven-tenths of the total area is arable and pasture. The rest is woods and heaths in the north of Sussex. Sussex is still one of the best-wooded counties in England. The acreage under grain crops shows a large decrease; nearly the whole of it is occupied by oats and wheat. The acreage under green crops is mainly devoted to turnips and other food for cattle, and to the supply of vegetables for the London market. The growing of hops has not kept pace with that in the neighbouring county of Kent. Cattle are kept in increasing numbers both for breeding and for dairy purposes. South Downs White is the best milk breed, and Sussex and Hampshire Black are the best dairy breeds. The county is famed for black-faced sheep and Sussex is famed for a special breed of black-faced sheep. The numbers, however, show a steady decrease. Poultry farming is largely carried on in some parts of the county. The cultivation of hops, by which land descends to the youngest son, prevailed to an extraordinary degree in Sussex, and no fewer than 140 manors have been catalogued in which it was found. Gavelkind tenure existed in Rye, in the large manor of Brede, and in Courntard manor (in Brede parish).

Other Industries.—The manufacturing industries are meagre. The London, Brighton & South Coast Railway Company has large works at Brighton. At Heathfield in 1901 the development of the field directory is a further indication of the growth of the company, which is still at its highest point. There are a number of important, including cord, herrings, mackerel, sprats, plaice, soles, turbot, shrimps, crabs, lobsters, oysters, mussels, oysters and cuttlefish. There are thousands of acres of salt marshes. When he visited the county in 681, taught the people the art of net-fishing. At the time of the Domesday survey the fisheries were extensive, and no fewer than 285 salines (saltworks) existed. The customs of the Rye district were preserved to 1576, in 563.202. The earliest statement as to the population is made by Bode, who describes the county as containing in the year 681 land of 7000 families; allowing ten to a family (not an unreasonable estimate), the whole population would be 70,000. In 1593 the county is stated to have contained 21,517 houses. If seven were allowed to a house at that date, the total population would be 150,759. It is curious, therefore, to observe that in 1801 the population was only 85,114, and in 1901 it stood at 695,202. The reasons for this decrease have been stated, but the work of the census probably accounts for the small increase of population during several centuries, although after the massacre of St Bartholomew up to 250,000 people were expelled in 1586, 10 years after the revocation of the Edict of Nantes, many more refugees were added to the county.

An act of Henry VII. (1504) directed that for convenience the county court should be held at Lewes as well as at Chichester, and this apparently gave rise to the division of Sussex into east and west parts, each of which is an administrative county. East Sussex has an area of 628,879 acres, and West Sussex of 603,602 acres. The division includes the county boroughs of Brighton and Hastings. East Sussex contains the municipal boroughs of Bexhill (pop. 12,213), Brighton (123,475), Eastbourne (43,344), Hastings (65,528), Hove (39,110), and Worthing (29,444). The ancient county of this division are Battle (996), Burgess Hill (4888), Cuckfield (1813), East Grinstead (6094), Haywards Heath (3717), Newhaven (8772), Portslade-by-Sea (5417), Seaford (3555) and Uckfield (2895). In West Sussex the municipal boroughs are Arundel (2750), Chichester a city (12,244) and Worthing (20,015). The urban districts are Bognor (6180), Horsham (9446), Littlehampton (7365), Shoreham (3868) and Southwick (3566). The ancient county, which is wholly in the diocese of Chichester, contains 373 ecclesiastical parishes or districts, wholly or in part. The total number of civil parishes is 338. Sussex is divided into the following parliamentary divisions: northern or East Grinstead, eastern or Rye, southern or Eastbourne, mid or Lewes, western or Chichester, north-western or Horsham, each returning one member: and contains the parliamentary boroughs of Brighton, returning two members, and Hastings, returning one.

History.—Apart from conclusions to be drawn from prehistoric remains, the history of Sussex begins in 477, when the Saxons landed in the west of the county under Ella and his three sons, and built up the kingdom of the South Saxons (see Sussex, Kin and Family). They took the Roman city of Regulam, which became Chichester, afterwards westward, into the forest of Andred. The Roman fortress of Anderida, the site of the castle of Pevensey, also fell to the Saxons. Ella became the most influential of the contemporary Saxon chiefs, and was, according to Bede, the first Bretwald. After his time the kingdom of Sussex gradually declined, and fell entirely under the dominion of Wessex in 823. Interesting Saxon remains are found in numerous cemeteries, and scattered burial places along the south slopes of the Downs. The cemetery on High Down hill, where weapons, ornaments and vessels of various kinds were found, and the Chantry hoard of coins, are among the most noticeable relics. A coin of Offa of Mercia, found at Beddingham, recalls the charter of Archbishop Wilfred in 825, in which Offa's connexion with the monastery in that place is recorded. From 895 Sussex suffered from constant raids by the Danes, till the accession of Canute, after which arose the two great forces of the house of Godwine and of the Normans. Godwine was probably a native of Sussex, and by the end of the Conqueror's reign a third part of the county was in the hands of his family. Norman influence increased after 1066, when the Conqueror died, and the barons of Hastings, Rye, Winchelsea, Selsey and Shoreham, who were kept by the Normans so long as the abbey of the Norman abbey of Fécamp, while the Norman chaplain of Edward the Conqueror, Osbern, afterwards bishop of Exeter, held the estate of Bosham.

The county was of great importance to the Normans; Hastings and Pevensey being on the most direct route for Normandy. William was accordingly careful to secure the lines of communication with London by placing the lands in the hands of men bound by close ties to himself, such as his half-brother, the count of Mortain, who held Pevensey, and his son-in-law, William of Warre, who held Winchelsea. The warrens and large tracts of lands held by the Church and the Crown, the five rapanies of Sussex were held by these and three other Norman tenants-in-chief: William de Braose, the count of Eu, and Roger, earl of Montgomery, who held respectively Bramber, Hastings and Arundel. The honour of Battle was afterwards made into a rape by the Conqueror, and provides one of the arguments in favour of the theory of the Norman origin of these divisions of the county. The county was divided into five (afterwards six) strips, running north and south, and having each a town or center of military, commercial and maritime importance. These were the rapes, and each had its sheriff, in addition to the sheriff of the whole county. Whether the origin of the rapes, as districts, is to be found in the Icelandic territorial division hreppr (repeated in the New English Dictionary), or in the Saxo rap, a rope, or is of Norman origin, as lords
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they undoubtedly owed their existence to the Normans. The holdings—which had been scattered under the Saxons, so that one man’s holding might be in more than one rape—were now determined, not by the manors in which they lay, but by the borders of the rape. Another peculiarity of the division of land in Sussex is that, apparently, each hide of land had eight instead of the usual four virgates.

The county’s boundary was long and somewhat indeterminate on the north, the Crown owning dense forest of Andredswald, which was uninhabited till the 11th century. Evidence of this is seen in Domesday Book by the survey of Worth and Lodsworth under Surrey, and also by the fact that as late as 1834 the present parishes of north and south Amersham in Sussex were part of Hampshire. At the time of the Domesday Survey Sussex contained sixty hundreds, which have been little altered since. A few have been split up into two or three, making seventy-three in all; and the names of some have changed, owing probably to the meeting-place of the hundred court having been altered. These courts were in private hands in Sussex; either of the Church, or of great barons and local lords. The county court was held at Lewes and Shoreham until the Great Inquest, when it was moved to Chichester. After several changes the act of 1504 arranged for it to be held alternately at Lewes and Chichester. There was no gaol in the county until 1487; that at Guildford being used in common by Surrey and Sussex, which were under one sheriff until 1597.

Private jurisdictions, both ecclesiastical and lay, played a large part in the county. The chief ecclesiastical franchises were those of the archbishop of Canterbury, of the bishop of Chichester, of the Saxon foundation of Bosham, where Bishop Wilfrid had found the only gleam of Christianity in the county, and of the totive abbey of Battle, founded by the Conqueror. This abbey possessed, besides land in many other counties, the “Lowy of Battle,” a district extending, for 3 m. round the abbey. The see of Chichester was co-extensive with the county, and has altered little. It is one of the oldest bishoprics, having been founded by Wilfrid at Selsey; the seat was removed to Chichester by William I. Among the lay franchises, the most noticeable are those of the Cinque Ports and of the honor of Pevensey, named the honor of the Eagle from the lords of L’Aigle or Aguila.

Sussex, from its position, was constantly the scene of preparations for invasion, and was often concerned in rebellions. Pevensey and Arundel play a great part in rebellions and forfeiture during the troubled times of the early Norman kings. In the barons’ wars the county was a good centre for the king’s forces; Lewes being in the hands of the king’s brother-in-law, John de Warenne, earl of Surrey, Pevensey and Hastings in those of his uncle, Peter of Savoy. The forces of the king and of De Montfort met at Lewes, where the famous battle and “Mise of Lewes” took place. The corrupt and burdensome administration of the county during the 13th and 14th centuries, combined with the constant passage of troops for the French wars and the devastating plagues of the 14th century, were the causes of such rebellions as the Peasants’ Rising of 1381 and Jack Cade’s Rebellion in 1450. In the former Lewes Castle was taken, and in the latter we find such men engaged as the abbot of Battle and the prior of Lewes. During Elizabeth’s reign there was again constant levying of troops for warfare in Flanders and the Low Countries, and preparations for defence against Spain. The sympathies of the county were divided during the Civil War, Arundel and Chichester being held for the king; and Lewes and the Cinque Ports for the parliament. Chichester and Arundel were besieged by Waller, and the Roundheads gained a strong hold on the county, in spite of the loyalty of Sir Edward Ford, sheriff of Sussex. A royalist gathering in the west of the county in 1645 caused preparations for resistance at Chichester, of which Algernon Sidney was governor. In the same year the “Clubmen” rose and endeavoured to compel the armies to come to terms. Little active part in the national history fell to Sussex from that time till the French Revolution, when numbers of volunteers were raised in defence. At the outbreak of war with France in 1793 a camp was formed at Brighton; and at Eastbourne in 1803, when the famous Martello towers were erected.

The parliamentary history of the county began in 1290, for which year we have the first extant return of knights of the shire for this county, Henry Hussey and William de Etchingham, representatives of two well-known Sussex families, being elected.

Waste and localistic reform was effected by the Redistribution Act of 1832, when Bramer, East Grinstead, Seaford, Steyning and Winchelsea were disfranchised after returning two members each, the first being classed among the worst of the “rotten” boroughs. Before 1832 two members each had been returned also by Arundel, Chichester, Hastings, Horsham, Lewes, Midhurst, New Shoreham (with the rape of Bramber) and Rye. Arundel, Horsham, Midhurst and Rye were each deprived of a member in 1832, Chichester and Lewes in 1867, and Hastings in 1885. Arundel was disfranchised in 1868, and Chichester, Horsham, Midhurst, New Shoreham and Rye in 1885.

In the 13th century the duke of Newcastle was all-powerful in the county, where the Pelham family had been settled from the time of Edward I; the earl of Chichester being the present representative of the family. Among the oldest county families of Sussex may be mentioned the Ashburnhams of Ashburnham, the Gages of Firle and the Bartelots of Stopham.

The industries of Sussex, now mainly agricultural, were once varied. Among those noted in the Domesday Survey were the herring fisheries, the salt pans of the coast and the wool trade; the South Down sheep being noted for their wool, at home and in the Levant as early as the 13th century. The iron mines of the county, though not mentioned in Domesday, are known to have been worked by the Romans; and the smelting and forging of iron was the great industry of the Weald from the 13th to the 18th century, the first mention of the trade in the county being in 1266. In the 15th century ordnance for the government was made here. Some old banded guns with the name of a Sussex maker on them may be seen at the Tower of London. The first cast-iron cannon made in England came from Buxted in Sussex, and were made by one Ralph Hogge, whose device can be seen on a house in Buxted. The large supply of wood in the county made it a favourable centre for the industry, all smelting being done with charcoal till the middle of the 18th century. In the time of Henry VIII. the destruction of the forest for fuel began to arouse attention, and enactments for the preservation of timber increased from this time forward, till the use of pit-coal for smelting was perfected, when the industry moved to districts where coal was to be found. Camden, Thomas Fuller, and Drayton in his Polycion refer to the busy and noisy Weald district, and lament the destruction of the trees. The glass-making industry, which had flourished at Chiddingfold in Surrey, and at Wesborough Green, Loxwood and Petworth in Sussex, was destroyed by the prohibition of the use of wood fuel in 1615. The timber trade had been one of the most considerable in early times; the Sussex oak being considered the finest shipbuilding timber. Among the smaller industries weaving and fulling were also to be found, Chichester having been noted for its cloth, also for malt and needles.

Antiquities.—From early times castles guarded three important entries from the coast through the South Downs into the interior provided by the valleys of the Ouse, the Adur and the Arun. These are respectively at Lewes, Bramber and Arundel. These are now in ruins and have little fighting, do not compare in grandeur with the third, which is still the residence of the Dukes of Norfolk. More famous than these are the massive remains, in part Norman but mainly of the 13th century, of the stronghold of Pevensey, within the walls of Roman Anderida. Other ruins are those of the finely situated Hastings Castle; the Norman remains at Knep near West Grinstead; the picturesque and remarkably perfect moated fortress of Bodiam, of the 14th century; and Hurstmonceaux Castle, a beautiful 15th-century building of brick. Specimens of ancient domestic architecture are fairly numerous; such are the remnants of old
palaces of the archbishops of Canterbury at Mayfield and West Tarring; Amberley Castle, a residence until the 16th century of the bishops of Chichester; and the Elizabethan mansions of Parham and of Danny at Hursstpierpoint. There are many fine residences dating from the 18th century or later; Goodwood is perhaps the most famous. Here and elsewhere are fine collections of paintings, though the county suffered a loss in this respect through the partial destruction by fire of the modern castle of Knapp in 1904.

Monastic remains are few and generally slight. The ruins of Battle Abbey near Tunbridge Wells, and of Battle Abbey, may be noticed. There are numerous churches, however, of great interest and beauty. Of those in the towns may be mentioned the cathedral of Chichester, the churches of Shoreham and Rye, and the mother church of Worthing at Broadwater. Construction of pre-Norman date is seen in the churches of Bosham, Sombiting and, most notably, Worth. There is very rich Norman work of various dates in the church of St Nicholas, Steyning. Several perfect specimens of small Early English churches are found, as at West Tarring, and at Climping near Littlehampton. Perhaps the most interesting church in the county is the magnificent Decorated fragment at Winchelsea; another noteworthy church of this period is at Etchingham, near the eastern border. The church of St Denis, Midhurst, is mainly Perpendicular; but this style is not otherwise predominant. The large church at Fletching, of various styles, contains the tomb of Gibbon the historian. At Cowfold, south-east of Horsham, is a great Carthusian monastery, founded in 1277. The iron memorial slabs occurring in several churches recall the period of the iron industry in Sussex.

**SUSSEX, KINGDOM OF SUTHERLAND, EARLS OF**

Sutheird's return to Sussex was the beginning of a new chapter in Sussex history. The king's exactions in relieving a famine which occurred in Sussex the king granted to him eighty-seven hides in and near the peninsula of Selsey which, with a lapse until 709 after Wilfrid's retirement, remained the seat of the South Saxon bishopric until the Norman Conquest. Shortly afterwards, however, Ethelwald was slain and his kingdom ravaged by the exiled West Saxon prince Ceddwalla. The latter was eventually expelled by two princes named Berthun and Andhun, who thereupon assumed the government of the kingdom. In 868 the South Saxons attacked Hlothhere, king of Kent, in support of his nephew Eadric, but soon afterwards Berthun was killed, and the kingdom subjugated for a time by Ceddwalla, who had now become king of Wessex.

Of the later South Saxon kings we have little knowledge except from occasional charters. In 692 a grant is made by a king called Nothelm to his sister, which is witnessed by two other kings called Nunna and "Uattuss." Nunna is probably to be identified with Nun, described in the Chronicle as the kinman of Ine of Wessex who fought with him against Gereht, king of the West Welsh, in 710. According to Bede, Sussex was subject to Ine for a number of years. A grant, dated by Birch about 725, is made by Nunna to Eadforth, bishop of Selsey, and to this too "Uattuss" appears as a witness. In 722 we find Ine of Wessex at war with the South Saxons, apparently because they were supporting a certain Aldbyrht, probably an exile from Wessex. An undated grant is made by Nunna about this time, which is witnessed by a King Ethelberht. After this we hear nothing more until shortly before 755, when a grant of land is made by a king named Aelfwald with two other kings, Aelwald and Osric, as witnesses. In 765 and 770 grants are made by a King Osmund, the latter of which is witnessed by Offa of Mercia. Offa also appears as witness to two charters of an Ethelberht, king of the South Saxons, and in 732 he grants land himself in Sussex, with Oswald, duw of the South Saxons, as a witness. It is probable that about this time Offa definitely annexed the kingdom of Sussex, as several persons, Osmund, Ethelwald and Osric, who had previously used the royal title, now sign with that of duw. In 825 the South Saxons submitted to Egbert, and from this time they remained subject to the West Saxon dynasty. The earldom of Sussex seems later to have been held sometimes with that of Kent.

**AUTHORITIES.**—See T. W. Hobsford, History, Antiquities and Topography of Sussex (Lewes, 1838); J. Dallaway, History of the Western District (London, 1838); J. M. Moore, Lower History of Sussex (Lewes, 1870), Churches of Sussex (Brighton, 1872) and Worthies of Sussex (Lewes, 1869); Sussex Archaeological Society's Collections; W. E. Baxter, Domedog Book for . . . Sussex (Lewes, 1875); E. D. Hughes, Life of William Berkeley (London, 1888); Sussex Dialect (Brighton, 1884) and Sussex Songs and Music (Brighton, 1885); A. J. C. Hare, Sussex (London, 1894).

**SUSSEX, KINGDOM OF (546-Soce, i.e. the South Saxons),** one of the kingdoms of Anglo-Saxon Britain, the boundaries of which coincided in general with those of the modern county of Sussex. A large part of that district, however, was covered in early times by the so-called Saxon Shore. According to the traditional account given in the Anglo-Saxon Chronicle, it was in 477 that a certain Ella (Ella) led the invaders ashore at a place called Cymenes or and defeated the inhabitants. A further battle at a place called Mearcreses burne is recorded under the year 485, and in the annal for 491 we read that Ella and Cissa his son sacked Anderida and slew all the inhabitants. Ella is the first king of the invading race whom Bede describes as exercising supremacy over his fellows, and we may probably regard him as an historical person, though little weight can be attached to the tradition by which he is represented.

The history of Sussex now becomes a blank until 607, in which year Ceolwulf of Wessex is found fighting against the South Saxons. In 618 Wilfrid of York, on his expulsion from Northumbria by Egfrith, retired into Sussex, where he remained until 686 converting its pagan inhabitants. According to Bede, Ethelwald, king of Sussex, had been previously baptized in Mercia at the suggestion of Wulfhere, who presented him with the Isle of Wight and the district about the Meon. After Wilfrid's exertions in relieving a famine which occurred in Sussex
of 1715. This Earl, who took the name of Sutherland instead of that of Gordon, was succeeded by his grandson William (1708-1750), a very humane, who helped to suppress the rebellion of 1745. William, the next earl, died without male issue in 1766. This Earl’s daughter Elizabeth (1705-1839) claimed the peerage, and although her title thereto was contested by Sir Robert Gordon, Bart., a descendant of the first Gordon earl, it was confirmed by the House of Lords in 1771.

Established in the possession of the title and the vast estates of the earldom, the countess of Sutherland was married in 1785 to George Granville Leveson-Gower (1758-1833), who succeeded her father as second marquess of Stafford in 1803. In addition to the vast estates of the earldom, and the Bridgewater Canal and estates from his maternal uncle, Francis Egerton, 2nd Duke of Bridgewater, and these properties, together with his wife’s estates, which included almost the whole of the county of Sutherland, made him a "leviathan of wealth," as he is called by Charles Greville.

In 1833 he created duke of Sutherland. Leveson-Gower was a member of parliament from 1778 to 1784 and again from 1787 to 1798 and was British ambassador in Paris from 1790 to 1792. From 1790 to 1810 he was joint postmaster-general. He inherited the estates of the Duke of Sutherland and the London residence of the dukes of Sutherland. As a landlord he greatly improved his estates in Staffordshire and Shropshire and then turned his attention to those of his wife in Sutherlandshire. He was responsible for the construction of about 450 m. of road and of many bridges, but his policy of removing a large number of his tenants from the interior to the coast aroused bitterness and criticism. However, he reduced rents and brought thousands of acres into cultivation. He died at Dunrobin Castle on the 5th of July 1833.

His eldest son, George Granville (1786-1861), became the 2nd Duke. The 2nd Duke’s wife, Harriet Elizabeth Georgiana (1806-1868), a daughter of George, 6th Earl ofCarlisle, was one of Queen Victoria’s most intimate friends. She was mistress of the robes to the queen, whose refusal to part with her in 1839 led to a ministerial crisis. Some of her letters are published in Stafford House Letters, edited by her son Lord Ronald Gower (1801).

George Granville William, the 3rd Duke (1828-1892), spent large sums in improving his estates. His wife Anne (1830-1883), daughter of John Hay, Maclean, was created countess of Crichton in 1881, and the earldom descended to her younger son, Lord Francis Leveson-Gower, who became earl of Ellesmere in 1846. The 2nd Duke’s wife, Harriet Elizabeth Georgiana (1806-1868), a daughter of George, 6th Earl of Carlisle, was one of Queen Victoria’s most intimate friends. She was mistress of the robes to the queen, whose refusal to part with her in 1839 led to a ministerial crisis. Some of her letters are published in Stafford House Letters, edited by her son Lord Ronald Gower (1801).

In 1892 Crichton Leveson-Gower (b. 1851), who had been M.P. for Sutherlandshire, became 4th Duke of Sutherland. His wife, Millicent Fanny, daughter of the 4th Earl of Rosslyn, became well known in literary as well as in social and philanthropic circles.

See Sir Robert Gordon and George Gordon, Genealogical History of the Earldom of Sutherland (Edinburgh, 1813); and also the article Stafford, Earls and Marquesses of.

SUTHERLANDSHIRE, a northern county of Scotland, bounded N. and W. by the Atlantic, E. by Caithness, S.E. by the North Sea and S. by the shire of Ross and Cromarty. It has an area of 1,207, 846 acres or 2,028 sq. m., being the fifth largest shire in Scotland. The western and northern shores are much indented and terminate at many points in precipices and rugged headlands. The mountains are distinguished by grandeur of outline. Ben More (3,573 ft.) in Assynt is the highest in the shire, and next to it in height is Ben Clitherick (3,954 ft.). Ben Hope (Icelandic Hög, haven, 3,040 ft.) in the north, is noted as the only place in Great Britain where the Alpine Alpine Rubella is found, and also for its fauna, ptarmigan being common, and even the wild cat and golden eagle occurring at rare intervals. Other lofty hills include Findochan (wart mountain, 2980 ft.) in the north-west; Ben Hee (3864 ft.), the highest point in Reay Forest; the serrated ridge of Quinag (2653) and Glaive (2541) north, and the cone of Canisp (2779) south of Loch Assynt; the precipitous Carn Stackie (2630) in Durness; Ben Arkle (2580) and Ben Stack (2564), frowning above Loch Stack; the fantastic peaks of Ben Loyal (the hill of the young calves, or deer, 2504 ft.) in Tongue; and Suilven (2390). The greater part of the mountainous region consists of wild and desolate moorlands. The chief river is the Oykell, which, rising in Coniveall (3273 ft.), a peak of Ben More, flows south and then south-east for 33 m. to Dornoch Firth, forming the major part of the southern boundary of the shire. Its principal left-hand tributaries, the Kyle of Tongue and the Oykell, also join from the south. Dornoch Firth are the Helmsdale (22 m.), issuing from Loch an Ruathair; the Brora (28 m.), rising in Mt Uaran and preserving in its name (bridge river) the fact that its bridge was the only important one in the county; and the Fleet (17), the head of the estuary of which was embanked for 1000 yds. in 1813 by Thomas Telford, whereby a considerable tract of rich alluvial land was reclaimed from the sea. The longest rivers flowing to the north coast are the Dionard (1.4) to Kyle of Durness, the Naver (27) to Torridon Bay, and the Halladale (22), rising in Assynt. The beds of these drain the basins of the sea to the east of Portskerry. Much of the surface in the vicinity of Assynt is honeycombed with lakes and tarns, but the only large lake is Loch Assynt, which is 1/2 m. long, lies 215 ft. above the sea, has a drainage area of 43 sq. m., and a greatest depth of 282 ft., and empties into the sea by the Inver. Other lakes are Loch Croach, little more than 1 m. long by 1/ m. wide, in which the ratio of the area of islands to the total area of the loch is greater than in any other British lake; Loch Shin (17 m. long); Loch Loyal (4 m.); Loch Hope (6 m.); Loch Naver (6 m.); and Loch More (4 m.). The principal inlets of the sea are, on the north coast, Kyle of Tongue, on the east shore of which stands Tongue House, once the property of the Roy family, now a seat of the Duke of Sutherland—Loch Eriboll and Kyle of Durness; on the west, Lochs Inchard, Laxford (salmon fjord), Caithness, Glendhu, Glencoul, Eddarachlis Bay and Loch Inver; and, on the south-east, Loch Fleet. There are many waterfalls in the county. Those of Escullan, near the head of Glencoul, are among the finest in Great Britain. There are three principal capes—Strathy Point on the north; Cape Wrath at the extreme north-west; and Ry Stor, near which is the Old Man of Stoer, a detached pillar of rock about 250 ft. high. On its seaward face Cape Wrath, (a corruption of the Icelandic krav, turning-point) rises in precipices to a height of 300 ft. The gneiss rocks are scored with pink granite. Sunken reefs keep the sea almost always in tumult. Of the larger islands Handa, usually visited from Scourie on the west coast, has magnificent cliff scenery, distinguished for its beautiful coloration, its caverns and the richness and variety of the bird life, especially on the north-west, where the Torridonian sandstone rocks are 406 ft. high. The cave of Smoo (Icelandic smaga, hole: same root as smuggle) on the north coast, 1 m. east of Durness, is the most famous cavern in the north coast, Kyle of Tongue: on the west coast of which stands Tongue House; the entrance hall, 33 ft. high and 20 ft. wide, opens from the inner chamber, 70 ft. long by 30 ft. wide, by a ledge of rock beneath which pours a stream that descends as a cataract from a hole in the roof, 80 ft. above. Behind the waterfall is the third chamber, 120 ft. long by 8 ft. wide, which can only be seen by artificial light.

Geology.—A very irregular line from Loch Eriboll on the north coast to the neighbourhood of Cromalt near the southern boundary separates the two rock groups that form the foundation of the major portion of the county. On the western side of this line are the ancient gneisses and schists (the Lewisian gneiss); these are penetrated by innumerable basic and acid dikes which generally have a north-west to south-east trend. On the eastern side of the line, occupying the whole of the remaining area except the eastern fringe of the county, is a younger series of metamorphic rocks, the Moine schists. Resting with marked unconformability upon the old gneisses near Cape Wrath, at R.Stor, Quinag, Canisp and Suidven are the dark red conglomerates, breccias and sandstones of Torridonian.
The Sutlej, serpulite good when 1891 In in under reclamation. Assynt a of evicted fortieth on of along Firth, robin striking schists by it rock, "(3) of the agricultural rest, of west Scotland great and of the north-east extent, of the Mesozoic scale; of the Cambrian Lewisian rocks, of the Torridonian limestone and of the Lewisian quartzite. These masses of granite appear in the eastern shorthorn area. Between the River Firth, the Sutlej rises E.S.E. of the Manaswar lakes in Tibet, at an elevation of about 15,200 ft., threads its way through the gorges of the Himalayas with heights of 20,000 ft. on either side, crosses Bashahr and the Simla hill states, and enters the British district of Hoshiarpur. Thence it flows through the plains of the Punjab, receives the Beas in Kapurthala state, and joins the Chenab near Madawala. From that point the whole river bears the name of Panjnad (“five rivers”) until it falls into the Indus near Mithankot after a course of 900 m. In the time of Ranjit Singh the Sutlej formed the boundary line between the Sikh and British dominions, and the Sikh states south of the river still bear the title of Go-Sutlej.

The Sutlej supplies two systems of irrigation works: the Sirhind canal, which draws off the whole of the cold season supply of the Sutlej at Rupar, 100 m above its junction with the
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Beas; and the inundation canals of the Upper and Lower Sutlej, Ferozepur and Bahawalpur, which come below the junction. 

SUTLER, a camp-follower who sells provisions, liquor and other things to an army in the field, in camp or in quarters. The word was one of the numerous naval and military terms adapted in English from the Dutch, where it appears as soeteelaar or soetebaar. It meant originally one who does dirty work, a drudge, a scullion, and is derived from soelen, detoil, fully, a camp-follower, common "suds," hot soapy water, "seethe," to boil, and "sadden."

SUTRI (anc. Sutrum), a town and episcopal see of Italy, in the province of Rome, 4 m. W.N.W. of the railway station of Capranica, which is 36 m. from Rome; 955 ft. above sea-level. Pop. (1901), 2701. The town is picturesquely situated on a narrow hill, surrounded by ravines, a narrow neck on the west alone connecting it with the surrounding country. There are some remains of the ancient city walls of rectangular blocks of tufa on the southern side of the town, and some rock-cut sermons in the cliffs below them. The cathedral is modern, but the crypt, with twenty columns, is old, and the campanile dates from the 13th century. In the cliffs opposite the town on the south is the rock-cut church of the Madonna del Parto, developed, no doubt, out of an Etruscan tomb, of which there are many here; and close by is a rock-hewn amphitheatre of the Roman period, with axes of 55 and 44 yds., now most picturesque.

The position of Sutri was important, commanding as it did the road into Etruria, the latter Via Cassia; and it is spoken of by Livy as one of the keys of Etruria, Nepet being the other. It came into the hands of Rome after the fall of Veii, and a Latin colony was established there; but it was abandoned in 356, but was recovered and recolonized in 383 (?). It was besieged by the Etruscans in 311-10 B.C., but not taken. With Nepet and ten other Latin colonies it refused further help in the Hannibalic War in 209 B.C. Its importance as a fortress explains, according to Festus, the proverb Sutrium ere, of one who goes on important business, as it occurs in Plautus. It is mentioned in the war of 41 B.C., and received a colony of veterans under the triumvir (Colonia coniuncta Italia Sutrina). Inscriptions show that it was a place of some importance under the empire, and it is mentioned as occupied by the Lombards.

See G. Dennis, Cities and Cemeteries of Etruria, i. 62 (London, 1883).

SUTTEE (an English corruption of Sanskrit sati, "good woman" or true "wife"), the rite of widow-sacrifice, i.e. the burning the living widow on the funeral pyre of her husband, as practised among certain Hindu castes. As early as the Atharva Veda the rite is mentioned as an "old custom," but European scholars have shown that the text of the still earlier Rig Veda had been corrupted, probably willfully, by the Hindu priesthood, and that there was no injunction that the rite should be observed. The directions of the Rig Veda seem to have involved a merely symbolic suttee: the widow taking her place on the funeral pile, but being recalled to "this world of life" at the last moment by her brother-in-law or adopted child. The practice was sporadically observed in India when the Macedonians reached India late in the 4th century B.C. (Diod. Sic. xix. 33-34); but the earlier Indian law books do not enjoit it, and Manu simply commands the widow to lead a life of chastity and asceticism. About the 6th century A.D. a recrudescence of the rite took place, and with the help of corrupted Vedic texts it soon grew to have a full religious sanction. But even so it was not general throughout India. It was rare in the Punjab; and in Malbar, the most primitive part of southern India, it was forbidden. In its medieval form it was essentially a Brahminic rite, and it was where Brahminism was strongest, in Bengal and along the Ganges valley and in Oudh and Rajputana, that it was most usual.

The manner of the sacrifice differed according to the district. In south India the widow jumped or was forced into the fire-pit; in western India she was placed in a grass hut, supporting the corpse's head with her right hand while her left held the torch; in the Ganges valley she lay down upon the already lighted pile, while in Nepal she was placed beside the corpse, and when the pile was lighted the two bodies were held in place by long poles pressed down by relatives. The earliest attempt to stop suttee was made by Akbar (1542-1605), who forbade compulsion, voluntary suttees alone being permitted. Towards the end of the 18th century the British authorities, on the initiative of Sir C. Malet and Jonathan Duncan in Bombay, took up the question, but nothing definite was ventured on till 1839 when Lord William Bentinck, despite fierce opposition, carried in council on the 4th of December a regulation which declared that all who abetted suttee were "guilty of culpable homicide." Though thus illegal, widow-burning continued into modern days in isolated parts of India. In 1905 those who assisted at a suttee in Behar were sentenced to penal servitude.

Widow sacrifice is not peculiar to India, and E. B. Tylor in his Primitive Culture (ch. 11) has collected evidence to support a theory that the rite existed among all primitive Aryan nations. He thinks that in enjoining it the medieval priesthood of India were making no innovation, but were simply reviving an Aryan custom of a barbaric period long antedating the Vedas. See also Jakob Grimm, Verbrechen der Leichen.

SUTTNER, BERTHA, BARONESS VON (1843— ), Austrian writer, was born at Prague on the 9th of July 1843, the daughter of Count Franz Kinsky, Austrian field marshal, who died shortly after her birth. On her mother's side she was descended from the family of the German poet, Theodor Körner. After receiving a careful education she travelled abroad and resided for a long period in Paris and in Italy. In 1876 she married the novelist, Freiherr Arthur Gundaccar von Suttner (1850-1902), and for the next nine years lived with him at Tiflis in the Caucasus. After 1885 she resided at Schloss Harmsdorf, near Eggenburg, in Lower Austria. The Baroness von Suttner, a fertile writer, has produced numerous tales, books on social science and romances, among which the best known are Inven- torium einer Seele (1882), Die Waffen nieder (1884), Honna (1894), La Traviata (1898), Schad der Qual (1899), Martha's Große Hochzeit (1900), Die Heimgesinnten (1901), Die Herbortin (1904), a collection of essays, and a one time secretary to Alfred Nobel, and as a champion of the "brotherhood of nations," had much influence on him and others; and in this connexion has published Krieg und Frieden (1896), Das Maschinen-Zeitalter, Zukunft-Vorlesungen über unsere Zeit (1899) and Die Haager Friedenskonferenzen (1900). In 1905 she was awarded a Nobel prize of £5000 for her endeavours in the cause of peace.

Her Memoiren, full of interesting autobiographical matter, were published at Stuttgart in 1908.

SUTTON, SIR RICHARD (d. c. 1524), the founder, with William Smyth, bishop of Lincoln, of Brasenose College, Oxford, and the first lay founder of any college, is said to have come of a good north-country family, the Suttons of that ilk, near Macclesfield, Cheshire. Little is known of his life, but he was a barrister, and in 1407 a member of the privy council. In 1513 he became steward of the monastery of Sion, a house of Brigitine nuns at Isleworth. How Smyth and Sutton came to plan a college is not known, but in 1508 we find Edmund Croston, or Crofon, bequeathing £6, 13s. 4d. towards the building of "a college of Brasynnose" if the projects of "the bishop of Lincoln and master Sutton" were carried into effect within a stipulated period. In the same year Sutton obtained a ninety-two year lease of Brasenose Hall and Little University Hall for £3 per annum, and from that time until the end of his life he was occupied in purchasing estates with which he might endow the new college. He is thought to have contributed to the funds of Corpus Christi College, Oxford, as well. He was knighted some years before his death, which occurred about 1524.

SUTTON, THOMAS (c. 1532-1611), founder of Charterhouse school and hospital, was the son of an official of the city of Lincoln, and was educated at Eton College and probably at Cambridge. He then spent some time travelling in Europe and appears to have acted as secretary to two or three English noblemen. He became a soldier, and in 1590 was with the troops engaged in suppressing the rising in the north of England; in 1570 he was
made master and surveyor of the ordnance in the northern parts of the realm and in this capacity he took part in the siege of Edinburgh Castle by the English in May 1573. Sutton obtained great wealth by the ownership of coal mines in Durham and also by his marriage in 1582 with Elizabeth (d. 1602), widow of John Dudley of Stoke Newington. His wish to devote some of his money to charitable purposes led him in 1611 to purchase for £13,000 the Charterhouse (q.v.) from Thomas Howard, earl of Suffolk. On this spot Sutton erected the hospital and school which he had originally intended to build at Hallingbury, Essex. Sutton died at Hackney on the 13th of December 1621 and was buried in the chapel in the Charterhouse. His wealth was left for charitable uses, but in 1613 James I. ordered his executors to make an allowance to his natural son, Roger Sutton.

**SUTTON**, an urban district in the Epsom parliamentary division of Surrey, England, 11 m. S. of London by the London Brighton & South Coast railway. Pop. (1891), 13,977; (1901), 17,223. It is pleasantly situated at the edge of the Downs, and is in favour as an outer residential district of London. The manor, according to Domesday, belonged to the abbey of Chertsey at the Conquest and continued so until the dissolution of the monasteries by Henry VIII.

**SUTTON COLDFIELD**, a municipal borough in the Tamworth parliamentary division of Warwickshire, England, 7 m. N.E. from Birmingham on branches of the London & North-Western and Midland railways. Pop. (1901), 14,264. The town, which lies high in a hilly situation, is the centre of a residential district for persons having their business offices in Birmingham, Walsall, and other towns. The church of the Holy Trinity, Early English arches, was restored in 1879, contains a fine Norman font and the tomb of Bishop Vesey. On the picturesque park near the town, 2400 acres in extent, the inhabitants have the right of grazing horses and cattle at a small fee. This, with the Crystal Palace gardens, forms a recreation ground for the people of Birmingham. In the vicinity are New Hall, an interesting mansion of the 13th century, with a hall of the 16th, used as a boys' school; and Peddimore Hall, a moated mansion of the ancient family of Arden, of which there are slight remains. The town is governed by a mayor, 6 aldermen, and 18 councillors. (Area, 12,828 acres.)

The church of St Mary Magdalene of the 12th and 14th centuries was restored in 1868. There are collieries and lineworks in the vicinity. Cotton hosiery and thread are the principal manufactures.

**SUVÁROV**, ALEXANDER VASILEVICH, COUNT (1720-1800), Russian field marshal, was born at Moscow on the 24th of November 1729, the descendant of a Swede named Suvar who emigrated to Russia in 1622. He entered the army as a boy, served against the Swedes in Finland and against the Prussians during the Seven Years' War. After repeatedly distinguishing himself in battle he was made a colonel in 1762. He next served in Poland, dispersed the Polish forces under Pulaski, stormed Cracow (1768) and was made a major-general. In his first campaigns against the Turks in 1773-74, and particularly in the battle of Kösudzki in the latter year, he laid the foundations of his reputation. In 1775 he suppressed the rebellion of Pugachev, who was decapitated at Moscow. From 1777-1785 he served in the Crimea and the Caucasus, becoming lieutenant-general in 1780, and major-general in 1783, on the conclusion of his work there. From 1787 to 1791 he was again fighting the Turks and won many victories; he was wounded at Kinburn (1787), took part in the siege of Ochakov, and in 1788 won two great victories at Focsani and on the Rinnik. For the latter victory, in which an Austrian corps under Prince Josias of Saxe-Coburg participated, Catherine II. made him a count with the name Rimmenski in addition to his own name, and the emperor Joseph II. created him a count of the Holy Roman Empire. On the 2nd of December 1799 Suvarov was made field marshal in Berlin, and the same year he was allowed some of the expenditure which that followed the capture equals in horror such events as the "Spanish Fury" and the fall of Magdeburg. He was next placed at the head of the army which subdued the Poles, and repeated the triumph, and some of the cruelties, of Ismail at Warsaw. He was now made a field marshal, and was retained in Poland till 1795, when he returned to St Petersburg. But his sovereign and friend Catherine died in 1796, and her successor Paul dismissed the veteran in disgrace. Suvárov then lived for some years in retirement on his estate of Konchausky, near Moscow. He criticized the new military tactics and dress of the French, and, in his old age and the same year in which he reached the ears of Paul. His conduct was therefore watched and his correspondence with his wife, who had remained at Moscow—for his marriage relations had not been happy—was tampered with. On Sundays he tolled the bell for church and sang among the rustics in the village choir. On week days he worked among them in a smock frock. But in February 1799 he was summoned by the tsar to take the field again, this time against the French Revolutionary armies in Italy.

The campaign (see FRENCH REVOLUTIONARY WARS) opened with a series of victories (Cassano, Troyes, Novi) which induced the French government to desperate straits and drove every French soldier from Italy, save for the handful under Moreau, which maintained a foothold in the Maritime Alps and around Genoa. Suvárov himself was made a prince. But the later events of the eventful year went uniformly against the allies. Suvárov's lieutenant Korsakov was defeated by Masséna at Zürich, and the old field marshal, seeking to make his way over the Swiss passes to the Upper Rhine, had to retreat to the Vorarlberg, where his army, much shattered and almost destitute of horses and artillery, went into winter quarters. Early in 1800 Suvárov returned to St Petersburg in disguise. Paul refused to give him an audience, and, worn out and ill, he died a few days afterwards on the 18th of May 1800 at St Petersburg. Lord Whitworth, the English ambassador, was the only person of distinction present at the funeral. Suvárov lies buried in the church of the Annunciation in the Alexandro-Nevskii monastery, the simple inscription on his grave being, according to his own direction, "Here lies Suvárov." But within a year of his death the tsar Alexander I. erected a statue to his memory in the Field of Mars, St Petersburg.

His son Arkadi (1785-1811) was a general officer in the
Russian army during the Napoleonic and Turkish wars of the early 19th century, and was drowned in the river Rimnik in 1811. His grandson Alexander Arkadievich (1804–1882) was also a Russian general.

Among the Russians the memory of Suvorov is cherished to this day. A great captain, viewed from the standpoint of any age of military need for leadership, and, especially for the capital of the Russian nation, for the character of his leadership responded to the character of the Russian soldier. In an age when war had, become an act of diplomacy he restored its true significance as a war of conquest. He redefined the role of the general as not only on the achievement of the objective in hand, and he spared his own soldiers as little as he showed mercy to the population of a fallen city. He was a man of great simplicity of nature, modest, and he could not be a private army, sleeping on straw and contending himself with the humblest fare. But he had himself passed through all the gradations of military service; moreover, his education had been of the rudest kind. His gifts were considerable; he was known as a man of ability and action for ignorant favourites and ceremonial carpet-knights. But his drolleries served, sometimes to hide, more often to express, a soldierly genius, the effect of which the Russian army has not outgrown. If the tactics of the Russians in the war of 1905-06 reflected too literally some of the maxims of Suvorov's Turkish war, the spirit of self-sacrifice, resolution and indifference to losses there shown was a precious legacy from those wars. Dragomirov (g.v.) avowed that his teaching was based on Suvorov's practice, which he held to be representative of the truths of war and of the military qualities of the Russian nation.

Suvorov's activities are described in Kriegsgeschichte der Grafen Suvorow (Gotha, 1796-1799); F. von Smitt, Suvorows Leben und Heerzüge (Vilna, 1833-1834) and Suvorov und Polens Untergang (Leipzig, 1858); Von Reckling-Bibelberg, Der Zag Suvorow, ein Ehrengast der Könige (Zlatarevo, 1851); H. van de Sande (London, 1890); G. von Fuchs, Suvorows Korrespondenz, 1799 (Glogau, 1835); Suvorou en Italie, by Gachot, Masséna's biographer (Paris, 1903); and the standard Russian biographies of Polevoi (1853; German, Mitau, 1853; Rybkin (Moscow, 1874) and A. Asliev (Vilna, 1899).

SUWALKI, a government of Russian Poland, of which it occupies the N.E. corner, extending to the N. between East Prussia and the Russian governments of Vilna and Grodno, with the government of Kovno on the N. Its area is 4846 sq. m. It includes the east of the low Baltic swelling (800 to 1000 ft. above the sea) and is studded with lakes. Its northern slopes descend to the valley of the Niemen, while in the south it falls away gently to the marly tract of the Bogatyr river. Rivers flow there in deep-cut gorges and hollows, diversifying the surface. The Niemen forms its eastern and northern boundary and has many affluents from both slopes of the swelling. The Augustow canal connects the navigable Hancza, a tributary of the Niemen, with a tributary of the Biebrza, which belongs to the basin of the Vistula, and an active traffic is carried on by this canal. Forests cover about one-fourth of the area. Tertiary and cretaceous strata occupy large areas, and the entire surface is covered with Post-Tertiary deposits. The bottom moraine of the great ice-sheet of North Germany, containing scratched boulders and furrowed by depressions having a direction N.E. and S.S.W., extended over immense tracts of the ridge of the lake-districts and its slopes, while limited spaces are covered with well-washed glacial sands and gravel. On the northern slopes of the coast-ridge, the boulder-clay being covered with lacustrine deposits, there are in many places areas of fertile soil; and in the southern parts of the province the boulder-clay is stony, and sometimes covered with gravel. Still, nearly nine-tenths of the surface are suitable for cultivation.

The population in 1906 was estimated at 633,900. The majority (82·7%) are Lithuanians, mostly in the north; there are 21·5% Poles (and Mazury chiefly in the town); 6·5% Jews; 2·5% Russians and 4·2% others. The chief towns of the seven districts into which the government is divided are Suwałki, Augustowo, Kalwaria, Mariampol, Seiny, Wilkowiski (or Volkovyski) and Wladislavow. The principal crops are rye, wheat, oats, barley and potatoes, which are largely exported to Prussia for use in the distilleries. Bee-keeping is widely spread, and about 40,000 lb of honey are obtained every year. The weaving of linen, woolen cloth and fishing-nets is extensively carried on in the villages as a domestic industry, and in small factories. A large number of the inhabitants are compelled to seek work in winter in other parts of the empire. The felling of timber, which is floated down the Niemen, gives occupation to many.

SUWALKI, a town of Russian Poland, capital of the government of the same name, situated at the source of the Hancza, a tributary of the Niemen, 65 m. by rail N.W. of Grodno. Pop. 27,165. In the 15th century it was a small village amid forests, possessed of some rights granted by the lord in timber, grain, flax, linen, wool, and to a certain extent, to the king's taille of 3% in money. It was granted a town charter in 1450 and has a market in 1465. It fell into decay after the abolition of the taille in 1795. Its manufactures are flax, linen, worsted, wollen cloth and other manufactured goods.

SUYUTI [Abu-l Fadl Abd ur-Rahman ibn Abi Bakr Jalal ud-Din us-Suyuti (1445-1505), Arabic encyclopaedic writer, was the son of a Turkish slave woman. His father, who was of Persian descent, had been cadi in Suuyut (Upper Egypt) and professor in Cairo, but died before his son was six years old. The boy's training was taken in hand by a Sufi friend of the father. He was precocious and is said to have known the Koran by heart before he was eight years old. In 1462 he was already a teacher; in 1464 he made the pilgrimage to Mecca; in 1472 he became a professor, and in 1486 was promoted to a chair in the mosque of Bihars. Here, however, he provoked a revolt among the students and in 1501 was discharged for maladministration of trust funds. Two years later he was offered the same post again, but declined, and worked in seclusion at Raua, an island of the Nile, and there died in 1505. He was one of the most prolific writers of the East, though many of his works are only pamphlets and some are mere abridgments of the work of others.

We know of 563 separate titles of his works, and over 316 exist in the libraries of Turkey. He was given a permit to publish the Nebi Nasir, in the career of the Koran, published with an analysis by A. Spranger (Calcutta, 1852-1854) and often in Cairo; the commentary on the Koran, known as the Tasfir al-Jaldain, begun by Jalal ud-Din al-Maqrizi (1389-1465) and finished by Suyut, published in the East; and the history of the caliphs, published at Calcutta (1858) and elsewhere.

Suzerainty. "Suzerain," a term of feudal law, is now used to describe persons or states in positions of superiority to others. Its etymology, according to Professor W. W. Skeat (Eymological Dictionary), is as follows: "A coined word; made from French suz., Latin suusum suum suus, signifying 'his'; in the same way as sovereign is made from Latin super; it corresponds to a Low Latin type suzeranus." Another form of the word is suzerain (F. Godfroy, De l'Ancienne langue francaise). Suzerain has been defined as "Qui possede un fief dont d'autres feifs relevent" (Liittré and Dictionnaire de l'académie francaise). C. Loyseau, in his Traité des seigneuries (3rd ed., 1610, p. 14), explains that there are two kinds of public seigneuries, that is, sovereign seigneurs, possessing sumsum imperium, and suzerains, "Les suzeraines sont celles qui ont puissance supérieure mais non suprême." Elsewhere he says that suzerainy is a form of public seigneuries which has been " usurpée par les particuliers pour laquelle exprimer il nous a fallu forger un mot exprès, et l'appeller suzeraineté, mot qui est aussi étrange comme celle espèce de seigneuries est absurde " (p. 11). Loyseau adds, "Seigneurie suzeraine est dignité d'un fief ayant justice " (p. 35). Bouquet (Nouveau dictionnaire de droit) defines suzerain as " supérieur, celui dont un fief relevait;" Rogulau (Glossaire du droit francais), " supérieur en quelque charge ou dignité autre que le roi. " The name does not occur in the Consuetudines feudorum, or in Hotoman's De verbis feudalibus commentarius. It was rare in feudal times in England. But it was used in France to describe a feudal lord, the supreme suzerain being the king. Merlin, under suzeraineté, shows that the word was not used by all feudal writers in the same sense. (See also Chas. Butler's note to Coke on Litt. 101 a.)

In modern times the term has come to be used as descriptive of relations, ill-defined and vague, which exist between powerful and dependent states; its very indefiniteness being its recommendation. According to feudal law the vassal owed certain duties to the lord; he promised fidelity and service; and the lord was bound to perform reciprocal duties, not very
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clearly defined, to the vassal—Dominus vassallo confregit et amicitiam dicuit. The relation between a lord and his vassals, implied in the oath of fealty, has been extended to states of unequal power: it has been found convenient to designate certain states as vassal states, and their superiors as suzerains. Originally and properly applicable to a status recognized by feudalism, the term vassal state has been used to describe the subordinate position of certain states once parts of the Ottoman Empire, and still loosely connected therewith. Such are Egypt and Bulgaria. Rumania, Servia and Montenegro, once vassal states, may now be regarded as independent. The relations of these states to the Ottoman Porte are very varied. Egypt has been variously described as a vassal state or as a protectorate. But all of these pay tribute to the sultan, or in some way acknowledge his supremacy (Emanuel Ullmann, Völkerecht, § 16): M. de Martens (Traité de droit international, 1883, i. 333 n.) thus defines the term: "La suzeraineté est la souveraineté limitée exercée par le pouvoir suprême d'un état sur un gouvernement mi-souverain," a definition applicable to protectorates, with which it is often confounded. Thus Mommsen (History of Rome) indiscriminately describes the supremacy of Rome over Armenia as "suzerainity" or "protectorate." To emphasize the vague use of the word in modern diplomacy may be quite misleading; it was concluded by Lord Kimberley, which Mr Chamberlain in the correspondence as to South Africa mentioned with approval: "Superiority over a state possessing independent rights of government subject to reservations with reference to certain specified matters" (1899 [C. 9027], p. 28).

M. Gaillard (Le Protectorat international) distinguishes suzerainty from protectorate in these respects: (a) suzerainty proceeds from a concession on the part of the suzerain (p. 112); (b) the vassal state is bound to perform specific services; and (c) the vassal state has larger powers of action than those belonging to a protected state; (d) there is reciprocity of obligation. According to M. F. Despagnet the term suzerain is applicable to a case in which a state concedes a fief, in virtue of its sovereignty (Éssai sur le protectorat international, p. 46), reserving to itself certain rights as the author of this concession.

Another writer draws these distinctions: (a) a state connected by protectorship with another previously enjoyed autonomy; the vassal state did not; (b) the protected state retains its nationality and its internal administration; the vassal state acquires a distinct nationality; (c) the establishment of a protectorate modifies few of the institutions of the protectorate state except as to foreign relations; the establishment of a suzerainty changes the institutions of the vassal state; (d) the protected state exercises its internal sovereignty & peu près pleinement; the vassal state remains subordinate in several respects; (e) while the protected state has the right to be assisted in case of war by the protecting state, but is not bound to defend the latter, the vassal state is bound to aid its suzerain (Thomacoff, De la Souveraineté du protectorat. See also Hachenburger, De la Nature juridique du protectorat.

W. E. Hall thus defines vassal states: "States under the suzerainty of others are portions of the latter which during a process of gradual disruption or by the grace of the sovereign have acquired certain of the powers of an independent community, such as that of making commercial conventions, or of conferring their exequatur on foreign consuls. Their position differs from that of the foregoing varieties of states (protectorates, &c.), in that a presumption exists against the possession by them of any given international capacity (International Law, 4th ed., p. 31).

Another suggested distinction is this: Suzerainty is title without corresponding power: protectorate is power without corresponding title (Professor Freund, Political Science Quarterly. 1899, p. 28).

On the whole, usage seems to favor this distinction: while a protectorate flows from or, is a reduction of, the sovereignty of the protected state, suzerainty is conceived as derived from, and a reduction of, the sovereignty of the dominant state.

As to the power of making treaties, a vassal state cannot, as a rule, conclude them; such power does not exist unless it is specially given. On the other hand, a protected state, unless the contrary is stipulated, retains the power of concluding treaties (Bry, p. 204).

It is sometimes said that a protected state, unlike a vassal state, has the right of sending representatives to foreign states. But such distinctions are of doubtful value: the facts of each case must be considered (Ullmann, § 26).

There is one practical difference between the two relations: while the protecting and protected states tend to draw nearer, the reverse is true of the suzerain and vassal states; a protectorate is generally the preliminary to incorporation, suzerainty to independence. Sometimes the suzerain and vassal states are formed as protectorates. But the vassal state forms part of the territory of the suzerain; a proposition which is true for some purposes, but not for all.

All definitions of suzerainty are of little use. Each instrument in which the word is used must be studied in order to ascertain its significance. Even in feudal times suzerainty might be merely nominal, an instance in point being the suzerainty or over-lordship of the papacy over Naples. In some cases it may be said that suzerainty brings no practical advantages and implies no serious obligations. Among the instances in which the term has been applied it has been used as a synonym for protectorate (March 1896, Treaty, Peace of Paris, 1856 (arts. 21 and 22), recognizing the suzerainty of Turkey over the Danubian principalities Moldavia and Wallachia, modifying the "sovereignty" of Turkey recognized by the Treaty of Adrianople. "Les principautés de Valachie et de Moldavie continueront à jouir, sous la suzeraineté de la Porte et sous la garantie des Puissances contractantes, des privilèges et des immunités dont elles sont en possession." The convention of the 19th of August 1858 (Hertael x. 1592) organized the then principalities "under the suzerainty of the sultan" (art. 1). The internal government was to be exercised by a hospodar, who received his investiture from the sultan, the sign of vassalship, it has been said (Thomacoff, p. 45). The autonomy of these vassal states has been fully recognized by the Treaty of Berlin of 1878 (art. 1). In the Interpretation Act, 1889, s. 18 (5), "suzerainty" is used to describe the authority of the sovereign over native princes.

The word suzerain is used in the Pretoria convention of the 3rd of August 1881 between the British government and the late South African Republic. The convention (by its preamble) granted to the inhabitants complete self-government, "subject to the suzerainty of her Majesty," and this suzerainty was formally referred to in the articles. Even when the convention was being negotiated doubts arose as to its meaning, and legal authorities were divided as to its effect (see speech of Lord Cairns, Hansard, 260, p. 261; Lord Selborne, 260, p. 390; answer of attorney-general 260, 1534). It was doubtful whether territory could be ceded by the Crown of its own authority; and if the power existed the cession could, it was said, be made only by virtue of clear words. From the articles substituted in the London convention of the 27th of February 1884 for those of 1881, the word "suzerainty" was omitted. Fresh doubts arose as to the effect of this omission; and a correspondence on the subject took place between the British government and the government of the republic before the outbreak of hostilities in South Africa, the former maintaining that the preamble of 1881, by which alone any self-government was granted, was still in force, and therefore that the suzerainty—whatever it involved—remained; the Transvaal government, on the other hand, contending that the suzerainty had been abolished by the substitution of the 1884 convention for the 1881. Writers on international law differ greatly as to the exact position of the South African republic under the later convention. Some considered it an independent sovereign state (Mr Taylor (A Treatise of International Public Law, p. 174) treats the Transvaal after the convention of 1884 as a "neutralized state only part sovereign." Other writers describe the relation as that of a protectorate (see Professor J. Westlake, Revue de droit international, 1896, p. 268 seq.; International Law, pt. 1, p. 27). Professor de Louther defines it as "une servitude du droit des gens (servitus juris gentium), et qui diffère de la servitude du
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droit privé en ce qu'elle ne constitue pas un droit réel (jus in re aliena) mais un droit entre deux personnes de droit international (subjecta juris gentium)" (Revue de droit international, 1899, p. 330). Dr F. Von Lützow (Das Völkerrecht, p. 331) treats the South African republic as an example of a half sovereign state. M. Gairal describes it as a vassal state. Probably the soundest opinion is that the British Crown reserved no other rights than those expressly stated in the treaty. Furthermore, it is probable that the clergy did much to increase the welfare and independence of the Danish Church in difficult times, while his representations to the king that Danish theology was not likely to be promoted by placing Germans over the heads of native professors bore good fruit. Svane died on the 26th of July 1668, in his 62nd year.

See Dotlev Gotthard Zwergius, Sjælendes klæreris (Copenhagen, 1754).

SVANETIA, a mountainous district on the south slopes of the Caucasus, immediately underneath the loftiest glaciated peaks of the middle of the system. It extends over the upper valleys of the Rioni, Ingur and Tkhenis-iskhali, and is included in the modern government of Kutais. The Svanetians belong to the Georgian race. (See Caucasus and Caucasia.)

SVENDBORG, a seaport of Denmark, capital of the omil (county) of its name, on the south shore of the island of Fünen. Pop. (1901), 11,543. The situation is pleasant. The narrow Svendborg Sund separates Fünen from the lesser islands of Taasinge and Turø, of which the former rises to 245 ft. Land from the town there is also elevated ground, the Ovnhøj. The harbour is accessible to vessels drawing 20 ft. There are tobacco and earthenware manufactories, host-building yards, and distilleries. Butter is the principal export, and petroleum, coal and iron the imports. Neighbouring to the town are the mined coal of Orkil, the watering-place Christiansminde, and the extensive orchards of Gammel Hesthove, where wine is produced.

SVENDSEN, JOHANN SEVERIN (1840— ), Norwegian composer, was born in Christiania on the 30th of September 1840. He learnt the elements of music and violin-playing from his father, and after serving for some time in the army, and later touring as violinist with a troupe of instrumentalists, he entered the conservatorium at Leipzig through the aid of the king of Sweden. After another tour, which extended to the British Isles, Svendsen spent a year in Paris, and in 1871-1872 was leader of the once famous Euterpe concerts in Leipzig. In 1871 he married an American, and from 1872 to 1877 he conducted the Christiania Musical Society, while in 1877-1879 he lived in Rome, London and Paris. In 1883 Svendsen became court kapellmeister at Copenhagen. Probably we have to go back to Schubert to find a composer whose Opus 1 has attained the wide popularity of Svendsen's A minor string quartet, while his beautiful octet, Opus 3, added to his fame. Though Svendsen was at one time intimate with Wagner, the latter does not seem to have influenced his music, which includes two symphonies, a violin concerto, and a romance for violin, as well as a number of Norwegian rhapsodies for the orchestra.

SVERDRUP, JOHAN (1816—1892), Norwegian statesman, was born at Jarlsberg on the 30th of July 1816. His father, Jakob Sverdrup, was a land steward, and the founder of the first school of agriculture in Norway. Johan entered the Storting in 1830, sitting first for Lærvik, and then for the district of Akershus, and was its president from 1871 to 1884; during the whole of the dispute over the prerogative of the Crown. He built up a strong political party, which, relying for support chiefly on the Norwegian peasantry, was determined to secure strict constitutional government and practically to destroy the power of the king. Under his leadership the opposition, in 1872, secured the passing of a bill for the admission of the ministers to the Storting, which bill was passed by a large majority. The independence of the cabinet on a majority in that assembly. King Charles XV. refused his sanction to this bill, and on its third passing in 1880 Oscar II. opposed his veto, at the same time claiming his right to the absolute veto. Sverdrup then proposed the proclamation of the law in defiance of the king's action. The
retirement of Frederik Stang removed Sverdrup's chief political opponent from the field. He was aided in his campaign by Bjoernstjerne Bjornson and, after a series of political crises he became prime minister in June 1884. But when he became prime minister he soon found himself at issue with Bjornson on church matters. Inspired chiefly by his nephew Johan he secured the refusal of a pension to the novelist Kielland because of his anti-clerical views, and he further wished to give the parish councils the right to strike off the voting list persons who had broken away from church discipline. Therefore, although during his term of office no fewer than eighty-nine measures, many of them involving useful reforms, became law, he failed to satisfy the expectations of moderate Liberals, and it was only by appeal to the moderate Liberals. He was compelled to retire in 1880, and died on the 17th of February 1892 at Christiania.

SWABIA, Suevia or Suevia (Ger, Schwaben), one of the stem-duchies of medieval Germany, taking its name from the Suevi, a tribe which inhabited the district in the first century of the Christian era. Dwelling in the angle formed by the Rhine and the Danube, they were joined by other tribes, and were called Almannia, whilst the district was called Almannia, until about the 11th century, when the form Swabia began to prevail, and at length Suevia to the Rhine, and Almannia to the Danube, the former, turned under Frankish rule, and governed by dukes who were dependent on the Frankish kings. In the 7th century the people were converted to Christianity, bishoprics were founded at Augsburg and Constance, and in the 8th century abbys at Reichenau and St Gall. The Almanni had gradually thrown off the Frankish yoke, but in 730 Charles Martel again reduced them to dependence, and his son Pippin the Short abolished the tribal dukedom and ruled the duchy by two counts palatine, or Kammerbolten. The duchy, which was divided into gau or counties, took about this time the extent which it retained throughout the middle ages, and was bounded by the Rhine, the lake of Constance, the Lech and Franconia. The Lech, separating Almannia from Bavaria, did not form, either ethnologically or geographically, a very strong boundary, and there was a good deal of inter-communion between the two races. During the later and weaker years of the Carolingian rule the counts became almost independent, and a struggle for supremacy took place between them and the bishops of Constance. The chief family in Almannia was that of the counts of Raetia, who were sometimes called the Almanni, and one of whom, William, was called duke of the Almanni. Burkhard was killed in 811, and two counts palatine, Bertold and Erchanger, were accused of treason, and put to death by order of the German king Conrad I. In 917, Burkhard, count in Raetia, took the title of duke, and was recognized as such by King Henry I., the Fowler, in 919. His position was virtually independent, and when he died in 926 he was succeeded by Hermann, a Franconian noble, who married his widow. When Hermann died in 948 Otto the Great gave the duchy to his own son Ludolf, who had married Hermann's daughter Ada; but he reduced the ducal privileges and appointed counts palatine to watch the royal interests. Ludolf revolted, and was deposed, and other dukes followed in quick succession. Burkhard II., son of Burkhard I., ruled from 934 to 973, Ludolf's son, Otto, afterwards duke of Bavaria, to 982, and Conrad I., a relative of Duke Hermann I., until 997. Hermann II., possibly a son of Conrad, succeeded, and, dying in 1003, was followed by his son Hermann III. During these years the Swabians were loyal to the kings of the Saxon house, probably owing to the influence of the bishops. Hermann III. had no children, and the succession passed to Ernest, son of his sister Elisabeth and Ernest I., margrave of Austria. Ernest held the duchy for his son until his own death in 1015, when Gisela undertook the government, and was married a second time, to Conrad, duke of Franconia, who was afterwards the German king Conrad II. When Ernest came of age he quarrelled with his step-father, who deposed him, and, in 1030, gave the duchy to Gisela's second son, Hermann IV. and, on his death in 1058, to Henry, his own son by Gisela. In 1045 Henry, who had become German king as Henry III., granted Almannia to Otto, grandson of the emperor Otto II. and count palatine of the Rhine, and, in 1048, to Otto, count of Schwentfurt. Rudolph, count of Rheinfelden, was the next duke, and in 1077 he was chosen German king in opposition to the emperor Henry IV., but found little support in Swabia, which was given by Henry to his faithful adherent, Frederick I., count of Hohenstaufen. Frederick had to fight for his position with Bertold, son of Duke Rudolph, and the duke's son-in-law, Bertold II., duke of Zähringen, to whom he ceded the Breisgau in 1056. Frederick II. succeeded his father in 1102, and was followed by Frederick III., afterwards the emperor Frederick I. The emperors were rulers of the duchies of Franconia, Hesse, and Swabia, where they received steady support, although ecclesiastical influences were very strong. In 1152 Frederick I. gave the duchy to his kinsman, Frederick, count of Rothenburg and duke of Franconia, after whose death in 1167 it was held successively by three sons of the emperor, the youngest of whom, Philip, was chosen German king in 1198. During his struggle for the throne Philip purchased support by large cessions of Swabian lands, and the duchy remained in the royal hands during the reign of Otto IV., and came to Frederick II. in 1214. Frederick II. made it his own in 1235, to his son Conrad, whose son Conradin, setting out in 1266 to take possession of Sicily, pledged his Swabian inheritance to Ulrich II. count of Württemberg. The duchy was ripe for dissolution and, after Conradin's death, in 1268, the chief authority in Swabia fell to the counts of Württemberg, the margraves of Baden, the counts palatine of Tübingen, the counts of Hohenzollern and others.

When the emperor Maximilian I. divided Germany into circles in 1512, one, which was practically coterminous with the duchy, was called the Swabian circle. The area, which was formerly Swabia, is now covered by the kingdoms of Württemberg and Bavaria, the grand-duchy of Hesse and the western part of the kingdom of Bavaria. Although the name Swabia is occasionally used in a general way to denote the district formerly occupied by the duchy, the exact use of the name is now confined to a Bavarian province, with its capital at Augsburg.

See J. Leichtlen, Schwaben unter den Römer (Freiburg, 1825); J. C. v. Plater, Pragmatische Geschichte von Schwaben (Heilbronn, 1823, continuation to 1496, 1827).

SWABIAN LEAGUE. An association of the great cities, principally in the territory which had formed the old duchy of Swabia. The name, though usually given to the German federation of 1488, is applicable also to several earlier leagues (e.g. those of 1331, 1370). The Swabian cities had attained great prosperity under the protection of the Hohenstaufen emperors, but the extinction of that house in 1268 was followed by disintegration. Cities and nobles alike, now owing allegiance to none but the emperor, who was seldom able to defend them, were exposed to the aggression of ambitious princes.

In 1331, twenty-two Swabian cities, including Ulm, Augsburg, Reutlingen and Heilbronn, formed a league at the instance of the emperor Louis the Hutten to return for their support promised not to mortgage any of them to a vassal. The count of Württemberg was induced to join in 1340. Under Charles IV. the lesser Swabian nobles began to combine against the cities, and formed the Schlegelerbund (from Schlegel, a maul). Civil war ensuing in 1367, the emperor, jealous of the growing power of the cities, endeavoured to set up a league under his own control, for the maintenance of public peace (Landfriedenbund, 1370). The defeat of the city league by Eberhard II. of Württemberg in 1372, the murder of the captain of the league, and the breach of his obligations by Charles IV., led to the formation of a new league of fourteen Swabian cities led by Ulm in 1376. This league triumphed over the count of Württemberg at Reutlingen in 1377, and the emperor having removed his ban, it assumed a permanent character, set up an arbitration court, and was rapidly extended over the Rhineland, Bavaria and Franconia. In 1382 an alliance was made at Eihingen with the archduke of Austria, and through his mediation with the
three chief knightly associations of Swabia. The new king, Wenceslaus, hoped at first, like his father Charles, to check the federal movement by associating all estates of the realm under his own lead in Landfriedensbeischaffungen, but such a compact made at Heidelberg in 1384, although renewed at Mergentheim three years later, was a mere makeshift. The struggle between burghers and nobles was precipitated by the inclusion of the urban members of the Swiss confederation in the league in 1385 and the overthrow of Archduke Leopold of Austria by the latter at Sedlmeyr in the following year. A quarrel between the latter of Bavaria and the archbishop of Salzburg gave the signal for a general war in Swabia, in which the cities, weakened by their isolation, mutual jealousies and internal conflicts, were defeated by Count Eberhard II. at Dössingen (Aug. 24, 1388), and were severally taken and devastated. Most of them quietly acquiesced when Wenceslaus proclaimed a Landfriede at Eger in 1389 and prohibited all leagues between cities. The professed aims of the cities which had formed this league of 1376 were the maintenance of their imperial status (Reichtumsmittelbarkeit), security against sale or mortgage and against excessive taxation, the protection of property, trade and traffic, and the power to suppress disturbances of the peace. There is no trace of cooperation with the Hanseatic towns. The league necessarily opposed the pretensions of the emperors and the electoral princes, especially as set forth in the Golden Bull, and in accordance with the growing spirit of civil freedom demanded a share in the government, but that there was any widespread conscious desire for a fundamental change in the constitution, for the abolition of aristocratic privilege or for a republic, as certain historians maintain, is improbable.

For nearly a century there was no great effort at federation among the Swabian cities, attention being diverted to the ecclesiastical controversies of the time, but there were partial and short-lived associations, e.g. the league of twelve Swabian cities in defence of their liberties in 1392, the Marbach league in 1405 against the German king, Rupert, and in 1441 the union of twenty-two cities (in 1446 thirty-one) headed by Ulm and Nuremberg, for the suppression of highway robbery. This latter union in 1446 formed a standing army and waged war on a confederation of princes led by Albert Achilles, afterwards elector of Brandenburg (q.v.).

The growing anarchy in Swabia, where the cities were violently agitated by the constant infringement of their liberties (e.g. the annexation of Regensburg by Bavaria in 1489), induced Frederick III., who required men and money for the Hungarian War, to conciliate the cities by proposing a scheme of pacification and reform. His commissioner, Count Hugo of Werdenberg, met the Swabian estates at Esslingen and laid before them a plan probably drawn up by Bertold, elector of Mainz, and on the 14th of February 1458 the Great Swabian League was constituted. There were four constituent parties, the archduke Sigismund of Austria, Count Eberhard V. (afterwards duke) of Württemberg, who became the first captain of the league, the knightly league of St. George, and lastly twenty-two Swabian imperial cities. The league received a formal constitution with a federal council consisting of three colleges of nine counsellors each, a captain and a federal court with judicial and executive powers. The armed force which was to police Swabia consisted of 12,000 foot and 1200 horse, each party contributing one-fourth. The league gained strength by the speedy accession of Augsburg and other Swabian cities, the margraves of Brandenburg and Baden, the four Rhinen electors, i.e., and in 1490 of Maximilian, king of the Romans, whom the league had helped to rescue from the hands of the Netherlands in 1488. It did not render him the support he expected in his foreign policy, but it performed its primary work of restoring and maintaining order with energy and efficiency. In 1492 it compelled Duke Albert of Bavaria to renounce Regensburg; in 1519 it expelled the turbulent duke, Ulrich of Württemberg, who had seized Reutlingen, and it sold his duchy to Charles V.; and in 1523 it defeated the Franchonian knights who had taken up arms with Franz von Sickingen. In 1525, Truchsess, the league captain, aided by the forces of Trier and the palatinate, overthrew the rebel peasants of Königshofen on the Tauber and at Ingolstadt.

The league, which had been several times renewed, expired on the 2nd of February 1534, its dissolution being due to internal dissensions regarding the reformation. Futile attempts were made to renew it, in 1535 by the Bavarian chancellor, Eck, and in 1547 by Charles V.

See E. Osann, Zur Geschichte des schwäbischen Bundes (Giessen, 1861); K. Klüpfel, "Der schwäbische Bund" (in Hitl. Taschenbuch, 1883-1884), Urkunden zur Geschichte des schwäbischen Bundes (Stuttgart, 1846-1853). (A. B. Go.)

SWADLINCOTE, a town in the southern parliamentary division of Derbyshire, England, 15 m. S.S.W. of Derby, and 4 m. S.E. of Burton-upon-Trent, on the Midland railway. Pop. (1901), urban district of Swadlincote district, 18,014. This includes the civil parishes of Swadlincote, Church Gresley and Stanton and Newhall, which together form a large industrial township, mainly devoted to the manufacture of earthenware and fireclay goods. There are collieries in the neighbourhood.

SWAFFHAM, a market town in the south-western parliamentary division of Norfolk, England; 111 m. N.N.E. from London by the Great Eastern railway. Pop. of urban district (1901), 3371. The town lies high, in an open, healthy district. The church of St Peter and St Paul is Perpendicular, a handsome cruciform structure with central tower, and has a fine carved roof of wood. The town, which has a town-hall and assembly rooms, possesses iron foundries and a considerable agricultural trade, with cattle fairs. At Castle Acre, 4 m. N., are the picturesque ruins of a Cluniac priory, founded shortly after the Conquest by William de Warren. These comprise portions of the church, including the fine west front, arcaded, with three Norman doors and a Perpendicular window, with the chapter-house, cloisters and conventual buildings. The majority of the remains are Norman or Perpendicular. The castle of the same founder has left little but its foundations, but it was erected within the protection of a remarkable series of earthworks, which remain in good condition. These are apparently in part Roman, in part earlier. The site, on which Roman coins, pottery and other remains have been discovered, was on an ancient trackway running north and south. It may be noted that de Warren founded a similar castle and priory at Lewes in Sussex. The church of St James, Castle Acre, contains good Early English and Perpendicular work.

SWAHILI (Wa-Swahili, i.e. coast people, from the Arabic zaahir, coast), a term commonly applied to the inhabitants of Zanzibar and of the opposite mainland between the parallels of 2° and 9° S., who speak the KI-Swahili language. The Swahili are essentially a mixed people, the result of long crossing between the negroes of the coast and the Arabs, with an admixture of slave blood from nearly all the East African tribes. Among Swahili are found every shade of colour and every type of physique from the full-blooded negro to the pure Semite. Usually they are a powerfully built, handsome people, inclined to stoutness and with Semitic features. They number about a million. They figured largely in the history of African enterprise during the 19th century. The energy and intelligence derived from their Semitic blood have enabled them to take a leading part in the development of trade and the industries, as shown in the wide diffusion of their language, which, like the Hindustani in India and the South American in South America, has become the principal medium of intercourse between a large area of Africa south of the equator. During his journey from the Indian Ocean to the Atlantic (1873-1874) Commander V. Lovett Cameron found that a knowledge of this language enabled him everywhere to dispense with the aid of an interpreter, as it was understood by one or more persons in all the tribes along the route. Owing to this circumstance the Swahili have been found invaluable assistants in every expedition from the eastern seaboard to the interior after they began to be
employed by J. H. Speke and Richard Burton as porters and escorts in 1857. The language is somewhat archaic Bantu, much mixed with Arabic, while Indian, Persian and even English, Portuguese and German words have contributed to the vocabulary. Many of these words have since been published, and into it portions of the Bible have been translated by Bishop Steere.1 The Swahili are Mahomedans, but in disposition are genuine negroes. Christian missions among them have met with little success.


SWALLOW (A. S. swælwe, Icel. swalda, Du. swaluw, Ger. Schwebe), the bird which of all others is recognized as the harbinger of summer in the northern hemisphere. The name Hirundo rustica of Linnaeus is now employed for the common chimney-swallow of Europe, which has been divided into many races and subspecies. In summer it ranges all over Europe, and in Asia extends to Manchuria and China; in winter it migrates south, reaching India, Burma, the Malay Peninsula and the whole of Africa. The common swallow of North America, usually called the barn-swallow, is H. erythrogaster, but in summer it also reaches Alaska and Greenland and extends across to Lake Balikal. The winter migration extends to Burma for the Asiatic swallows and to South Brazil for those of America.

In all some twenty-seven species of Hirundo are recognized, the range of the genus being practically worldwide. It is usually considered, to its summer haunts, after its winter sojourn in southern lands, and generally reaching England about the first week in April, the English swallow at once repairs to its old quarters, nearly always around the abodes of men; and, about a month later, the site of the nest is chosen, resort being had in most cases to the very spot that has formerly served the same purpose—the old structure, if still remaining, being restored and refurnished. So trustful is the bird that it commonly establishes itself in any of men's works that will supply the necessary accommodation, and a shed, a barn, or any building with an open roof, a chimney-dovey or for a support for the nest, or even the room of an inhabited house— if chance should give free access thereto—to say nothing of extraordinary positions, may be the place of its choice. Wheresoever placed, the nest is formed of small lumps of moist earth, which, carried to the spot in the bird's bill, are duly arranged and modelled, with the aid of short straws or slender sticks, into the required shape. This is generally that of a half-saucer, but it varies according to the exigencies of the site. The materials dry quickly into a hard crust, which is lined with soft feathers, and therein are laid from four to six eggs, bluish-black, speckled with grey and orange-brown deepening into black. Two broods are usually reared in the season, and the young on leaving the nest soon make their way to some leafless bough, whence they try their powers of flight, at first accompanying their parents in short excursions on the wing, receiving from them the food which they are as yet unable to capture, until able to shift for themselves. They collect in flocks, often of many hundreds, and finally leave the country about the end of August or early in September, to be followed, after a few weeks, by their progenitors. They moult their feathers in their winter quarters, and this outward change is accompanied by the profoundest arguments against the popular belief (which, curious to say, is still partly if not fully entertained by many who should know better) of their becoming torpid in winter, for a state of torpidity would suspend all animal action.2 The crest at the forehead and throat, the shining steel-blue upper plumage, and the dusky white—in some cases reddening so as almost to vie with the frontal and gular patches—of the lower parts are well known to every observer; and this is the markedly forked tail, which is become proverbial of this bird.

Taking the word swallow in a more extended sense, it is used for all the members of the family Hirundinidae, excepting a few to which the name martin (q.v.) has been applied, and this family includes about seventy species, which have been placed in four genera, and differ in different genera. The true swallow has very many affinities, some of which range almost as widely as itself does, while others seem to have curiously restricted limits, and much the same may be said of several of its more distant relatives. But altogether the family forms one of the most circumscribed and therefore one of the most natural groups of Oscines, having no near allies: for, though in outward appearance and in habits it bears a striking resemblance to swifts (q.v.), the latter belong to a different order, and are not Passerine birds at all, as their structure, both internal and external, proves. It has been sometimes stated that the Hirundinidae have their nearest relations in the flycatchers (q.v.); but it must be quite obvious that the supposition that they are allied to the Amelidiæ (cf. WAXWING), though possibly better founded, has not been confirmed. An affinity to the Indian and Australian Artamus (the species of which genus are often known as wood-swallows or swallow-shrikes) has also been suggested, but has not been accepted.

A. N.]

SWALLOW-HOLE, in physical geography the name applied to a cavity resulting from the solution of rock under the action of water, and forming, or having at some period formed, the entrance to a subterranean stream-channel. Such holes are common in calcareous (limestone or chalky) districts, or along the line of outcrop of a limestone belt among non-calcareous strata. They are known as caves, swallow-holes, subterranean butter-tubs, and by other local names, and sometimes as potato-holes; the last term, however, is also synonymous with Giant's Kettle (q.v.). See CAVE.

SWAMMERDAM, JAN (1637-1680), Dutch naturalist, was born on the 12th of February 1637 at Amsterdam, the son of an apothecary and naturalist. He was destined for the Church; but he preferred the profession of medicine, taking his doctor's degree at Leiden in 1667. Having necessarily to interest himself in human anatomy, he devoted much attention to the preservation and better demonstration of the various structures, and he devised the method of studying the circulatory system by means of injections. He also spent much time in the study of insects, investigating the subject of their metamorphosis, and in this and other ways laying the beginnings of their natural classification, while his researches on the anatomy of mayflies and bees were also of great importance. His devotion to science led to his neglect of practice; his father, resenting this, stopped all supplies and thus Swammerdam experienced a period of considerable privation, which had the most unfortunate consequences to his health, both bodily and mental. In 1675 his father died, leaving him an adequate fortune, but the mischief was irreparable. He became a hypochondriac and mystic, joined the followers of Antoïette Bourignon, and died at Amsterdam on the 15th of February 1680.

His Allgemeine Verhandelung van bloedloose dierijen appeared at Utrecht in 1669, and his Bildia naturae, sive Historia insectorum in certis classes reducita was published after his death by H. Boerhaave in 1724-1728. He is the author of Miraculum naturae, seu Uteri mihi corporis fabrica (Leiden, 1672).

SWAN, JOHN MACALLAN (1847-1910), English painter and sculptor, received his art training first in England at the Worcester and Lambeth schools of art and the Royal Academy schools, and subsequently in Paris, in the studies of J. L. Gérôme and E. Frémiet. He began to exhibit at the Academy in 1878, and was elected associate in 1894 and academician in 1905. He was appointed a member of the Dutch Water-Colour Society in 1885; and associate of the Royal Society of Painters in Water Colours in 1896 and full member in 1899. A master of all, water-colour and pastel mediums, an accomplished

1 An enormous amount of labour has been bestowed upon the Hirundinidae by R. Bowdich's Descriptive List of the Birds of the British Isles, x. 85-210, and in the finely-illustrated Monograph which he and C. W. Wyatt have published (2 vols. 4to, London, 1885-1894).

2 The language was first reduced to writing by the Arabs, who still use the Arabic character. But the European missionaries have reported the progress of the syntax somewhat suited for the transliteration of most African, and especially of the Bantu, tongues.

3 See John Hunter's Essays and Observations in Natural History, edited by Sir R. Owen in 1864 (ii. 280). An excellent bibliography of the torpidity controversy, up to 1878, is given by Professor Coues (Birds of the Colorado Valley, pp. 378-390), who seems still to hang on the ancient faith in "hibernation."
SWAN, SIR J. W.—SWAN

painter and a skilful draughtsman, he ranks also as a sculptor of distinguished ability. He has treated the human figure with notable power, but it is by his representations of the larger wild animals, mainly the felidae, that he chiefly established his reputation; in this branch of practice he has scarcely a rival. His picture "The Prodigal Son," bought for the Chantrey collection in 1859, is in the National Gallery of British Art. He was awarded first class gold medals for painting and sculpture in the Paris Exhibition, 1900. He died on the 14th of February, 1904.


SWAN, SIR JOSEPH WILSON (1828- ), English physicist and electrician, was born at Sunderland on the 31st of October 1828. After serving his apprenticeship with a chemist in his native town, he became first assistant and later partner in a firm of manufacturing chemists in Newcastle. Among its operations this firm included the manufacture of photographic plates, and thus Swan was led to one of the advances in photography as to which his name is chiefly associated, the invention of an extremely rapid dry plate, which were the outcome of an original observation made by him on the effect of heat in increasing the sensitiveness of a gelatino-bromide of silver emulsion. In 1861 he patented the first commercially practicable process for carbon printing in photography. This depended on the fact that when gelatine is exposed to light in the presence of bichromate salts it is rendered insoluble and non-absorbent of water. Swan took a surface of gelatine, dusted over with lampblack and sensitized with bichromate of ammonium, and exposed it to light below a photographic negative; the result was to make the gelatine from the surface downwards insoluble to a depth depending on the intensity, and therefore penetration, of the light which had reached it through the negative. In this operation the surface of the gelatine was also rendered insoluble, and it therefore became necessary to get at its back in order to be able to wash away the portions that still remained soluble; this was effected by cementing the insoluble surface to a fresh sheet of paper by means of indiarubber solution, and then detaching the original support. It thus became possible to reach the soluble portions with water and to obtain a representation of the picture, though reversed as to right and left, in relief on the pigmented gelatin. This process has been simplified and improved by subsequent workers, but in its essential features it forms the basis of some of the methods of photographic reproduction most widely used at the present day. But Swan's name deserves remembrance even more in connexion with the invention of the incandescent electric lamp than with improvements in photographic technique. He was one of the first to undertake the production of an electric lamp in which the light should be produced by the passage of an electric current through a carbon filament, and he was almost certainly far ahead, in point of time, of any other worker in the same field in realizing the conditions to be met and the difficulties to be overcome. So far back as 1860 he constructed an electric lamp with a carbon filament, which was formed by packing pieces of paper or card with charcoal powder in a crucible and subjecting the whole to a high temperature. The carbonized paper thus obtained he mounted in the form of a fine strip in a vacuous glass vessel and connected it with a battery of Grove's cells, which though not strong enough to raise it to complete incandescence, were sufficient to make it red-hot. This was substantially the method adopted by Edison nearly twenty years later, after various fruitless efforts to make a practical lamp with a filament of platinum or a platinum alloy, had convinced him of the unsuitability of that metal for the purpose—a conclusion which Swan had reasoned out for himself many years before. By the time Edison had hit upon the idea of carbonizing paper or bamboo by heat to form the filament Swan had devised the further improvement of using cotton thread "parchmentized" by the action of sulphuric acid, and it was by the aid of such carbon filaments that on the 20th of October 1880 he gave at Newcastle the first public exhibition on a large scale of electric lighting by means of glow lamps. In another method devised by him for the manufacture of filaments, collodion was squirted into a coagulating solution and the tough threads thus obtained carbonized by heat. He also devoted attention to apparatus for measuring electric currents, to the improvement of accumulators and to the conditions governing the electro-deposition of metals. He was elected a fellow of the Royal Society in 1854, and served as president of the Institution of Electrical Engineers in 1896-1897 and of the Chemical Society in 1901. In the last named year he received the honorary degree of D.Sc. from Durham University, and he was knighted in 1904.

SWAN (A. S. swan and swon, Icel. swur, Du. swaan, 'Ger. Schwan'), a large swimming-bird, well known from being kept in a half-domesticated condition throughout many parts of Europe, whence it has been carried to other countries. In England it was far more abundant formerly than at present, the young, or cygnets, being highly esteemed for the table, and it was under especial enactments for its preservation, and regarded as a "bird royal" that no subject could possess without licence from the Crown, the trading of which, however, was accompanied by the condition that every bird in a "game" (to use the old legal term) of swans should bear a distinguishing mark of ownership (cyginitata) on the bill. Originally this privilege was conferred on the larger freeholders only, but it was gradually extended, so that in the reign of Elizabeth upwards of 400 distinct swan-marks, being those of private persons or corporations, were recognized by the royal swanherd, whose jurisdiction extended over the whole kingdom. It is impossible here to enter into further details on this subject, interesting as it is from various points of view. It is enough to remark that all the legal protection afforded to the swan points out that it was not indigenous to the British Islands, and indeed it is stated (though on uncertain authority) to have been introduced to England in the reign of Richard Cœur de Lion; but it it now so perfectly naturalized that birds having the full power of flight remain in the country. There is no evidence to show that its numbers are ever increased by immigration from abroad, though it is known to breed as a wild bird not farther from the British shores than the extreme south of Sweden and possibly in Denmark, whence it may be traced, but with considerable vacuities, in a south-westerly direction from the Danube and the western part of Central Asia. In Europe, however, no definite limits can be assigned for its natural range, since birds more or less reclaimed and at liberty consort with those that are truly wild, and either induce them to settle in localities beyond its boundary, or of themselves occupy such localities, so that no difference is observable between them and their untamed brethren. From its breeding-grounds, whether they be in Turkestan, in south-eastern Europe or Scania, the swan migrates southward towards winter, and at that season may be found in north-western India (though rarely), in Egypt, and on the shores of the Mediterranean.

The swan just spoken of is by some naturalists named the mute or tame swan, to distinguish it from one to be presently mentioned, but it is the swan simply of the English language

1 Here, as in so many other cases, we have what may be called the "name game" of descriptive nomenclature, by which, while it which it bore when alive was of Teutonic origin.
2 The king and the Companies of Dyers and Vintners still maintain their swans on the Thames, and a yearly expedition is made in the month of August to take up the young birds—thence called "swan-upping" and corruptly "swan-hopping"—and mark them. The largest swannery in England, indeed, the only one worthy of the name, is that belonging to Lord Hambleden on the river called the Fleet, lying inside the Chelsh Bank on the coast of Dorset, where from 700 to double that number of birds may be kept—a stock doubtless too great for the area, but very small when compared with that of the Danube swanherds, which are retained for the benefit of the whole country. The swanpit at Norwich seems to be the only place now existing for fattening the cygnets for the table—an expensive process, but one fully appreciated by those who have tasted the results. The English swan, with its distinctive colors and resonant tones, has been, unfortunately, but admirably treated by Serjeant Manning (Penny Cyclopædia, xxiii. 271, 272).
SWANAGE

and literature. Scientifically it is usually known as Cygnus olor. Its large size, its spotless white plumage, its orange-red bill, surmounted by a black knob (technically the "betry") larger in the male than in the female, its black legs and stately bearing, evidence the swan's presence on a grand scale. Indeed, it is a member of the family Anatidae. The young swans, or cygnets, are not readily apparent in the water, but their distinctive presence is evident from their unique appearance, almost every one. When left to itself its nest is a large nest of aquatic plants, often piled to the height of a couple of feet and possibly some six feet in diameter. In the midst of this is a hollow which contains the eggs, generally from five to nine in number, of a greyish-olive colour. The period of incubation is between five and six weeks, and the young when hatched are clothed in sooty-grey down, which is succeeded by feathers of sooty-brown. This suit is gradually replaced by white, but the young birds are more than a twelve-month old before they lose all trace of colouring and become wholly white.

It was, however, noticed by Plot (N.H. Staffordshire, p. 228) more than 200 years ago that certain swans on the Trent had white cygnets; and it was subsequently observed of such birds that both parents and progeny had legs of a paler colour, while the young had not the "blue bill" of ordinary swans at the same age that has in some parts of the country given them a name, besides offering a few other minor differences. These, being examined by W. Yarrell led him to announce (Proc. Zool. Society, 1858, p. 319), as "a new species," them forming a distinct species, C. immutabilis, to which the English name of "Polish" swan had already been attached by the London poulterers, but which is now regarded merely as a variety, not in any way specially associated with Poland but possibly a dimorphic form.

The whooper, whistling or wild swan1 of modern usage, Cygnus cygnus, which was doubtless always a winter-visitor to Britain, though nearly as bulky and quite as purely white in external plumage, is at once recognizable from the species which has been half domesticated by its wholly different but equally graceful carriage, and its bill—which is black at the tip and lemon-yellow for a greater or lesser length of the position. This latter character is a distinguishing mark of most of Iceland, eastern Lapland and northern Russia, whence it wanders southward in autumn, and the musical tones it utters (contrasting with the silence that has caused its relative to be often called the mute swan) have been celebrated from the time of Homer to our own. Otherwise in a general way there is little difference between the habits of the two, and very closely allied to the whooper is a much smaller species, with very well marked characteristics, known as Bewick's Swan, C. bewickii. This was first indicated as a variety of the last by P. S. Pallas, but its specific validity is now fully established. Apart from size, it may be easily distinguished by the whooper by the bill having only a small patch of yellow, which inclines to an orange rather than a lemon tint; while internally the difference of the vocal organs is well marked, and its cry, though melodious enough, is unlike. It is known incidentally that the Bewick’s swan is a much better flier than the whooper, but its winter infrequently occurs in Britain.

Both the species last mentioned have their representatives in North America, and in each case the transatlantic bird is considerably larger than that of the Old World. The first is the trumpeter-swam, C. buccinator, which has the bill wholly black, and the second the C. columbianus—greatly resembling Bewick's Swan, but with the coloured patches on the bill of less extent and deepening almost into scarlet. South America produces two very different birds commonly regarded as swans, Cygnus melancoryphus, the black-necked swan, and that which is called Coscoroba. This latter, though not in the same extent as the first, is the smallest species known—pure white in colour except the tip of its primaries, but having a red bill and red spots on the feet. It is found in the interior of the continent and was first observed by Capt. Cook in 1778, and rediscovered by Mr Gibson in 1820. The tussle between the sexes in the nest is very noisy. The wings are much smaller than those of the Bewick's swan, and its general appearance more like that of a goose.

1 M. Gerbe, in his edition of Degland's Ornithologie Européenne (ii. 477), makes the amusing mistake of attributing this name to the pourleurs (furlers) of London, and of reading it Cygne du pôle (polar, and not Polish, swan).

12 Perhaps original wild-fowlers "elk," which perhaps may be cognate with the Icelandic Alft and the Old German Elbs or Elps (cf. Gesner, Ornithologia, pp. 385, 389), though by modern Germans Elbschwan seems to be used for the preceding species.

13 Or, "a loquacious bird," from the Latin, suggesting the idea of being a noisy animal, which is evident from the account given of its habits.

14 Or, "a loud trumpet-call," and that it swims with the neck curved and the wings raised after the true swan model. P. Forster's Mammalia und Vögel des Ost Indien (Amsterdam, 1726). The incidents of the voyage are related in Deel iii. Hoofde, iv. (which has for its title Description of Banda, pp. 68-71).
of St Mary has a massive tower possibly of pre-Norman date; there is a town-hall, an institute with library and lecture hall, and memorials to a victory gained by King Alfred over the Danes in the bay in 877, and to Albert, Prince Consort. A large export trade is carried on in stone from the Purbeck quarries.

SWANSEA, a municipal, county and parliamentary borough, market town, and seaport of Glamorganshire, South Wales, finely situated in an angle between lofty hills, on the river Tawe or Tawel. Part of its scene on Swansea Bay, and the lofty record of the Bristol Channel, 201 m. W. of London by rail and 453 m. W.N.W. of Cardiff. The Great Western main line has a junction within the borough at Landore, whence a branch runs into a more central part of the town. The Vale of Neath branch of the same railway and the Rhondda & Swansea Bay railway (now worked by the Great Western) have terminal stations near the docks on the other (eastern) side of the river, as also has the Midland railway from Hereford and Brecon. All these lines approach the town from the north and east through an unattractive industrial district, but the central Wales branch of the London & North-Western railway from Craven Arms in entering it on the west passes through some beautiful woodlands and then skirts the bay, having parallel to it for the last 3 m. the light (passenger) railway which runs from Swansea to Mumbles Pier. The older part of the town, being the whole of the municipal borough previous to 1836, occupies the west bank of the Tawe near its mouth and is now wholly given up to business. Stretching inland to the north along the river for some 3 m. through Landore to Morriston, and also eastwards along the sea margin towards Neath, is the industrial quarter, while the "residential part occupies the sea front and the slopes of the Town Hill (580 ft. high) to the west, stretching out to the pleasant suburb of Sketty. The east side of the river (known as St Thomas's and Port Tennant) is approached from the west by a road carried over the North Dock Lock and the river by two girder drawbridges, each of which has a double line of roadway (on which tramways are laid), two footpaths and a line of railway. All the main thoroughfares are spacious, and in two or three instances even imposing, but most of the residential part consists of monotonous stuccoed terraces. The climate is mild and relaxing and the rainfall averages about 40 in.

Public Buildings, &c.—The old castle, first built by Henry de Newburgh about 1099, has entirely disappeared; but of the new castle, which was probably intended only as a fortified house, there remain the great and lesser halls, a tower and a so-called keep with the curtain wall connecting them, its chief architectural feature being a fine embattled parapet with an arcade of pointed arches in a style similar to that of the episcopal palaces of St Davids and Llandeilo built by Henry Gower (d. 1347), bishop of St Davids, to whom the building of the new "castle" is also ascribed. Part of it is now used as the headquarters of the 4th Welsh (Howitzer) Brigade R.F.A. Possibly some traces of St Davids Hospital, built by the same prelate in 1331, are still to be seen at Cross Keys Inn. The parish church of St Mary was entirely rebuilt in 1805-1808. It previously consisted of a tower and chancel (with a fine Decorated window) built by Bishop Gower, the piers of the chancel arch being partly built on earlier Norman work, the Herbert Chapel (originally St Ann's) of about the same date as the chancel and rebuilt in the early part of the 18th century, and a nave built in 1739. Of the earlier work there remains the door of the chancel (built into a wall) 12 ft. by 7 ft., a Pavilion, carved with a representation of the resurrection, in memory of Sir Hugh Johnys (d. c. 1463) and his wife, and three canopied altar tombs—one with the effigy of a priest and another with effigies of Sir Matthew Craddock and his wife. Within the parish of St Mary was St John's, the church of a small parish of the same name lying to the north of St Mary's and once owned by the Knights Hospitallers. This church, which was entirely rebuilt in 1820, was renamed St Matthew in 1880, when a new St John's was built within its own parish. There are 26 other churches and 10 mission rooms belonging to the Church of England, besides 2 Roman Catholic churches, a synagogue and 84 Nonconformist, 31 Welsh and 53 English and 20 mission rooms, but all are modern buildings. There are 9 ecclesiastical parishes and parts of two or three others, all in the diocese of St Davids. The Royal Institution of South Wales, founded in 1835, is housed in a handsome building in the Ionic style erected in 1838-1839 and possesses a museum in which the geology, mineralogy, botany and antiquities of the district are well represented, there being a fine collection of neolithic remains from the Gower Caves and from Merrthyr Mawr. Its library is rich in historical and scientific works relating to Wales and Welsh industries and contains the collection of historical MSS. made by Colonel Grant-Francis, some time its honorary librarian, but one of its most valued possessions is the original contract of affiance between Edward II. (when prince of Wales) and Isabella. Its art gallery has many prints and drawings of great local interest and here the Swansea Art Society holds its annual exhibition. The Swansea Scientific Society also meets here. In its early days the institution was the chief centre of scientific activity in South Wales, those associated with it worked including L. W. Dillwyn, James Motley, Dr Gutch and J. E. Bicheno, all botanists, J. Gwyn Jeffreys, conchologist, Sir W. R. Grove and the 1st Lord Swansea, the last three being natives of the town.

The free library and art gallery of the corporation, a four-storeyed building in Italian style erected in 1887, contains the library of the Rev. Rowland Williams (one of the authors of "Essays and Reviews"), the rich Welsh collection of the Rev. Robert Jones of Rotherithe, a small Devonian section (presented by the Swansea Scientific Society) containing about 2500 prints and engravings, intended to be mutually illustrative, given by the Swansea portrait-painter and art critic, John Deffris Francis, from 1876 to 1881, to receive whose first gift the library was established in 1876. It also contains a complete set of the patent office publications.

The grammar school founded in 1682 by Hugh Gore (1613-1691), bishop of Waterford, is now carried on by the town council under the Welsh Intermediate Education Act of 1889, and there is a similar school for girls. The technical college is also carried on by the town council, the chief features of its building having been designed by Sir Aston Webb. An attracting college for school-mistresses, established by the British and Foreign School Society in 1872, was transferred to the town council in 1908.

The other public buildings of the town include the gildhall and law courts, in the Italian style with Corinthian pillars and pilasters, built in 1847 and internally remodelled in 1901; a prison and workhouse, both remarkably modern and of the same period (1886); the Albert Hall for concerts and public meetings (1864); the Royal Metal Exchange (1897); harbour trust offices (1904); a central post office (1901) and two theatres. The bencovolent institutions include the general hospital, founded in 1817, removed to the present site in 1867, extended by the addition of two wings in 1878 and of an eye department in 1890; a convalescent home for twenty patients from the hospital only (1903); the Royal Cambrian Institution for the Deaf and Dumb, established in 1847 at Aberystwyth, removed to Swansea in 1850, and several times enlarged, so as to have at present accommodation for eighty patients; the Welsh National Institution for the Blind, established in 1865 and now under the Board of Education; the Swansea and South Wales Nursing Institute (1873), providing a home for nurses in the intervals of their employment; a nursing institution (1902) for nursing the sick poor in their own homes, affiliated with the Queen's Jubilee Institute of London; the Sailors' Home (1864); a Sailors' Rest (1885); and a Mission to Seamen's Institute (1904).

On the other side of the Tawe are many acres of parks and open spaces, the chief being Llewyn Park of 42 acres in the north of the town near Morrison, Victoria Park (16 acres) and recreation ground (8 acres) abutting on the harbour, in the south; the privately owned football field between them, Cwmdonkin (13 acres) commanding a fine panoramic view of the bay, and Brynmill (9 acres) with a disused reservoir constructed in 1837 and now converted into an ornamental lake. Some of the most interesting features of Swansea are the Cwmdonkin, a good collection of waterfowl in Brynmill, and a small aviary of the rarer British birds in Victoria Park, which also has a meteorological station in connexion with the meteorological office,
SWANSEA

and a statue of Mr. William Thomas of Lan erected in 1905 in appreciation of the work done by him in preserving and obtaining in 1878 a statutory connexion with the town. Hence there are the statutes of J. Henry Vivian and of his son Henry Hussey Vivian (created Lord Swansea in 1873) each in his turn the 'copper king.' The corporation consists of the lord mayors, the two aldermen, and 26 members elected annually by the corporation of Swansea. The trustees are conservators of the river Tawe and parts of Swansea Bay, and have the charge and management of the town hall, and their powers were incorporated by the Harbour Act of 1854. There are 9 private graving docks.

The total exports (foreign and coastwise) from Swansea during 1929 amounted to 4,832,496 tons, of which coal and coke were 3,655,050 tons; patent fuel, 679,002 tons; tin, terne and black plates, 348,240 tons; iron and steel and their manufactures, 38,438 tons; various chemical and medicinal products, 37,100 tons; copper, zinc and silver, 22,633 tons, including the year amounting to 809,201 tons, of which 172,319 tons of grain and other agricultural produce, 136,620 tons of framed, 145,255 tons of pig-iron and manufactured iron and steel, 47,210 tons of iron ore, 121,168 tons of copper, silver, lead, tin and nickel with their ores and alloys, 63,009 tons of zinc, its ores and alloys, 41,029 tons of sulphur ore, phosphates and other substances, 105,095 tons of slag and cold blast (called "the metallurgical capital of Wales") is the chief seat of the copper, spelter, tin-plate and patent fuel industries, and has within a compass of 4 m. over 50 different works of 36 varieties (exclusive of collieries) for the treatment or manufacture of copper, gold, silver, lead, sulphate of copper, spelter, tinplates, steel and iron, nickel and cobalt, yellow metal, sulphuric acid, hydrochloric acid, crocoite, alkali, galvanised sheets, patent fuel as well as engineering works, iron foundries, large flour and provender mills, fuse works and brick works. Copper smelting, which during most of the 19th century was the chief industry, has not maintained its relative importance, though Swansea is still the chief smelting port of the world.

The town is lighted with gas supplied by a gas company first incorporated in 1830 and by electricity supplied by the corporation. There is a good system of electrically worked tramways, 51 miles being in working order, but the whole worked by the company. The town obtains its chief supply of water from moorlands situated on the Old Red Sandstone formation in the valley of the Cray, a tributary of the Usk, and the water, which is at a higher level than the town, is conveyed by a tunnel of 30,000,000 gallons capacity and has been constructed at a cost of £547,759, under parliamentary powers obtained in 1892, 1902 and 1905. The water is brought to the town in a conduit consisting of 23 m. of iron pipes and 3 m. of tunnel into a service reservoir of 3,000,000 gallons capacity made on the Town Hill at an elevation of 580 ft. above sea-level. There is a further supply obtained from three reservoirs of a combined capacity of 51,000,000, constructed in 1866, 1874 and 1880 respectively in the Llwi and adjoining valleys, in the drainage area of the Loughor, about 10 m. to the north of Swansea.

Harbour and Commerce.—Swansea owes its commercial prosperity to its great natural advantages as a harbour and its situation with regard to the trade of the three counties which it is the natural port of shipment. It is the most westerly port of the Bristol Channel and the nearest to the open sea, only 35 m. from the natural headland, and is sheltered anchorage under the Mumbles Head at all states of the tide.

The modern development of the port dates from about the middle of the 18th century when the town began to be extensively supplied by the Llansamlet and copper smelting (begun at Swansea in 1717, though at Neath it dated from 1834) assumed large proportions. The coal was conveyed to the works and for shipment to a wharf on the east bank, on the banks of mules and small precipices by 1820, and a trawling was especially by a private canal. The common quay was on the west bank; all ships coming in had to lie in the river bed or in a natural tidal basin known as the east basin. In 1794 the Act of Parliament allowed the trustees were appointed who cleared and deepened the river bed and built a long pier on either side of it; in 1796 the approach to the port was made safer by means of an improved light on Mumbles Head. A canal connecting the tidal part of the river Neath with the mouth of the Taw, made in 1789, was in 1824 connected with the Vale of Neath canal by means of aaqueduct across the Neath river, when also a small dock, Port Tennant (so named after the its owner or its previous owners), was opened near the mouth of this canal and this continued to be used till 1880. Meanwhile in 1798 the whole coalfield of the Swansea Valley was connected with the port by a canal 162 m. long through the village of Westland, a new harbour was opened in 1822; then in 1834 the river was diverted eastward into a new channel (called the New Cut) and its old channel was locked and floated, thereby forming the North Dock with an area of 113 acres and a half-tide basin 500 ft. wide. The New Valley was completed in 1837, a connecting lock with this dock, and on the island between the dock and the New Cut are patent fuel works, copper ore yards and other works. The Western Docks, the Mumbles and South Dock, begun in 1847 under powers obtained that year by a private company, transferred in 1857 to the harbour trustees and opened in 1859, is mainly used for shipping coal and for discharging timber and fish. Lying parallel to the seafront and to the west of the entrance channel from which it runs at right angles, it has an area of 13 acres with a half-tide basin of 4 acres and a lock 300 ft. long by 60 ft. wide. The next dock, the east end, lies at the mouth of Fabian's Bay, inside the harbour mouth, was utilized for the construction of the Prince of Wales's Dock (authorized 1874, opened October 1881, extension opened 1883). This dock, which is 22,000 ft. long and 7000 ft. wide, and it is connected with the Tennant canal. The very rapid increase in the demand for anthracite coal (for the shipment of which Swansea has practically a monopoly) soon necessitated still another dock. This was begun in 1875, the dock, which lies farther east and has an entrance direct from the bay. By means of the embankment made in connexion with it, 400 acres were reclaimed from the sea. It has an area of 69 acres, its length 2168 ft. and its width 230 ft., and it has a depth of 32 ft. of water, or inner cell. The total dock area of Swansea has thus been increased to about 147 acres with a half-tide basin 900 ft. wide. By 1928 the adjacent railways (which exceed 20 m.) are owned and administered by a harbour trust of 26 members, of whom one is the owner of the Briton Ferry estate (Earl Jersey), 4 represent the lordship of the seigniory of Gower (the slate of the former family of the counts of Gower), 12 are trustees of local charities and 9 are elected annually by the corporation of Swansea. The trustees

From 1535 to 1832 (with the exception of 1638-1650), Swansea was associated with the other boroughs of Glamorgan in sending one representative to Parliament. In 1658 Cromwell gave the town the right of separately returning a member of its own, but this right lapsed with the Restoration. In 1832 John's, St Thomas and parts of the parishes of Llansamlet and Llangyfelach were added to the parliamentary borough of Swansea, to which along with the boroughs of Neath, Aberavon, Kenfig and Loughor a separate representative was given. In 1836 the municipal borough was made coextensive with the parliamentary borough and continued so till 1868, when some further additions were made to the latter, with which the municipal borough of Neath was also united. Meanwhile in 1885 the parliamentary constituency was made into two divisions with a member each, namely Swansea Town consisting of the original borough with St John's, and Swansea District consisting of the remainder of the borough with the four contributory boroughs. In 1888 Swansea was made a county borough and in 1000 the various parishes constituting it were consolidated into the civil parish of Swansea. Its total area is 5104 acres. The corporation consists of 10 aldermen and 50 councillors. The assizes and quarter sessions for Glamorgan are held at Swansea alternately with Cardiff. The borough has a separate commission for a peace, and, since 1891, a court of quarter sessions.

The population of the old borough was 6090 in 1801 and 13,256 in 1831; after the first extension it amounted to 24,604 in 1841. The population in 1901 was 94,537. Of those who were three years of age and upwards, nearly 67 % were returned as speaking English only, 20% as speaking both English and Welsh, and 3% as speaking Welsh only.

History.—No traces of any Roman settlement have been discovered at Swansea, though there seems to have been a small one at Oystermouth, 5 m. to the south, and the Via Britannica, which led from London to Dinas on the northern part of the present borough, where a large quantity of Roman coins was found in 1835. The name Swansea stands for Swynniy's "ey" or inlet, and may have been derived from King Swynw Forkeard, who certainly visited the Bristol Channel
and may have established a small settlement at the estuary of the Tawè. The earliest known form of the name is Svey-
nesse, which occurs in a charter granted by William earl of
Warwick some time previous to 1184; in King John’s charter
(1215) it appears as Swaynehes, and in the town seal, the
origin of which is supposed to date from about the same period,
it is given as “Sweye.” An attempt has been made to derive
the name from Sein Henydd, the Welsh name of a Gower castle
which has been plausibly identified with the first castle built
at Swansea, but that derivation is etymologically impossible.
The Welsh name, Aber Tawè, first appears in Welsh poems of
the beginning of the 13th century. The town grew up round
the castle which Henry de Beauchamp (or Beaumont) on
his conquest of Gower about 1099, built on the west bank of
the river. The castle passed with the lordship or seigniory of
Gower, of which it was the caput, into the hands of the De
Braose family in 1203 (by grant from King John) and eventually
it came by marriage to the Somersets and is still held by
the dukes of Beaufort, whose title of barons de Gower dates from
1306. The castle was frequently attacked and on several
occasions more or less demolished, in the 12th and 13th cen-
turies. In the last year of the 12th century, the Earl of
Hereford, in the capacity of Dyvorser, it was visited by King
John in 1210 and probably by Edward II. In 1326, for,
after its capture, the encampment rolls were found de-
posited in the castle and were thence removed to Hereford.
It was finally destroyed by Glendower, was a "ruinous build-
ing" when seen by Leland (1536) and has since wholly disap-
ppeared. In the Civil War the town was royalist till the autumn
of 1645 when Colonel Philip Jones, a native of the adjoining
parish of Llanglyfelach and subsequently a member of Crom-
well’s upper house, was made its governor. Cromwell stayed
in the Welsh name, Aber Tawè, for several years in Welsh poems
and Ireland respectively, and later showed it exceptional favour
by giving it a liberal charter and parliamentary representation.
The town claimed to be a borough by prescription, for its
only known charters of incorporation are those of Cromwell
and James II., which were never acted upon. It probably
received its first grant of municipal privileges from William
3rd earl of Warwick some time before 1184. By a charter of
1215 (confirmed by Henry II. in 1234, by Edward II. in 1312
and Edward III. in 1332), John himself granted the burgesses
the right of trading, free of all customs dues, throughout the
wholesomeness of the land, and their lord the Tag of Emo.
This grant was extremely limited to the seigniory. By 1305 the burgesses had be
come so powerful as to want a more liberal grant of privileges from their then seigneur William de Braose (fourth in descent from his namesake to whom Gower was granted by King John in 1203), and he bound himself to pay £500 to the king and 500
marks to any burgess in the event of his infringing any of the rights contained in it. By this charter the burgesses acquired the right of nominating annually two of their number for the office of portreeve so that the lord’s steward might select one of them to exercise the office, an arrangement which continued till 1835; the bailiff’s functions were defined and curtailed, and the lord’s chancery was to be continually kept open for all requiring writs, and in Gower—not wherever the lord might happen to be. A patent of murage and pavage—from which it may probably be inferred that Swansea was a walled town—
was granted by Edward II. in 1317 and another by Edward
III. in 1338. Cromwell’s charter of 1655, though reciting that “time out of mind” Swansea had been “a town corporate,” incorporated it anew, and changed the title of portreeve into
mayor, in whom, with twelve aldermen and twelve capital bur-
gesses, it vested the government of the town. The mayor,
ex-mayor and one selected alderman were to be justices of the
peace with exclusive jurisdiction and the mayor was the coroner.
Four annual fairs were appointed, namely on the 8th of May,
2nd of July, 15th of August and 8th of October—the first, how-
ever, being the only new one. In 1658 the protector by another
charter granted the town independent representation in par-
liament. At the Restoration, Cromwell’s charters lapsed, but
in 1665 James II. granted another charter which contained the
arbitrary proviso that the king by order in council might
remove any officer or members of the corporation. This charter
was not adopted by the burgesses.
De Braose’s charter of 1305 bears some evidence to the im-
portance of the shipping of Swansea even at that date, for
by it there was granted or confirmed to the burgesses the right
to take from the lord’s woods’ sufficient timber to make four
great ships at a time and as many small vessels as they wished.
Coal was even then worked in the district. Cromwell in his
charter of 1655 recognized Swansea as “an ancient port town
and her town and city situate on the sea coast towards France conve-

tient for shipping and resisting foreign invasions.” Its status
was only that of a “creek” in the port of Cardiff till 1685,
when it was made an independent port with jurisdiction over
Newton (now Porthcawl), Neath or Briton Ferry and South
Burry, its limits being defined in 1847 as extending from Nash
Point on the east to Whitford Point on the west, but in 1904
Port Talbot, which was included in this area, was made into
a separate port.
From about 1768 to 1830 Swansea had a somewhat famous
apottery. Beginning with earthenware which twenty years
later was improved into “opaque china,” it produced from
1814 to 1823 superior porcelain which was beautifully decorated
with landscapes, birds, butterflies and flowers and is much prized
by connoisseurs. During a short period (1845-1850) an imita-
tion of Etruscan ware was also produced with figures of rich
red colour over a body of black.
See Lewis W. Dillwyn, Contributions towards a History of Swansea
(1840); Colonel G. Grant-Francis, Charters Granted to Swansea
(1807), and The Smelling of Copper in the Swansea District (2nd ed.
1881); S. C. Gamwell, A Guide to Swansea and District (1886);
Lieu.-Col. W. L. Morgan, R.E., An Antiquarian Survey of East
Gower. (D. LIT. T.)

SWANWICK, ANNA (1833-1890), English writer and philan-
thropist, was the youngest daughter of John Swanwick of
Liverpool, and was born on the 22nd of June 1833. She
was educated partly at home and partly at one of the fashionable
boarding-schools of the day, where she received the usual edu-
cation of accomplishments. Dissatisfied with her own intel-
lectual attainments she went in 1859 to Berlin, where she
took lessons in German, Greek and Hebrew. On her return to
London she continued these pursuits, along with the study
of mathematics. In 1853 appeared her first volume of transla-
tions, Selections from the Dramas of Goethe and Schiller. In 1857 she
published a translation of Schiller’s Jungfrau von Orleans;
this was followed in 1859 by Faust, Tasso, Iphigenie and Egmont.
In 1878 she published a complete translation of both parts of
Faust, which appeared with Retch’s illustrations. It passed
through several editions, was included in Bohn’s series of trans-
lations, and ranked as standard work. It was at the sug-
gestion of Baron Bunsen that she first tried her hand at trans-
lation from the Greek. In 1865 she published a blank verse
translation of Aeschylus’s Trilogy, and in 1873, a complete
edition of Aeschylus, which appeared with Flaxman’s illus-
trations. Miss Swanwick is chiefly known by her translations,
but she also published some original work. In 1886 appeared
Books, our Best Friends and Deadliest foes; in 1888, An Utopian
Dream and How it may be Realized; in 1892, Poets, the Interpre-
ters of their Age; and in 1894, Evolution and the Religion of
the Future. Miss Swanwick was interested in many of the
social and philanthropic movements of her day. In 1861 she
signed John Stuart Mill’s petition to parliament for the political
enfranchisement of women. She helped in the higher education
movement, took part in the foundation of Queen’s and Bed-
ford Colleges, and continued to take a sympathetic interest in
the movement which led to the opening of the universities to
women. Her work was acknowledged by the university of Aberdeen,
which bestowed on her the degree of L.L.D. She died in
November 1899.
See Memoir, by Miss Bruce (1904).

SWARTZ, OLOF (1760-1818), Swedish botanist, was born
in 1760. He commenced his botanical studies in Upsala, under
Linnaeus and Thunberg, and began early to make excursions. He made a voyage to America in 1783, visited England in 1788, returned to Sweden in 1789, and was made professor of natural history in Stockholm. He was the author of many systematic works, and largely extended our knowledge of both flowering plants and cryptogams. He died in 1818.

SWAT, a tract on the Peshawar border of the North-West Frontier province, consisting of the valley of the Swat river above its confluence with the Panjorka. This valley is some 70 m. long, varying from 10 m. to a few hundred yards in breadth; it is intersected by ravines and glens, which bring down the drainage of the ranges on either side. Only a portion of the valley which lies beyond the Peshawar frontier hills, and which is reached by the Malakand, the Shakhtot and other passes from the south, is SWAT. To the east are the independent hill tracts of Kohistan and Buner, all bordering the Indus, and to the west are Dir and Bajour.

The Swat river rises among snow mountains in the Kohistan, not far from the source of the Gilgit river. After flowing due south for nearly 70 m., it turns to the west and is joined by the Panjorka. It then passes through the Mohmand country, and on entering Peshawar district spreads out to the southeast in many channels which ultimately fall into the Kabul river. Total length about 400 m. In British territory its waters have been utilised by a series of canals to irrigate an area of about 160,000 acres; and the system is now being extended by means of a tunnel through the Malakand range, which will tap the river of much higher up.

Swat was better known to the ancients, and to the warriors of Baber's time, than it was to us until the frontier risings of 1895-97 gave British surveyors the opportunity of visiting the country. The ancient name of the river was Suastos, and that of the Panjorka was Ghoura, under which names they figure in the history of Alexander's campaign. The site of the city Massaga, the capital of the Assakeni, is supposed to be near the modern Manglaur. But since the adoption of the Khyber as the main high road from Kabul to Ind and the Swat routes had passed into oblivion. Only the lower portion of the Swat valley, where the river intervenes between Malakand and the passes leading to Dir from the Panjorka, is of military significance. The upper valley is closely gripped between mountain spurs stretching southwards from the Hindu Koh, rising to 1,500 ft. on one side and 19,000 ft. on the other, leaving but a narrow space between their rugged summits and the banks of the river. The valley, narrow though it is, and traversed by the worst conceivable type of hill tracks, contains many villages or hamlets, and is pretty thickly populated. The district has come into prominence of recent years, on account of its lying on the direct road to Chitrall.

The Swatis are a clan of Yusafzai Pathans numbering 40,000 fighting men but are of weakly and thin physique, due to the malaria with which the valley is saturated. They are divided into three main clans, the Baizais, Ranizais and Khwaz-ozais. They had not much name for valour, but they opposed a stout resistance to Sir Robert Low's advance over the Malakand Pass in 1893 to the relief of Chitrall; and again in 1897, under the influence of fanaticism, they showed desperate bravery in the attack on the Malakand and British garrison and their Mohommedans, and have earned the reputation of being the most bigoted of all the Afghan tribes. For many years they were under the religious dominance of the Akhund of Swat, Abdul Ghafur, who, born in 1794, obtained ascendance by means of his ascetic practices, ruled practically undisputed in Swat for the last 30 years of his life, and died in 1877. The Akhund, after his experience of the British strength in the Umbeyla Campaign of 1863, always exerted his influence in favour of peace with the British government, though in his earlier days he was sometimes troublesome. He was succeeded by his son Mian Gul, who never possessed the same influence as his father.

SWATOW (also Shaowow), a port of China, in the province of Kwang-tung, opened to foreign trade in 1860. The population is upwards of 60,000. The town is situated at the mouth of the main branch of the river Han, which 30 miles inland flows past the great city of Chi'achow Fu or Tai-chu (Tie-chu), while the surrounding country is more populous and full of towns and villages than any other part of the province. The climate is good, but being situated at the southern end of the plateau, the town is exposed to the full force of the typhoons, and much destruction is occasionally wrought. English merchants settled on Double Island in the river as early as 1826; but the city, which is built on ground but recently recovered from the sea, was formerly a mere fishing village. The trade of the port has rapidly increased. In 1869 the total value of the trade was £4,800,000, in 1884 £5,519,772, and in 1904 £7,063,579. The surrounding country is a great sugar-cane district producing annually about 2,400,000 cwt. of sugar, and there is an extensive refinery in the town employing upwards of 600 workmen and possessing a reservoir for 7,000,000 gallons of water. Next in value comes the manufacture of bean-cake, which is also imported in large quantities from Niuchwang, Chifu, Shanghai, Amoy and Hong-Kong. Among the leading exports are tea (since about 1872); grass-cloth, manufactured at Swatow from so-called Taiwan hemp (the fibre of the Boehmeria nivea from Formosa); pine-apple cloth, manufactured in the villages about Chieh-Yang (a town 22 m. distant); oranges, for which the district is famous; cheap fans; and pewter, iron and tin wares. Swatow is also a great emigration port and for the scene of many kidnapping adventures on the part of foreigners in the early days. Their outrages gave rise to much hostile feeling towards foreigners who were not allowed to enter the city of Chi'achow Fu until the year 1861. Of the whole foreign trade of the port upwards of 83% is in British bottoms, the trade with Hong-Kong being of especial importance.

About 1865 the whole Swatow district was still divided into a number of "independent townships, each ruled by its own headmen, and the population was described in the official gazetteer, as generally rebellious and wicked in the highest degree. Mr Forrest, British consular agent, relates that in that year he was witness to the preparations for a fight between the people living on the opposite sides of the estuary, which was only prevented by a British war- vessel. The T'ai-p'ings swept over the country, and by their ravages and plundering did much to tame the independence of the clans. The punishment inflicted in 1869 by Commander Jones on the inhabitants of Otingpui (Ou-ting-pel), about 8 m. from Swatow, for the attack they had made on the boats of H.M.S. "Cockchafer," showed the Chinese authorities that such piratical villages were not so easily subdued. Within the last year or two, the native of Chi'achow Fu) was sent to reduce the district to order, and he carried out his instructions with remorseless rigour.

SWAZILAND (native name Pungwane), a country of British South Africa bounded S., W. and N. by the Transvaal, E. by the Portuguese possessions at Delagoa Bay and the Ingwavuma division of Zululand. It lies between the Drakensberg and Lebombo Mountains and is separated from the Indian Ocean by low land varying in width from 30 to 50 m. It has an area of 65,548 sq. m. (being somewhat larger than Yorkshire). The height of the mountains (1904), of 9,545, and 9,896 ft. whites were whites. The natives are nearly all Amaswazi Bantus, commonly called Swazis, and are closely allied to the Zulus.

Spurs from the Drakensberg occupy a large part of the country, which may be divided into three parallel belts running north and south. The western belt is that of the Maputulu and the northern belt of the Komati (g.v.) and the Umbeloi. The Umbeloi has two chief headstreams, the Black and the White Umbeloi, the White branch being the more southerly. The climate is warm but healthy wave in some of the river valleys. The flora and fauna differ in no
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essential respects from the corresponding regions of the Transvaal and Zululand (see those articles).

Towns and Communications.—The seat of the administration is Embaabaana (Mbabane), a town on a northern tributary of the Usutu (60 m.), and the capital of the Swaziland Colony and administration of the Tugela Valley, about 18 m. east of Johannesburg. It replaced (1904) the former capital of Bremersdorp situated in the middle veld 23 m. south-east of Embaabaana, and destroyed by Boer forces during the war of 1899-1901. The settlement of Mbabane was named after the British explorer Sir Henry Mares, who, long runs through Portuguese territory to the Swaziland border at Umbelizoe Poort. This line is the eastern link in the direct railway connexion designed to make the Tombozi (the Swazi) fertile. On it has been constructed.

There is telegraphic connexion with the Transvaal.

Industry and Trade.—The soil is generally fertile. On the high veld, where green herbage is found all the year round, large numbers of sheep and cattle are pastured. This region serves as a winter grazing ground for sheep from the Transvaal. The middle veld is suitable for grain crops as well as bananas, sugar, coffee, tea and other semi-tropical produce. Millet, maize, pumpkins and ground-nuts are extensively cultivated. On the low veld cotton is grown, but the variety is scanty and the price low.

Besides agriculture the only considerable industries are gold, tin and coal mining. The goldfields, situated in the north-western part of the country, are a continuation of the De Kaap (Barberton) field. Theyield of gold, however, is by no means such as to be of great extent. Up to the outbreak of the Anglo-Boer War in 1899 the value of the gold exported from Swaziland was about £300,000. Gold mining re-started on a small scale in 1904. The output for 1906-1907 was 63,000 t., and in 1908-1909, 102,000 t. was successfully in the neighbourhood of Embaabaana, casseriterite to the value of £45,000 being exported in 1905-1907. The output for 1908-1909 was valued at £36,000. Anthracite coal occurs in quantity on the eastern part of the country.

Administration, &c.—Swaziland forms a crown colony under the government of the High Commissioner for South Africa. It is administered by a resident commissioner. Legislation is by ordinance. Roman-Dutch common law prevails except when modified by statute. The costs of Swaziland are met from the general revenue of the country.

The chiefs are customarily respected as the heads of the four groups of the nation. The administration has a few schools, and the education is largely received.

History.—The Abaswe tribe is believed to have occupied the country now known as Swaziland from the period of the invasion of South East Africa by the Bantu peoples. They were formerly called Ba-Rapuza or Barabuza after a chief under whom in the 18th century they acquired homogeneity. In the early part of the 19th century they fell under the domination of the newly constituted Zulu nation. In 1843, the year in which the British annexed Natal and with it a part of the country hitherto ruled by the Zulus, the Barabuza, under a chief named Swazi, took advantage of the comparative weakness of the Zulu power, achieved independence and founded the present state. According to Kanes, the custom they adopted the name of their deliverers. The Boers of the Transvaal began to move into the regions adjacent to Swaziland and in 1855 the Swazis in order to get a strip of territory between themselves and the Zulus, whose power they still dreaded, ceded to the Boers the narrow strip of land north of the Pongola river now known as the Piet Retief district. The Zulus under Cetywayo claimed the ceded district as their own, and the Swazis as their subjects and for over ten years no white farmers were able to settle in the district. With the Boers the Swazis remained on friendly terms and this friendship was extended to the British on the occupation of the Transvaal in 1877. In 1879 they joined the British in the attack on the Bapedi chief Sikukuni, whom they looked upon as an ally of the Zulus.

They captured from Sikukuni certain "rain medicine," the possession of which has since greatly increased the prestige of the paramount chief of the Swazis among the Kafirs of South Africa. On the retrocession of the Transvaal in 1881 the independent status of the Swazi nation was recognized by the Boers. The Pretoria convention of that year defined the boundaries of the country. By the London convention of 1884 the Transvaal again recognized the independence of Swaziland. Immediately afterwards, however, the Boers began a series of efforts to obtain control of the country. In 1886 the governor of Natal received a paper from Umbandine (Mbandini), the paramount chief of the Swazis, stating that Piet Joubert had called on him and requested to sign a paper saying that "he and all the Swazis agreed to go over and recognize the authority of the Boer government, and have nothing more to do with the English. On his refusal the Boers reply to him, why then refuse to sign the paper? You know we defeated the English at Majuba." The Boers further added that if the Swazis were relying on the British, they were leaning on a broken reed, and would find themselves left in the lurch. Umbandine followed up this communication with a request for British protection, but without result. Later on, in 1887, both Boers and gold prospectors of all nationalities were overrunning his country, and Umbandine asked for a British resident. This request was also refused. The Boers now determined to adopt towards Swaziland the policy which had proved so successful in Zululand, and endeavoured to force them to cede valuable parts of their territory. A considerable body of British soldiers was sent to within the Swazi territories and proclaimed "The Little Free State." Umbandine was then at length induced to ask the Transvaal for annexation.

The Transvaal applied in 1889 to Great Britain for permission to accede to this request, but the British government replied that the only intervention to which they would consent must be a dual one. Consequently a joint commission was appointed to visit Swaziland and report on the condition of things there. Sir Francis de Winton, the British commissioner, who was accompanied by Generals Joubert and Smit on behalf of the Transvaal, reported that Umbandine had already granted to the British crown certain concessions, such as postal, telegraphic, banking, customs, &c., to the Transvaal, and concessions of land mining and grazing rights to various adventurers. Umbandine had in short granted concessions of every conceivable character, including exemption from taxation. A charter of self-government had also been granted (1888) to the whites in the country. In the circumstances de Winton considered a British protectorate inadvisable and impracticable. A dual control was arranged in 1890, but the convention then signed proved abortive owing to the objection of the Transvaal to join the South African Customs Union. In 1893 a further convention was drafted, but after negotiations between Lord Carnarvon, high commissioner for the Transvaal, and President Kruger, the result of which was that the administration of Swaziland, with certain reservations as to the rights of the natives, was made over to the South African Republic. In the following year six Swazi envoys visited England for the purpose of asking Queen Victoria to take Swaziland under her protection. In view, however, of the arrangement come to, this petition had to be refused. In 1894 a convention was signed between Great Britain and the Transvaal, and the Boers, in spite of the Swazi opposition, assumed administration of the country. The Boers' object in intriguing to acquire Swaziland was not merely that of obtaining that country; they desired also to annex the coast lands to its east and thus obtain—at Kosi Bay—a seaport of their own. This object they might have attained if they had agreed to de Winton's proposals, but Great Britain in view of the increasingly hostile attitude...
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assumed by the Transvaal government now intervened and by
annexing in 1884 Transvaal, the region in question, blocked
the Boers' further progress towards the sea (see SOUTH AFRICA:
History).

Swaziland suffered during the struggle between the Transvaal
and Great Britain as to its destiny. Umbandine died in 1889
and had various successors. Ilavanu, installed by the Boers
as paramount chief in 1894, was a sanguinary despot and
was compelled to flee in 1899. The principal convention
for which Umbandine was defeated, however, his widow Naba
Taiben, known to Europeans as the queen regent. She more
than once appealed to the British to cause the Boers to respect
the terms of the conventions, and before the outbreak of the
Anglo-Boer war in 1899 she took the side of the British.

On the annexation of the Transvaal in 1901 the queen regent asked
that Swaziland might be annexed also. On the cessation of hostilities a British special commissioner was sent into the
country—then in a condition bordering on anarchy—and a pro-
visional administration established. In June 1903 an order in
Council formally conferred the government of the country on
the governor of the Transvaal (then Lord Milner). Lord Milner
visited Swaziland in July 1904 and denounced "the abominable
network of concessions" in which the country was entangled.

On the 3rd of October following the governor issued a pro-
clamation providing further for the administration, and for the
expropriation of the concessions other than those relating to
land and minerals. In September 1906 Lord Selborne, who had
succeeded Lord Milner, conferred with the queen regent and her
council on questions specially affecting the natives. A Swazi
sovereign born about 1889 was selected as para-
mount chief, Naba Taiben, his grandmother, being confirmed
as regent during his minority. In December 1906 the control of
Swaziland was severed from the government of the Transvaal
and transferred to the High Commissioner for South Africa,
and in March 1907 a resident commissioner was appointed.

When the Union of South Africa was established in 1910,
Swaziland, with other native territories, remained under direct
Imperial control.

vol. xxx., and "Swaziland: its agricultural and pastoral future,
" in Transvaal Agricultural Jour., vol. iv. (1906); T. R. Jones,
"Notes on the Geology of West Swaziland" in Geol. Mag. (1899),
vol. vi. Colonial office reports on the country have been issued
annually since 1877. A government Geologist's report issued
yearly. In it are cited the Blue Books dealing with Swaziland.
For history see also Transvaal: Bibliography.

SWERING (O. Eng. sweiring, to swear, originally to speak aloud,
ciaud, and sweiring, to answer, Ger. schwören, Dan. svørga,
dc., all from root svør- , to make a sound, cf. "swarm," pro-
perly buzzing of bees, Lat. suspurrus), the affirmation or utter-
ing of a solemn declaration with an appeal to the Deity, some
holy personage or sacred object as confirmation, hence the act
of declaring the truth of a statement upon oath (see OATH
and EVIDENCE). The common use of the word is for the uttering
of profane oaths or curses. In English law, when blasphemy
(g. b.) was at common law an indictable offence, cursing or
swearing was left to the ecclesiastical courts. The Profane
Oaths Act 1745 inflicted a sliding scale of fines for the use of
profane oaths according to the rank of the offender, 1s. for
a common labourer, 5s. for a soldier or seaman, 2s. for everyone below
the rank of gentleman and 5s. for those of or above that rank; the
procedure under this act is regulated by the Summary Juris-
diction Acts. By s. 8 of the Town Police Clauses Act 1847
the use of profane or obscene language is an offence punishable
on summary conviction by a fine not exceeding 40s. or
imprisonment not exceeding 14 days. The offence must be
committed in a street and the act is confined to urban sanitary
districts or to such rural districts to which s. 276 of the Public
Health Act 1875 has extended it. By s. 12 of the Metropolitan
Police Court Acts 1839 a similar offence is punishable in the
metropolitan police area, and various districts have put in force
by-laws for punishing swearing, cursing, or causing annoyance
in public places. The restriction as to the place where the
offence must be committed to be liable to punishment has led to
the enforcement on occasions of the Profane Oaths Act,
which applies to the whole of England and Wales and is not
limited to cursing in the streets. It should not, however,
apply to obscene language.

SWEATING-SICKNESS. A remarkable form of disease, not
known in England before, attracted attention at the very
outbreak of the reign of Henry VIII. It was known, indeed, a few days after the landing of Henry at Milford Haven on the
7th of August 1485, as there is clear evidence of its being
spoken of before the battle of Bosworth on the 22nd of
August. Soon after the arrival of Henry in London on the
28th of August it broke out in the capital, and caused
great mortality. This alarming malady soon became known
as the sweating-sickness. It was regarded as being quite
distinct from the plague, the pestilential fever or other
edemics previously known, not only by the special symptom
which gave it its name, but also by its extremely rapid and fatal

From 1485 nothing more was heard of it till 1507, when the
second outbreak occurred, which was much less fatal than the
first. In 1517 was a third and much more severe epidemic.
In Oxford and Cambridge it was very fatal, as well as in other
towns, where in some cases half the population are said to have
perished. There is evidence of the disease having spread to
Calais and Antwerp, but with these exceptions it was confined
to England.

In 1528 the disease recurred for the fourth time, and with
great ferocity. It first showed itself in London at the end of
May, and speedily spread over the whole of England, though
not into Scotland or Ireland. In London the mortality was
very great; the court was broken up, and Henry VIII. left
London, frequently changing his residence. The most remark-
able fact about this epidemic is that it spread over the
Continent, suddenly appearing at Hamburg, and spreading
so rapidly that in a few weeks more than a thousand persons
died. Thus was the terrible sweating-sickness started on a
destructive course, during which it caused fearful mortality
throughout eastern Europe. France, Italy and the southern
countries were spared. It spread much in the same way as
cholera, passing, in one direction, from north to south, arriving
at Switzerland in December, in another northwards to Denmark,
Sweden and Norway, also eastwards to Lithuania, Poland and
Russia, and westwards to Flanders and Holland, unless indeed
the epidemic, which declared itself simultaneously at Antwerp
and Amsterdam on the morning of the 27th of September,
came from England direct. In each place which it affected it
prevailed for a short time only—generally not more than a
fortnight. By the end of the year it had entirely disappeared,
except in eastern Switzerland, where it lingered into the next
year; and the terrible "English sweat" has never appeared
again, at least in the same form, on the Continent.

England was, however, destined to suffer from one more out-
break of the disease, which occurred in 1551, and with regard
to this we have the great advantage of an account by an eye-
itness, John Kaye or Caius, the eminent physician.

Symptoms. The symptoms as described by Caius and others
were as follows. The disease began very suddenly with a sense of
apprehension, followed by cold shivers (sometimes very violent);
giddiness, headache and severe pains in the neck, shoulders and
limbs, with great prostration. After the cold stage, which might
last from ten to half an hour and sometimes up to three hours, followed the stage of heat
and sweating. The characteristic sweat broke out suddenly, and,
as it seemed to those accustomed to the disease, without any
obvious cause. With the sweat, or after that was poured out,
came great distress of heart and lungs, with palpitation, throb,
pulse and intense thirst. Palpitation and pain in the heart were
frequent symptoms. No eruption of any kind on the skin
was generally observed; Caius makes no allusion to such a symptom. In the throat there may have been cough, hoarseness
or an irresistible tendency to sleep, which was thought to be fatal
if the patient were permitted to give way to it. The malady was
1 GugenbühI, Der englische Schweiz in der Schweiz (Lichtensteig,
1858).
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 remarked rapid in its course, being sometimes fatal even in two or three days, and in these cases, not more than one case than that time. Moreover, it was protracted to a period of twelve to twenty-four hours, beyond which it rarely lasted. Those who survived for twenty-four hours were considered safe.

As with the plague, the sweating-sickness was not especially fatal to the poor, but rather, as Caius affirms, attacked the richer sort and those who were free livers according to the custom of England in those days, and was most prevalent with people who were men of wealth, ease or welfare, or of the poorer sort, such as idle persons, good ale drinkers and taverners.  

Causes.—Some attributed the disease to the English climate, its moderate habits, the temperate climate, and the habits of the people, and to the frightful want of cleanliness in their houses and surroundings which is noticed by Erasmus in a well-known passage, and about which Caius is equally explicit. But we must conclude with Hecker that the sweating-sickness is not, either separately or collectively, to produce the disease, though each may have acted sometimes as a predisposing cause. The sweating-sickness was, in fact, to use modern language, a specific infective disease, in the same sense as plague, typhus, scarlatina or malaria.

The only disease of modern times which bears any resemblance to the sweating-sickness that is known as military fever ("Schwitz-friesel" "sweat miliaria" or the "Picardy sweat"), a malady which has been repeatedly observed in France, Italy and southern Germany, but not in the United Kingdom. It is characterized by severe sweating, and occurs in limited epidemics, not lasting in each case more than two or three days, in an individual or an Institute. On the other hand, the attack lasts longer than the sweating-sickness did, is usually accompanied by eruptions of vesicles, and is not usually fatal. The first clearly described epidemic (though not as a sweat-sickness) occurred before the last in 1861. Between these dates some one hundred and seventy-five epidemics have been counted in France alone.

For a short history see Bacon's Life of Henry VII, and the chronicles of Grafton, Holinshed, Baker, Fabyan, &c. The only English medical account is that of John Caius, who wrote in English A Boke or Counsell Against the Disease commonly called the Sweate, or Sweating Sickness (London, 1552); and in Latin De ephemeria britannica (Louvain, 1556; reprinted London, 1721). The English tract is reprinted in Babington's translation of Hecker's Epidemics of the Middle Ages (Syd. Soc., 1844). This also contains Hecker's valuable treatise on the English sweating sickness of the 16th century (1834), and also printed in his Volkskunde der Mittelalter, edited by Hirsch (Berlin, 1865). Grüner's Scriptores de sudore anglico (Frankfort, 1847), contains nearly all the original documents, including the writings of Caius. See also Hirsch, Handbook of Geographical and Historical Pathology, trans. by Creighton (New Syd. Soc., 1885).

SWEATING SYSTEM, a term loosely used in connection with oppressive industrial conditions in certain trades. This "system" originated early in the 19th century, when it was known as "the contract system." Contractors supplying the government with clothing for the army and navy got the work done by giving it out to sub-contractors, who in some cases made the garments and sold them at a profit; in others the sweaters, with the workman, are called the sub-contractor or subcontractor, and in others sublet their sub-contracts to men who carried them out with similar help. Afterwards this plan was adopted in the manufacture of ready-made clothing for civilian use, and of "bespoke" garments (made to the order of the customer). Previously the practice had been for coats, &c., to be made up by workmen employed on the premises of the master tailor or working together in common workshops, but in either case directly employed by the master tailor. The new plan brought a large number of workpeople possessing little skill and belonging to a very needy class into competition with the regular tailors and showed that the sweaters, with the workman, are called the sub-contractor or subcontractor, and in others sublet their sub-contracts to men who carried them out with similar help. Afterwards this plan was adopted in the manufacture of ready-made clothing for civilian use, and of "bespoke" garments (made to the order of the customer). Previously the practice had been for coats, &c., to be made up by workmen employed on the premises of the master tailor or working together in common workshops, but in either case directly employed by the master tailor. The new plan brought a large number of workpeople possessing little skill and belonging to a very needy class into competition with the regular tailors and showed that the sweaters, with the workman, are called the sub-contractor or subcontractor, and in others sublet their sub-contracts to men who carried them out with similar help. Afterwards this plan was adopted in the manufacture of ready-made clothing for civilian use, and of "bespoke" garments; garments made up in insanitary surroundings, the matter attracted little public notice until 1834, when the system again came into prominence in connexion with the immigration of poor foreigners into East London, where large numbers of these people were employed in various trades, especially in the tailoring, boot-making, and cabinet-making industries, under conditions generally similar to those complained of in the earlier agitations. In 1888 a select committee of the House of Lords was appointed to inquire into the subject; and after a lengthy investigation—in the course of which evidence was given by 291 witnesses in relation to tailoring, boot-making, furrery, shirt-making, mantle-making, cabinet-making and upholstery, cutlery and hardware manufacture, chain and nail-making, military accoutrements, saddlery and harness-making, and other handicrafts. The committee presented its final report in April 1890. The committee found themselves unable to assign an exact meaning to the term "sweating," but enumerated the following conditions as those to which that name was applied: "(1) A rate of wages inadequate to the necessities of the workers or disproportionate to the work done; (2) excessive hours of labour; (3) the insanitary state of the houses in which the work is carried on. They stated that, "as a rule, the observations made with respect to sweating apply, in the main, to unskilled or only partially skilled workers, as the thoroughly skilled workers can almost always obtain adequate wages."

With regard to the sweating system, the committee declared that this cannot be regarded as responsible for the industrial conditions described; for "the middleman is the consequence, not the cause of the evil; the instrument, not the hand which gives motion to the instrument, which does the mischief. Moreover, the middleman is found to be absent in many cases in which the evils complained of abound." While, on the one hand, we find, as pointed out by this committee, that "sweating" exists without the presence of the "middleman," (the fact being that many grossly underpaid workpeople are in the direct employment of large firms), it is, on the other hand, the "sub-contractor or subcontractor" who is common in numerous trades in which there is no trace of any such oppression of the workpeople employed by the sub-contractors as is denoted by the term "sweating." Thus, for example, in shipbuilding in many cases men work in squads, the leading workmen employing their own helpers; in the cotton trade the mule-minders engage and pay their own pieces, and the weavers their own tenets; in the manufactured-iron trade, in mining, &c., a good deal of work is done under sub-employers employing their own assistants, none of these sub-contractors being alleged to "sweat" their helpers. There is, in short, no system of employment which can properly be called "the sweating system." At the same time, whatever workers possessing a small degree of skill and deficient in organization are employed under a number of small masters, there "sweating" is likely to occur.

The common idea that the "sweater" is an unscrupulous tyrant, who fulfils no useful function, and who makes enormous profits, has no counterpart in fact. Whatever may have been the case in earlier days, before the interminable competition of the "middlemen" had time to produce its inevitable effects upon the position of these sub-employers, it may now be considered to be of no consequence in the context. The "too great," "too little," and "too large" employment which is injurious to the individuals." The committee also found that "sweating" is likely to occur in the case of those who do not work. He is also free from restrictions as to the subdivision of labour and the employment of a certain class of workpeople which the detriment of the regular factory workers would impose upon him. The regular tailor, for example, thinks that no one who has not, by a lengthy period of tuition,
acquired the capacity to make a coat "right out" ought to be allowed to enter the tailoring trade. But in the workshop of the sub-contractor the work is split up into fractions, each of which is soon learned, so that it becomes possible to introduce into the trade persons possessing no previous training, and generally willing to work for wages far lower than those to which the regular tailors consider themselves entitled, and which, so long as they are not exposed to the competition of these outsiders, they are usually able to secure. On the other hand, while it may suit the manufacturer, anxious and keen to increase his own share of production, to give his work out to middlemen, it is beyond question that any form of the "small master" system is necessarily liable to abuse in many directions. Among these small masters the eagerness to secure employment is usually so keen that the work is often taken at a price too low for it to be possible for these sub-employers to pay to their workpeople wages adequate to provide the reasonable requirements of working-class life. The workshops of the middlemen are scattered over large districts, and these little masters frequently move their business from one to another. Both of these are instinctances which tend strongly to make efficient regulation by the factory and the sanitary inspectors very difficult. Not seldom, especially when trade is brisk, these work-places are overcrowded in a manner injurious to health, and in not a few cases their sanitary condition is defective. It will readily be understood that combination among the people employed in these numerous small isolated work-places is much less easy than among the compact bodies of workers employed in large factories, so that any attempt to resist oppressive conditions of employment by combination organization meets with serious obstacles. But perhaps the worst of all the features which this method of manufacture presents is the absence of motor power and machinery. The fact that a manufacturer has laid out a large sum in plant, thus entailing a heavy expenditure in "standing charges," necessarily induces him to do his best to make employment regular. In the little outside workshop, on the other hand, lengthy spells of enforced idleness are followed by short periods of most severe toil, during which the hours of daily labour are prolonged to an inhuman extent. At the same time, the workpeople employed in the ill-equipped workshop of the little master are competing with the much more efficient production of the factory provided with labour-saving machinery driven by steam or other mechanical power; and in many cases their only chance of retaining the work under these circumstances is to take it at starvation prices. But the progress of invention moves fast, and antiquated methods of production are gradually being abandoned. Already, in many of the trades in which the sweating system has hitherto largely prevailed, especially in the tailoring, the boot-making, the cabinet-making and the nail-making industries, the factory system is coming so far to the front in the race for cheapness of production that, although in certain industrial centres, in which the rents of factories are high and a specially abundant supply of needy and unskilled workpeople is available, a good deal of work is still given out to small outside masters, the proportion of the total output manufactured in this manner is day by day diminishing. (D.Sch.)

An endeavour has been made in the United Kingdom to combat legislatively the evils of sweating. The Trade Boards Act 1909 established trade boards for trades to which the act applied. The trades specified were ready-made and wholesale tailoring, the making of paper or chip boxes, machine-lace making and chain-making, but the board of trade was given power to apply the Act to any other trade if it so desired. The Act requires traders to fix, subject to certain restrictions, minimum rates of wages with a view to the standardization of wages paid in the same trade for their trades, while they may also fix general minimum rates of wages for work, and these rates may not be applied either universally to the trade, or to any special process in the work of the trade or to any special class of workers, or to any special period of the year. There must become obligatory by order of the board of trade upon the expiration of six months from the date when made by a trade board, but they may, in the meantime, have a limited operation (1) in the absence of a written agreement; (2) where an employer has given written notice to the board of trade that he is willing to pay them; and (3) in the case of contracts with government departments and local authorities. If the minimum rate of wages has been made obligatory and an employer has already paid a lower rate of wages, he is liable to a penalty of not exceeding £20 in respect of each offence and to a penalty of not exceeding £5 for each day on which the offence is continued. The Act provides for the imposition of an additional tax, in addition, a sum equal to the wages due. The trade boards consist of an equal number of representative members of employers and workers, together with appointed members whose number must be specified by Act. The board of trade may also establish district trade committees with a constitution similar to their own and may delegate to them their powers and duties under the act. Women are eligible for membership of trade boards or district trade committees. The Act does not apply for a trade in which women are largely employed, at least one of the appointed members must be a woman.

SWEDEN [Sverige], a kingdom of northern Europe, occupying an island and a large part of the Scandinavian peninsula. It is bounded N. by Finland (Russian Empire), E. by the Gulf of Bothnia and the Baltic Sea, S.W. by the Cattegat and Skagerrack, and W. by Norway. It extends from 60° 3' 21" to 55° 20' 18" N., and from 11° 6' 15" E. on the south-west coast to 24° 9' 11" E. on the Finnish frontier, the extreme length being about 990 m., the extreme breadth (mainland) about 250 m., and the total area estimated at 173,547 sq. m. Out of a detailed total estimate of the boundary line at 6100 m., 4737 m. are coastal, the Norwegian frontier is 1030 m., and the Finnish 333 m.

Topography. The backbone of the Scandinavian peninsula is a range, or series of masses, of mountains (in Swedish Kölén, the keel) extending through nearly the whole length of the peninsula towards the western side. The eastern or Swedish flank has, therefore, the more incised character slopes of the country. The western (Finnish) side is mainly an upland of hills, an upland which is more or less a continuation of the Swedish coast and stretches out to the Baltic. The border of Finland being of low level, the line of junction between Sweden and Norway from the extreme north to the north of Svealand, the central of the three main territorial divisions of Sweden and Svalbard, and the Baltic is, therefore, a convenient line of demarcation. Although this boundary is not so well marked that the political frontier may follow it throughout, Sweden itself may be considered in four main physical divisions—the mountains and highland district, covering all Norrland; the forested districts of central Sweden; the so-called Småland highlands, in the south and south-east; and the plains of Skåne, occupying the extreme southward projection of the peninsula.

The first district, thus defined, is the largest, and includes the greatest elevations in the country and the finest scenery. The highest mountains are found in the north, the bold peak of Kebnekaise reaching 7065 ft., Sarjekstjakta, 6792 ft., being the highest point in a mountain range including the Sarjeksfall, Alaksjafell and Partefjell, which range, from 6500 ft. upwards; and, farther south, Sulitjelma, 6158 ft. of these mountains are in the border district of Norway, and are composed of pre-Cambrian rocks. There is an abrupt fall from Storgull to the Svalbard range, which, from 2500 ft. at the south of which the railway from Trondhjem in Norway into Sweden crosses the fine pass at Storlien. South of this lies the ridge, from which descend the glaciers and from which issue the waterfalls of the great river, the Storfjell in Norway, the Falunbo in Sweden.

Within the region of the mountains, the general aspect is high and rugged, with steep and rocky sides, often rounded, and abounding in masses, of masses, of mountains (in Swedish Kölén, the keel) extending through nearly the whole length of the peninsula towards the western side. The eastern or Swedish flank has, therefore, the more incised character slopes of the country. The western (Finnish) side is mainly an upland of hills, an upland which is more or less a continuation of the Swedish coast and stretches out to the Baltic. The border of Finland being of low level, the line of junction between Sweden and Norway from the extreme north to the north of Svealand, the central of the three main territorial divisions of Sweden and Svalbard, and the Baltic is, therefore, a convenient line of demarcation. Although this boundary is not so well marked that the political frontier may follow it throughout, Sweden itself may be considered in four main physical divisions—the mountains and highland district, covering all Norrland; the forested districts of central Sweden; the so-called Småland highlands, in the south and south-east; and the plains of Skåne, occupying the extreme southward projection of the peninsula.

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Of these districts, the two most remarkable are: Northern Highlands, including the Sarjeksfall, Alaksjafell and Partefjell, which range, from 6500 ft. upwards; and, farther south, Sulitjelma, 6158 ft. In the north this is the highest point in a mountain range which decreases, throughSIDE578 ft. and Åreskutan (566 ft.), to the southern of which the railway from Trondhjem in Norway into Sweden crosses the fine pass at Storlien. South of this lies the ridge, from which descend the glaciers and from which issue the waterfalls of the great river, the Storfjell in Norway, the Falunbo in Sweden.
From the spinal mountain range a series of large rivers run in a south-easterly direction to the Gulf of Bothnia. In their upper parts they drain great lakes which have resulted from the formation of morainic dams, and in some cases the streams are at present very deep and have a great elevation above sea-level. All lie at elevations between 900 and 1300 ft. All are narrow in comparison with their length, which is not infrequently magnified, to view when two lakes are connected by a very short stretch of running water. An example of this is the divide between Hornafvan, Uddejaur and Storafvan on the Skellefte river. The following are the principal rivers from north to south: The Torne, which flows from Lake Torne to Lake Karesuando, drains with Finland, has a length of 227 m, and drains lake Torne (Torne-träsk), the area of which is 126 sq. m. The Kalix is 208 m. in length. The Lule is formed of two branches, Storn and Lilla (Great Lule). The total length, however, is 503 m. The Stora Lule branches drain the Langas and Stora Lule lakes (Langsajaur, Luleträsk), which have a length together exceeding 50 m., a fall between them of some 16 ft. and a total area of only 87 sq. m. as they are very narrow. Below Stora Lule the lake forms the Harspräng (hare's leap); Njömmelsuska of the Lapps, the largest and one of the finest cataracts in Europe. The sheer fall is about 100 ft., and there is a further fall of 150 ft. in a series of tremendous rapids extending for 1.5 m. Farther up, at the head of Langsajaur, is the Stora Sjöfallet (great lake fall; Lapp, Attu Muorki Karjje), a fall of 1.50 m. only less grand than the Harspräng. Below, and at a distance somewhat more than half the length of the SkellefteÄngen, an interruption of the Skellefte river, are the two falls which are visited. Following the Pite river (191 m.), The Skellefte (205 m.) drains Hornafvan and Storafvan, with a fall of 20 ft., and an area together of 275 sq. m. Hornafvan is a stream undefined by trough, flat-bottomed valleys, and lower falls of Skellefte, Storafvan and then the evening Uddejaur are broad, throwing off deep irregular inlets, and picturesquely studded with numerous islets. The Ume (237 m.) runs through a fine plain, the2nd largest basin in the country, and north bank some 20 m. from its mouth, and among several lakes drains Stor Uman (64 sq. m.). The further principal rivers of this region are the Angerman (243 m.), Indal (196 m.), draining the lakes Angerman and Indalsjaur, which in its lowest course forms these the two last rise in the southernmost part of the mountain region described, but do not as a whole belong to the region under consideration. The Angerman drains 3300 sq. m. of northern Sweden; the Indalsjaur drains the lakes north of it, and has thus a drainage area of 12,591 sq. m., which is exceeded only by that of the Torne (16,690 sq. m.), the average of the remaining rivers being 50 sq. m. Beyond the Harspräng and the Stora Sjöfallet the northern rivers do not generally form great falls, though many of the rapids are grand. The Indal, by changing its course in 1796 near Dyspsgården on the northern, has left bare the remarkable bed of a fall called Döda (dead) Fall, in which many "giants' caldrons" are exposed. In the uplands above the chain of lakes called Strömsvalltud, which are within the drainage area of the Angerman, there are almost lake chain without another fall. Fall are rare, but southern mountain valleys of the region there are several beautiful falls, such as the Tännfors, not far from Åre and the Storbo, Hällefors (250 m.).

Eastward from the main mountain range the highland region is divided into two belts: a middle belt of morainic deposits and marshes, and a coastal belt. The middle belt is gently undulating; view from the coast one sees little evidence of the morainic forests resembles a dark green sea, through which the great rivers flow straight between steep, flat-topped banks, with long quiet reaches broken by occasional rapids. The few lakes they form in this belt are rather mere widening in their courses; but the tributary streams drain numerous small lakes and peat-mosses. In the extreme north this belt is almost flat, a few low hills standing isolated and conspicuous; and the rivers have serpentines system, while steep banks are absent. The middle belt melts into the coastal belt, covered by geologically recent marine deposits, reaching an extreme height of 700 to 800 ft., and extending inland some 60 to 80 m. The chief tributary of the great rivers are characteristic, and the rivers have cut deep into the soft deposits of sand and clay, leaving lofty and picturesque bluffs (mipor).

The orographical division of the central lowlands bears comparison with the coast in the northern part of the country. Here are flat fertile plains of clay, well wooded, with innumerable lakes, including the four main basins, Valavan, Vetter, Mälar and Hjelmare. These, except the last, far exceed in area any lakes in the country except that of Vetter. Hjelmare (183 sq. m.) is only exceeded by Hornafvan-Storafvan. The areas of the other three lakes are respectively 2419, 733 and 442 sq. m. The four basins are divided by an innumerable system of very irregular and in form, and of great length. Mälar, Vener and Hjelmare contain many islands; in Vetter there are comparatively few. None of the lakes is of very great depth, the deepest sounding occurring in the middle of Mälar, which, however, is not more than 60 ft. from east to west, and is 12 m. in extreme width, the greatest depth is only 50 ft., but as its flat shores were formerly subject to inundation its level was sunk 6 ft. by deepening the navigable channel through it and clearing out various waterways (the

**Eskeläntuna river, Hjelmar canal, &c.) in 1878–1887.** The scenery of these lakes, though never grand, is always quietly beautiful, especially in the case of Mälar, the wooded shores and islands of which form a notable feature in the pleasant environs of the city of Stockholm, formed by elevations above sea-level as high as 240 ft., but a few isolated heights of Silurian rock appear, such as Kinnekulle, rising 988 ft. above sea-level on the south-eastern shore of Vener, and Källungen (978 ft.) between Lake Mälaren and Lake Vener (865 ft.) on the eastern shore of Vetter. Noteworthy local features in the landscape of the central lowlands are the eskers or gravel-ridges (kärr), traversing the land in a direction from east to west, and the sides of the eskers are often of a rounded surface. Typical instances occur in the cities of Stockholm (Brunkebergstaken and Upsala (Upsala-åsen). South of the central lowlands the so-called Småland highlands extend. These highlands are composed of the loess deposits (Great Drift) which cover large parts of the old province of Skane (Scania). Level plains, with rich open meadows and cultivated lands, the monotonous of which is in some parts relieved by bighills which are separated by slight ridges with small lakes. Småland is situated in the north-west, with an extreme elevation of 741 ft.

The hydrographical survey may now be completed. The Dal river at its southern entrance to the Baltic is joined by the union of eastern and western branches (Oster Dal, Vester Dal) not far from the town of Falun. The eastern branch drains various small lakes on the Norwegian coast and has a length of 227 m. The western branch drains the so-called Lake Vener, which is drained to the Cattegat by the short Gota river, on which, not far below the lake, are the celebrated falls of Trollhättan. Lake Vetter is drained by two branches (Söder Dal, norther branch) in the same direction by a short channel at Stockholm, the normal fall of which is so slight that the stream is sometimes reversed. The Småland highlands are drained to the Baltic and Cattegat by numerous rivers of less importance. Excepting Finland no country is so full of lakes as Sweden. About 14,000 sq. m., nearly one-twelfth of the total area, are under water.

The coast of Sweden is not indented by so many or so deep inlets as those of the Gulf of Bothnia, the Baltic and the Cattegat share in the peculiar grandeur of the North Sea coast. All, however, have the same feature in that they are bounded by a steep coast, almost entirely impassable, and they have been cut through the beautiful Lake Siljan.

The length of the whole river including the eastern as main branch is 283 m. The Klar river (228 m.) rises as the Eemund river in Pienomursia, or large lakes, and empties into the Baltic through the Beautiful Lake Siljan.

Farther north, a narrow sound (Alands Hal) intervening on the Swedish side, the vast Aaland archipelago, belonging to Russia, extends across the Gulf of Bothnia. The coast of Sweden is here also developed than that of either the Baltic or the Cattegat. The islands of the skärgård as a whole are rugged and picturesque, though never lofty like many of those of the Baltic coast. In some parts of this archipelago, especially the skargard near to which from the sea is famous for its beauty. Farther north, a narrow sound (Alands Hal) intervening on the Swedish side, the vast Aaland archipelago, belonging to Russia, extends across the Gulf of Bothnia. The coast of Sweden is here also developed than that of either the Baltic or the Cattegat. The islands of the skärgård as a whole are rugged and picturesque, though never lofty like many of those of the Baltic coast. In some parts of this archipelago, especially
of Vemland, Skaraborg, Elsbo, and down to the province of Kronoberg, where it becomes a sandstone. In every respect it is very similar to the Grauwacke of the same type with a red and yellowish tinge, and the diluvial clay. In most parts of Sweden these deposits were swept away when the ice advanced, but in Skåne they often occur as long, thin, highly compacted, and ordinary krossgrus (terminal and side moraine). The former generally consists of a hard and compact mass of rounded, scratched pebbles, with rounded edges and broken surfaces, and is often covered by a layer of crushed rock. The latter is less compact and contains angular boulders, often of a considerable size, but no powder. Of later origin than the krossgrus is the rollstensgrus (gravel of rolled stones), which is a mixture of huge stones, pebbles, and small pebbles, called åsar. During the disappearance of the great inland ice large masses of mud and sand were carried by the rivers and deposited on the sea floor. These deposits, known as argillaceous and glacial clay, cover most parts of Sweden south of the line of Kopparberg and Vemland, the more elevated portions of the provinces of Elsbo and Kronoberg excepted. In the glacial clay also called Yttel arctica have been met with in many places to the north (or Stockholm). At this epoch the North Sea and the Baltic were connected along the line of Vener, Vetter, Hjelmor and Måler. On the other side the White Sea was connected by Lakes Onega and Läng, and the Gulf of Finland, and the Baltic and of Lakes Vener and Vetter there actually exist animals which belong to the arctic fauna and are remnants of the mammals that used to be more widespread in the Baltic and into the Baltic Sea. The glacial clay of the Silurian regions is generally rich in lime and is calcareous. The glacial clay is often found developed into the island of Oland in the country, called the Tjörn. In Sweden, the glacial clay is found in the southern part of Sweden at a height ranging from 70 to 150 ft. above the level of the sea, but in the interior of the country at a height of 400 ft. above the sea.

On the coasts of the ancient ice-sea, in which the glacial clay was deposited, there were heaped-up masses of shells which belonged to species still extant around Spitzbergen and Greenland. Most remarkable are the bivalves, among which the Silurian genus, called the Truncklaiden, is often found. These shells are rich in lime and seldom less than 2 ft. thick. They are generally of insignificant thickness. In the shallow lakes and enclosed bays of the sea there began to form the new deposits of the thick, heavy, clay waters, known by the name gyttja, characterized by the diatomaceous shells it contains. Sometimes the gyttja consists mainly of diatoms, and is then called terrymil. The gyttja of the lakes is generally preserved by the preservation of the gyttja in places near the sea, there is still in progress the formation of an iron ore, called sjuslim, with which the sea becomes covered by peat later than the sea has become surrounded by the first glaciation. The climate is very mild and the summers are long, of an enormous thickness, which have been brought into their present positions. The climate inclines to the character, others to the other. As a result of the wide latitudinal extent of the country there are also marked local variations to be contrasted. About one-seventh of the coasts of Norway are mountainous, and the climate of the Swedish part of the Baltic and the Baltic Sea. The climate of the Baltic is so far tempered by the warm Atlantic drift from the south-west that it is very unique in comparison with other countries of the same high latitude. The mountains of the Keel are not so high as the Iceland to destroy this effect over Sweden, and the maritime influence of the Baltic system has also to be considered. Sweden thus occupies a climatic position between the purely coastal conditions of Norway and the purely continental conditions of Russia; and in some years the climate inclines to the character, others to the other. As a result of the wide latitudinal extent of the country there are also marked local variations to be contrasted. About one-seventh of the coasts of Norway are mountainous, and the climate of the Swedish part of the Baltic and the Baltic Sea. The climate of the Baltic is so far tempered by the warm Atlantic drift from the south-west that it is very unique in comparison with other countries of the same high latitude. The mountains of the Keel are not so high as the Iceland to destroy this effect over Sweden, and the maritime influence of the Baltic system has also to be considered. Sweden thus occupies a climatic position between the purely coastal conditions of Norway and the purely continental conditions of Russia; and in some years the climate inclines to the character, others to the other.
at the south of lake Vetter—42°44'; and Vestervik (43 ft.) on the Baltic—43°2'.

But the local variations thus indicated are brought out more fully by the monthly isotherms, or lines of equal temperature, contained in the inland parts. The one is in the mountainous region of the south of Jemtland and the north of Dalarne, extending into Norway and Sweden, and appears as a thick line on the map in February. The average temperature in January is 8-9°, whereas at Östersund it is over 12°. The other and more strongly marked centre is in the far north, extending into Norway and Finland, where the average temperature in January is 2-3°, and isotherms run west of Lake Siljan and bends north-east to the Bothnian coast near Skellefteå. In July, on the other hand, the isotherms show an almost constant temperature all over the country, and the uniform curve is characteristic.

The relative length of the seasons shows contrasts similar to those of temperature. In the north spring begins in May, summer in the middle of June and autumn in the middle of August. In the south and west spring begins in March; summer in May and autumn in October. At Karesuando the last frost of spring occurs on an average on the 15th of June, and the first of autumn on or about the 6th of September; whereas at Stockholm the first of spring is on or about the 15th of April, and the first of autumn on or about the 1st of October; whereas at Stockholm 4½ months are free of frost. Ice forms about October in the north, in November or December in the midlands and south, and breaks up in May or June and in April respectively. In the great lakes the ice is formed in the north, 150 in the midlands and 200 to 220 in the north. A local increase of the ice period naturally takes place in the upper parts of the Småland highlands; and in the case of the great lakes of Norrland, the western parts have a shorter ice period than the eastern. As to the seas, the formation of ice on the west and south coasts is rare, but it is common and throughout the Baltic drift-ice and a frazil ice, ice in the form of needle-like crystals, takes place on the north coast from the 15th of December to the beginning of April. Navigation in the northern part of the Gulf of Bothnia is impeded from the end of November to the beginning of May, and in the north the gulf is covered with ice from November to the last half of May. Snow lies 47 days on an average on the plains of Skåne, while in the north it lies from 140 to 190 days.

The northern summers find compensation for brevity in duration of sunshine and light. At Karesuando in 68°26' N. and 1093 ft. above sea-level the sun is seen continuously above the horizon from the 26th of May to the 18th of July; at Haparanda for 23 hours, at Tornio for 15 and at Lofsdalen for 14. In the south at Stockholm the summer solstice brings not an inch of sunshine. Atmospheric refraction causes the sun to be visible for periods varying from south to north for a quarter to half an hour after it has actually sunk below the horizon. With the long twilight, perhaps 8 or 9 hours during the period of the summer solstice, a succession of atmospheric effects, day-light last without interruption from the 16th to the 27th of June as far south as Hernösand (60°36' N.).

The average annual rainfall for Sweden is 1972 in., locally increasing on the whole from north to south, and reaching a maximum towards the south-west, precipitation on this coast greatly exceeding that on the coast of the North Sea. Thus the average in the north of Norrland is 165 in., in the south of Norrland 226 in. At Borås, midway between the south end of Lake Vetter and the Cattgat, the average is 35-08 in., and 45-82 in. were registered in 1898. At Kalmar, however, on the Baltic opposite Öland, the average is 14-6 in. This is an extreme instance for the locality, but the minimum for all Sweden is found at Karesuando, with 12-32 in. of precipitation. The period of maximum is generally the latter half of summer, and the minimum in February; though at Stockholm the minimum occurs in January. The coast stations in Skåne and in the island of Gotland. The proportion of total precipitation which falls as snow exceeds 36% in the north, to 9% in the south.

Flora and Fauna.
The accompanying physical description is given of the vast extent of forest in Sweden. The alpine treeless region occupies only the upper flanks of the spinal mountain-range above 5000 ft. above sea-level, and extends from the Arctic circle to the 6000 ft. coast of the Greenland Sea, and from the mouth of the Baltic to the mouth of the Norwegian Sea. It is a belt of birch wood, with occasional mountain-ash and aspen, varying in width from about 20 m. in the north to a fraction of a mile in the south. Below this extends a great sub-alpine or mountain tract, with spruce, larch, fir, and pine. Pine bands below at the coast of the Baltic, Lake Vener and north of the Dal River. The fir (Pinus sylvestris) and pine (Pinus abies) are the predominating trees. Spruce is common, and even predominates in the higher parts (between the great valleys and immediately below the birch-belt) in the north of Norrland. Southern of the southern limit indicated, in the midland district of the great lakes, the oak (Quercus pedunculata) appears as well as pine and fir; and, as much of this area is under cultivation, many other trees have been introduced, as the ash, maple, elm and beech. The pines are numerous along the Swedish shore of the Baltic, Kalmar on the Baltic coast the beech begins to appear, and in Skåne and the southern part of the Cattgat seaboard becomes predominant in the woods which break the wide cultivated places. The oak, elm and alder are also found in the sheltered bays and inlets, where the maritime conditions are more endemic varieties); the bulk are immigrants after the last glacial epoch. Of these most are common to arctic lands, or occur in the mountainous regions of Europe, and which can therefore be regarded as belonging to the same faunal region as Sweden, as we advance from the south according to geographical distribution from south to north; thus while upwards of 1000 are found in Skåne, there are only about 700 in the midlands, 500 in the lower parts of southern Norrland and lower, and 100 in the far north.

Fauna.—The effects of the great latitudinal range of Sweden on its climate and flora has its parallel to a modified extent in the case of fauna. Only a few animals are common to the entire peninsula, and as the great majority of the species which occur are of the more southerly races, it is probable that certain others may be added if the high mountain region be left out of consideration, such as the squirrel, fox and various shrews. Among large animals, the common bear and the wolf have been greatly reduced in numbers even within later historic times. These and the lynx are now restricted to the solitary depths of the northern forests. Characteristic of the high mountain region are the arctic hare and the reindeer, which are almost the only animals that have remained imprinted in the forests of the high mountain massifs. In the north the partial retreats of the lowlands have a considerable temporary influence on the distribution of beasts and birds of prey. There may also be mentioned the wild reindeer, which is rare, though large domesticated herds are kept in the north, and the white-tailed deer which enter the lonely forests from the Arctic Circle even to the Småland highlands. The roe-deer and red-deer are confined to the southern parts; and the hare is found throughout the country. Among birds, which these plains the fox is most abundant, and the badger and hedgehog are found. Martens and otters are to some extent hunted for their fur. A white winter fur is characteristic of several of the smaller birds, which are confined to the forests. A few red deer and many ibex, and on the coasts the bears. On the coasts the seals are met with in the neighbouring seas, and Phoca vitulina is confined to the Baltic. Among birds by far the greater proportion is migratory. Characteristic types common to the whole country are the black grouse, sump, daub, and green plover and grey plover. In the northern mountains the ptarmigan is common, and like other creatures assumes a white winter dress; ducks and other water-fowl frequent the lakes; the ruff and the black-necked grebe, cormorant, black-throated loon, shelduck and sandy loon. Small birds the Lapland bunting (Emberiza lapponica) may be mentioned. In the coniferous forests the black grouse, hazel grouse and willow grouse, capercaillie and woodcock are the principal game birds; the crane is found in muddy clearings, birds of prey are numerous, and the Siberian jay in the north and the common jay in the south are often heard. But in the northern forests small birds are few, and even in summer these wildfowl give a strong general impression of wildness. In the middle part the ptarmigan is fairly common, though not readily enduring the harder winters; and ring-doves and stock-doves occur. The lakes are the habitat of the white-specialty; especially the middle and eastern lakes, while in the north the arctic murre, eider, auk, and gulls and terns are found, also the eider-duck and the sea-eagle, which, however, is also distributed far over the land. The species of reptiles and amphibians are few and chiefly confined to the south. Fresh-water fishes which are found are the common carp, the eel, the perch; three of lizard; and eleven of batrachians. The rivers and lakes are generally well stocked with fish, such as salmon, trout of various species, gwyniad and vendace (especially in the north), pike, eels, perch of various species, turbot, bream and roach. Few sportsmen who have visited the higher parts of the great northern rivers have found excellent trout-fishing, with pike, perch, char and grayling, the char occurring in the uppermost parts of the rivers, and the grayling below them. The fisheries, both fresh-water and sea, are important, and fall for consideration as an industry. The herring, cod, flatfish, mackerel and sprat are taken in the seas, and the latter seems to be the home of many species. The brackish waters of the east coast sea fish are found, together with pike, perch and other fresh-water forms. The crayfish is common in many places in central and southern Sweden. Pearls are some-
The population in 1908 was about 5,429,600. In 1721 it was 1,802,373, and in 1865, 4,114,141. The average annual increase was 7.86 per thousand in the 19th century, reaching a maximum of 19.39 in 1841-1860, before the period of rapid emigration set in. Emigrants numbered 38,259 men and 424,560 women between 1851 and 1900, these figures helping to account for the considerable excess of women over men in the resident population, which in 1900 was as 104:100. The periods of greatest emigration were 1868-1873 and 1879-1883; the decline in later years is regarded as a favourable sign. The United States of America receive a large majority of the emigrants, and only a very small percentage returns. The Swedish people belong to the Scandinavian branch, but the population includes in the north about 20,000 Finns and 7000 Lapps. Other foreigners, however, are few, and the population is a whole homogeneous.

Immigrants in the period 1851-1900 numbered only 165,357.

The highest mortality is found in the districts about Lken and Vetter; the highest in Norrotten, the east midland districts, Skde, and Gtebo och Bohus Län. The percentage of illegitimacy is rather high (though it decreased during the second half of the nineteenth century); one cause of this may be found in the fact that the percentage of married persons is lower than in most European countries. As regards social evils generally, however, the low, though undoubtedly improving, position of Sweden has had one of its chief reasons in the national intemperance. In 1775 Gustavus III. made the sale of spirits (brannvin) a government monopoly, and the drinking habit was actually fostered. After 1868 it is estimated that nine gallons of spirits were then consumed annually per head of the population. Mainly through the efforts of Peter Wiesegren, dean of Gothenburg (1800-1877), a strong temperance movement set in, and in 1885 important liquor laws were passed to restrict both production and sale of intoxicating liquors. The so-called Gothenburg System, providing for municipal control of the sale of intoxicants (see Liquor Laws), remained in full operation in Gothenburg until 1885. The temperance movement has had its reward; the average of consumption of beer and spirits in Sweden is considerably lower than in Europe as a whole, though the effect of prohibition on intoxication is somewhat limited and difference of temperatne is noticeable between the Swedes and Norwegians, the Swedes being the more light-hearted and vivacious. In some of the more remote parts of the country old customs are maintained and picturesque local costumes still worn, as in Dalecarlia (q.v.). The Lapps moreover retain their distinctive dress. In other cases early customs are preserved only as a historical reminiscence at festivities. Although the characteristic celebrations at weddings or periodical festivals are, as elsewhere, decreasing in favour, there are certain occasions which are observed as local customs. Christmas is a typical example. The carol-singing is a long established custom among the people. This alcoholic beverage, with its mixture of spirits and a glass of spirits. The more characteristic Swedish sports are naturally those of the winter. These include ski-running (skidlpping), skating and skate-sailing, tobogganing and sledding. The numerous inland waters and sheltered channels within the stergård have caused the high development of sailing as a summer sport, the Royal Swedish Yacht Club having its headquarters in Stockholm. Athletic sports are in high favour, especially such winter sports as snow-shoeing (skib), and, among ball games, lawn-tennis, and to some extent football, together with the game of park, peculiar to Gotland, are played.

1 Island included in Kalmar Län.
2 Including the four great lakes, Vener, Vetter, Målar Hjelmar, 3516 sq. m.
rich in historic sites and remains. In ecclesiastical architecture Sweden possesses the noble cathedrals of Lund, Upsala and Linköping; while that of Skara, near the southern shore of Lake Vener, dates originally from 1150, and that of Stenstägn on Lake Milar was constructed in 1262. All are Gothic in style, with aisles, transepts and towers, and constitute admirable examples of the national architecture of the 14th and 15th centuries. But the richest locality as regards ancient ecclesiastical architecture is the island of Gotland (q.v.).

Travel and Communication. - As a resort for foreign travelers and tourists Sweden is in the first rank in the northern territory of the continent, and possesses one of the most extensive railway systems in Europe. The Göta canal route, however, is used by many; the uplands of Dalecarlia (Dalarna) are frequented; and the railway through the Jämtland and Värmland parcellings into the western region, where numerous sanatoria are in favour with the Swedes themselves. The northern railway offers a land route to the Arctic coast of Norway. Along the southern coasts there are many watering-places. Malmö and near Gothenburg is one of the most fashionable. Örnsköldsvik, Lysekil and Varberg are on the same coast, Ronneby on the Baltic, with its chalybeate springs. Västra kaptenen, and several villages in the neighbourhood of Stockholm may also be noted. The government has made grants towards the construction of its trunk lines, and has in a few cases taken over such lines. The railways form a network over the country as far north as Gelle and across the northern parcellings of the country, and lines from Stockholm to Malmö, to Gothenburg and to Christiania as far as the Norwegian frontier, and other important through lines in the south. The great northern line is also worked by the government. The length of the construction and the main lines is nearly 6500 miles, or about one-third of all the government lines and about 60% of the private lines is 1435 metres (4 ft. 8½ in.). Nearly all the lines are single. Passenger travelling is slow, but extremely comfortable. The principal communication is through the chain of cathedrals from Malmö to Copenhagen, and from Trelleborg to Sassnitz in Germany.

The extensive system of natural waterways, especially in central Sweden, has been utilized to the full in the development of internal traffic. Where there is a river, a lake, or an estuary, water affords opportunity for safe and economical coastwise traffic. The earliest construction of canals dates from the 15th century, the patriot Engelbrekt and King Gustavus Vasa both foreseeing its importance. The theories of construction remained rudimentary until early in the 19th century, when the Göta (q.v.) canal was opened. The total length of the canaled water-system of Sweden is a battle over 700 m., though wholly artificial waterways amount only to 115 m. out of this total. A large local traffic is carried on by steam launches on the lakes during the season of open navigation; and vessels have been even introduced on the construction of canals in the province of Värmland. A connection with the timber trade. Posting, which is of importance only in the highland districts and the valley roads of Norland, is carried on by posting-stations (skjutstation) under government control. There are also ferries over the many navigable parts of the great northern rivers, rowing boats on the lakes form the only means of travel. The condition of the high roads is fair as a whole, and the inland waterways are in a very good state. Public ferries are in extensive use. They are not numerous in proportion to their upkeep; but in Norrland they are naturally not of the best. The postal and telegraph system is efficacious, and the telephone service, maintained partly by the state and partly by companies, is more and more extensively introduced. Telephone is in use per thousand of population, and a system of trunk-lines between the important towns has been established since 1889.

Agriculture. - Of the total area land of Sweden only about 13% is actually arable. The export of raw materials and foodstuffs forms a large part of the total export from the country, and will be considered in detail below. In the midlands about 50%, in the north from 4½% in southern Norrland to 3% in northern Norrland. Almost exactly half the total area is under forest, its proportion ranging from 25% in Skåne to upwards of 70% in the inland parts of Svealand and in the south of Norrland. Land which is neither cultivable nor under forest (mainly marshy, peaty districts, land above the upper limit of the forests) amounts to 61% in the far north and 36% in the Småland highlands, but only to 15% in the central plains and in Skåne. In the more highly cultivated districts the forest is mainly maintained by small independent farmers (only about 15% of the farms are worked by tenants), but until late in the 18th century a curious method of forest management prevailed. Each forest, consisting of a number of detached plots or strips, the divisions often becoming so minute that deforestation was inevitable. Early in the 19th century various enactments made it possible for each property to become a coherent whole. A legal parceling (förråde) was introduced in 1827 and slowly carried out in the face of considerable local opposition; instead, in the island of Gotland the system could not be enforced until 1870-1880. Roughly about 48½% of the total cultivated area is under cereals, 33½% under fodder-plants, 5½ under root-crops, and 11½ fallow, this last showing a steady decrease. Oats, rye, barley, mixed grain and wheat are the principal grains. But oats increased more in the earlier decades than any other, becoming the staple crop in Norrland, becoming the only grain-crop in the extreme north; in the richer agricultural lands of the midlands and south rye is predominant in the east, oats in the west. The distribution of agricultural cultivation is very irregular, perhaps the fact that although that province occupies only one-forth of the total area of Sweden, it produces 30% of the entire wheat crop, 33% of the barley, 18% of the rye and 13% of the oats. A system of rotation (cereal, roots, grass) is commonly followed, each division of land lying fallow one year as a rule; not more than two ripe grain-crops are commonly taken consecutively. Potatoes occupy about 2% of the land. These include the sugar-beet, the profitable growing of which is confined to Skåne and the islands of Åland and Gotland. The sugar industry, however, is very important. Orchards and gardens occupy about 1% of the land. Fruit trees are grown in the south and midlands; northward (as far as Härnösand) they flourish only in sheltered spots on the coast. Between 1850 and 1900 the total head of livestock increased from 4,500,000 to 5,360,000, and the great advance of cattle-farming is under the following proportions. Whereas in 1850-1875 imported cattle and cattle-farming produce exceeded exports as 12 to 7, in 1900 the value of the exports was to the imports as 3 to 1. As in the southern provinces as well as less as 1870-1885 the exports of agricultural produce exceeded imports in value, in 1896-1900 they were less than one-tenth. The principal breeds of cattle are the alpine in Norrland, and Swedish trotters, hard-shouldered, and heavy as a race, in the south. The Gotland, an old native light yellow breed, survives in the island of Gotland. Oxen, formerly the principal draught animals, have been replaced by horses. Cattle, especially cows, have greatly decreased in numbers. The Lapps own upwards of 230,000 head of reindeer. Dairy-farming is profitable. England and Denmark being the principal foreign consumers of produce, and the industry is carefully fostered by the government. A board of agriculture had been in operation for many years when in 1900 a separate department of agriculture was formed. There are one or more educational establishments in agriculture, such as the agricultural high schools at Ultuna nearUpsala, and at Alnarp near Lund in Skåne, an important agricultural centre, with dairy schools and other departments. There are in the province at large agricultural societies, large nurseries and gardening schools at Stockholm, Alnarp and elsewhere, and botanical gardens attached to the universities of Lund and Upsala.
dates from 1828. There are very numerous sawmills, using water-power, steam and electricity; they are situated chiefly in the coast districts of the Gulf of Bothnia, from Gelle northwards, especially in the vicinity of Sundsvall. There is also a large amount of fishing, and in the neighbourhood of all the ports as far north as Luleå and Haparanda. There are also upland mills in Dalarna and Värmland, and there are also some of them in the western provinces. The wood-pulp industry centres in the districts west and north of Lake Vener and south of Lake Vetter. In the latter vast quantities of timber are floated down the great rivers, and the lesser streams are used for ordinary purposes. There are many iron-ore districts, of which the limestone for the blast furnaces is often worked in the same quarry. Textile industry is Skåne, at the south end of the Sound, the cement works of Lomma in this vicinity, and the pottery works of Körstand in, and close to, Sweden, where beautiful manufactured china is produced. Stone is worked chiefly in Göteborg och Bohus and Blekinge Län.

**COMMERCE**—Exports include £20,000,000 and imports £40,000,000, of a aggregate tonnage of 17,500,000, enter and clear the ports. The principal ports of register are Gothenburg, Stockholm, Helsingborg and Gelle, in order; though the principal commercial ports are Stockholm, Gothenburg, and Helsingborg. The coast trade is considerable, and the skärgård excellent natural harbours are almost without number. Artificial harbours are consequently few. But, those at Helsingborg, Malmö, Halmstad, Ystad and Kalmar are exceptionally fine, and may be considered indicative of the high standard of construction. They are of stone, and their most westerly, at the mouth of the Kattegat, are reared on the rock. They are not more than 4-5 ft. above the sea at low water, and are on the coast 66% in the north of Sweden; and less than that of Göteborg; this far exceeds other European ports, though it is equalled by those in America. The vessels used in the pig-iron is produced with charcoal only; its quality is excellent, but Sweden’s proportion to the world’s produce is hardly more than 1%, whereas in the 17th and 18th centuries, before the use of coal, the production was high. The ironworks and blast-furnaces are almost wholly in the midland districts. Copper has been mined at Falun since the 14th century; it is also produced at Arvidshög in Österbotten, often of considerable quality, and in the neighbourhood of the lakes. Coal is produced in small beds in Skåne, east and north of Helsingborg, at Billingeby, Bjurf and in other parts; important rafts of iron-ore are found in the vicinity, some 300,000 tons annually. Mining administration is in the charge of a special bureau of the board of trade. The Iron Institute (Järnkontoret) was established in 1748 as a financial institution, in which the iron-mining companies have share in management of advantageous loans and promotion of the industry generally. It maintains a special education and investigation fund. The iron-mining at Stockholm (the higher school), Falun and Filipstad in Värmland.

Manufactures.—In the total value of the output of the manufacturing industries in Sweden be taken as 106, the following are the main branches: 1st. textile industry in the provinces of Skåne and Östergötland, especially for its cotton goods. 2nd. iron and steel, largely used in the shipbuilding industry, and in the neighbourhood of the ports. 3rd. machinery, especially for its cutting. A few other establishments, including both mechanical workshops and ore-extraction works may be mentioned: Domnarvet, on the Dal River, near Falun; Sundviken,等情况。
other banks are joint-stock banks and savings-banks, of which the total number in Sweden in 1890. The post office savings-bank was opened in 1884.

Coinsage.—The counting unit in the Swedish coinage is the krona, equal to £1 shilling. The monetary unit is 10 kronor gold, and gold pieces, not wide in the revenue (bodisagor), which was seven-eighths of the whole, customs, the taxes on spirits and beet-sugar, and income from the post office.

The departments to which the revenue expenditure is devoted are those of the army, the interior, the navy and education. A large proportion of the army expenditure was formerly defrayed by a system of military tenure on certain lands. Land-taxes, however, were finally abolished in 1804, and their place was taken by an increased taxation on real estate, the triennially, and by an income tax arranged on a sliding scale, up to 4% of the income (6-9 pence in the £), settled according to individual declaration. The national debt was practically nil until c. 1835, and the debt contracted thereafter owes its existence almost wholly to railway construction. It increased from about £5,300,000 in 1860 to £6,400,000 in 1870 and £18,600,000 in 1900. In 1901, it exceeded £20,000,000.

The greater proportion of communal revenue comes from income and capital from property under the Gothenburg System, and contributions from the treasury. Primary education, poor relief, and Church purposes form the principal items of this revenue.

Constitution and Government.—Sweden is a limited monarchy, the constitution resting primarily on a law (regerings-forren) of the 6th of June 1809. The king is irresponsible, and executive power is vested in him alone. All his resolutions, however, must be taken in the presence of the cabinet (statsråd). The cabinet councillors are appointed by the king and are responsible to the parliament (Riksdag). They are eleven in number, one being prime minister, two others consultative ministers, and the remaining eight heads of the departments of administration, which are justice, foreign affairs, land defence, naval defence, home affairs, finance, public works, agriculture. The councillors must be of Swedish birth, and must have been in the possession of the Lutheran confession. The appointment of the majority of public officials is vested in the king, who can himself dismiss cabinet ministers and certain others, whereas in most cases a judicial inquiry is necessary before dismissal. The king shares legislative powers with the Riksdag, (parliament or diet), possessing the rights of initiation and absolute veto. He has also, in certain administrative and economic matters, a special legislative right.

The Riksdag consists of two chambers. The members of the first chamber are elected by the landsdöningar, or representative bodies of the län, and by the municipal councils of some of the län, or the representatives of the inhabitants of the towns. The members of the second chamber number 230, of whom 150 are elected from rural constituencies and 80 from towns. The members receive a salary of 1,200 kronor (£60), and are elected for a period of three years by electors, or directly, according to the method of the electoral districts. If a member retires during that period, or if the chamber is dissolved, succeeding members are elected for the remainder of the three years, and thus the house is wholly renewed at regular intervals, which is not the case with the first house. The franchise was for long extremely limited in comparison with other countries, but in 1897 universal manhood suffrage was introduced, after protracted dissension and negotiation between the two houses. Eligibility to the lower house necessitates possession of the elective franchise, an age of at least 25 years, and residence within the electoral constituency. Both chambers have in theory equal power. Before a bill becomes law, but when they differ on budget questions the matter is settled by a common vote of both, which arrangement gives the second chamber a certain advantage from the greater number of its members. By revisers elected annually the Riksdag controls the finances of the kingdom, and by an official (justitieombudsmannen) the administration of justice is controlled; he can indict any king's servant of the state who has abused his power. The bank of the kingdom is supervised by trustees elected by the Riksdag, and in the same way the public debt is administered through an office (rissgällskontoret), whose head is appointed by the Riksdag.

Local Government.—For the purposes of local government Sweden is divided into the 25 administrative counties (län) each of which is governed by a council and an executive council (majors). A large proportion of the revenue is given in the paragraph dealing with population. The elected representative body in each is the landsdöningar, which deliberates on the affairs of the län and has a right to levy taxes. The chief official of the län is the länshöfder, under whom are secretaries and fiscal departments. Privilegion towns, receiving their privileges from the government (not necessarily on the basis of population), are governed by a mayor (borgmästare) and aldermen (rådmän), the aldermen being elected by the citizens, while the mayor is appointed by the government from the first three aldermen on the poll, is paid, and holds office for life. Gothenburg has two mayors, and the city of Stockholm has three.

The major rural divisions are the fägderier, under bailiffs, a subdivision of which is the länsmansdistrikt under a länsmann. The fägderier are subdivided into judicial divisions (tingslag). Each tingslag has a court (härads-tingslag), consisting of a judge and twelve unpaid assessors (häradsränta), of whom at least three are by law to vote them. The town-courts in the privileged towns are called rättstingsförvaltare, and consist of the mayor and at least two aldermen.

The navy.—General military service is enforced. Every Swedish man below 50 years of age (85 years for officers) between the age of 21 and 40, during which time he serves eight years in the first levy, four in the second, and eight in the reserves. The conscripts were formerly trained for 90 days, but according to the law of 1901, the conscript is bound to serve in time of peace in the infantry, position artillery, fortress artillery, fortress engineers, and the army service corps a total of 240 days; and in the cavalry, field artillery, (Kavalleriet, Fältartilleriet, and the Tingslag) a total of 120 days. The permanent cadres number about 22,000, and about 85,000 men are annually trained as recruits or recalled for further training. The organization of the army in time of peace is as follows: 82 battalions of line infantry, 799 regiments of line cavalry, 351 field batteries, 24 field and 7 position artillery batteries, 10 fortress artillery, 16 engineer, and 18 army service corps companies. There are six divisions, (I. to VI.), of which the 1st and 2nd are divided into the Gotland troops and the 3rd, 4th, 5th, and 6th into the Gotland troops at Visby. A division in time of war would probably consist of 2 battalions of infantry (4 regiments, 12 battalions), with 4 squadrons of cavalry, 1 artillery regiment, 1 company of engineers, &c. A cavalry division would consist of 2 brigades of 8 squadrons each, and 1 brigade of horse artillery. It is estimated that 500,000 men are available for service in the various capacities in case of war. There are fortresses at Stockholm (Vaxholm and Oscar-Fredriksborg), Boden on the northern railway near the Russian frontier, Karlsborg on Lake Vetter, and Karlskrona; and there are forts at Flora, Ystad, and on 60 islands.

The reforms of 1801 abolished the sällskapsrätter, a body including both infantry and cavalry, which was divided in various parts of the country, in some cases having their houses provided for them. This peculiar system of military tenure (indel) of the samhällsrätt, was originated in the reign of Charles XI, and certain landowners were exempt from other military obligations if they provided and maintained armed men. The navy is small, including 11 ironclads of 3100 to 3650 tons. The personnel consists of a cadre, reserve and fleet conscripts, including all the trained seamen and 1000 officers, with headquarters at Vaxholm and Karlskrona. The principal naval station is Karlskrona, and there is another at Stockholm.

Religion.—More than 99% of the total population belong to the Swedish Lutheran Church, which the state supports. The country is divided into 12 dioceses and 186 deaneries, the head of the church of Upsala being archbishop. The parish is an independent unit in Swedish ecclesiastical connexions. The rector presides over the local school board, which is appointed by the church assembly (kyrkostämman), and thus an intimate relation between the church and education has long been maintained. A peculiar duty of the clergy is found in the husförhör or meetings.
designed to enable the priest to test and develop the religious knowledge of his parishioners by methods of catechism. It was formerly enjoined upon the clergy to visit parishioners for this purpose, and the system is still maintained in the form of meetings, which have been held in Lutheran parishes since 1618. The clergy have a choice between a devotional or a pastoral form. The parishes number 2556, but one living may include more or less only one parish. In the sparsely inhabited districts of the north, parishes sometimes extend over many square miles. Gullivara, an area of about 6500 sq. m. In such cases the priest often makes protracted journeys from farm to farm through his parish, and on certain occasions the congregation at his church will include men and women from many different farms for several days in order to be present. Dissenters are bound to contribute to the maintenance of the Swedish Church, in consideration of the secular duties of the priests.

The connection between the church and education is so close that the control of both is vested in a single department of the government. Primary education is carried on in common schools of different grades, under both local and state inspection, the parish being the school district. Seminaries are maintained for common school teachers, with a four-years' course. At Haparanda and Mattissudden in Norbotten there are special institutions for teachers for the Finnish and Lapp populations respectively. Wide attention was awarded to Swedish educational methods principally by the introduction of the system of Sloyd (stöfd), initiated at the Näs seminary near Gothenburg, and consisting of the manual training of boys and girls, both for boys and girls. The higher education of the people is provided by people's high schools in the rural districts, especially for the peasantry, maintained by the county councils, agricultural societies and the state, Tove. These schools are provided in geographically extensive areas and in special practical subjects according to local needs. The men's course is held in winter; and a women's course, in some instances, has been worked out which includes in their studies a similar object. A system of university extension has been developed on the English pattern, summer courses being held at Upsala and Lund. In connexion with the army reform of 1901 a system of military instruction has been introduced into the public schools. Technical education is provided in higher schools at Stockholm, Gothenburg and certain other large industrial centres; and in lower schools distributed throughout the country, in which special attention is paid to the teaching of local languages and the more practical subjects. Technical training for boys and forestry schools have been mentioned in the paragraphs on these subjects. Public schools for boys are provided by the state, each bishopric having a separate system. In his system there are three lower classes (out of a total of nine) a single system of instruction is practised; thereafter there are classical and scientific sides. Greek is taught only in a section of the upper classical classes. Of modern languages, German is taught throughout; English in all classes of the scientific side, and the upper classical classes. Much attention is paid to singing, drill and gymnastics. The school terms together occupy 341 weeks in the year. At the schools exceedingly few entrants are allowed into the universities or higher special schools. Owing to the high development of state public schools, private schools for boys are few; but higher schools for girls are numerous. The state normal schools for girls and the state normal school at Stockholm. The state universities are at Upsala and Lund, and with these ranks the Caroline Medical Institution at Stockholm. There are universities (founded by princely establishments), the Catholic university at Upsala, and the State university at Gothenburg. The faculties at Upsala and Lund are theology, law, medicine and philosophy (including both art and science). The courses are long, ranging from six to nine years; and the degrees are those of candidate, licentiate and doctor. The students, who are distinguished by their white caps, are divided for social purposes into "nations" (landshuf) of ancient origin, based upon the distinctions between natives of different parts.

Scientific Institutions.—Among the scientific and literary societies are to be noted the Swedish Academy, consisting of 18 members, which was instituted in 1786 by Gustavus III., after the pattern of the French Academy. It is the culmination of the Swedish language and literature; and the Academy of Sciences was founded in 1739 by Linnaeus and others for the promotion of the natural sciences. The first distributes one and the second two prizes annually. The upland and People's University is a fourth institution under the Caroline Institution at Stockholm. There may be mentioned further the Royal Academies of History, Literature and Antiquities (1786), of Agriculture (1811), of Arts (1725) and of Music (1748). There are also Academies of Sciences in Stockholm, Upsala and Lund, and Gothenburg. The Royal Library in the Humlegård Park at Stockholm, and the university library at Lund, contain the largest collection of historical and scientific works published in the kingdom. Certain of the large towns have excellent public libraries, and parish libraries are widely distributed.

See Sweden, its People and its Industry, a government publication (eng. ver., Stockholm, 1894); Dagens Elvhans officiell Statistik (Stockholm, 1857 seq.); Statistisk Tidskrift, periodically from 1862; Publications (year-book, guides, &c.) of the Svenska Turistsällskapet (Swedish Touring Club) Stockholm; periodical Bulletin of the Geological Institute of Upsala University, in which may be noted K. Ahlénius, Beiträge zur Kenntniss der Seenkettenregion in Schwedisch- Lappland, No. V, (1900); Also, Dahlman, Introd. till Sveriges geografi (Stockholm, 1857); Statistisk Lexicon over Sveriges geografi (Stockholm, 1859-1870); M. Höjer, Konungariket Sverige (Stockholm, 1875-1885); C. Almqvist, La Suède, ses progrès sociaux (Stockholm, 1879); P. B. Di Chaillo, The Land of the Midnight Sun (London, 1881); C. M. Rosenberg, Geografisk-statistiskt handlexicon over Sveriges geografi, (Stockholm, 1882-1883); W. W. Thomas, Sweden and the Swedes (Chicago and New York, 1891); Healey, Educational Systems of Sweden, Norway and Denmark (London, 1883); Nyström, Handbok i Sveriges geografi (Stockholm, 1895), and Sveriges rike (Stockholm, 1902); G. Andersson, Geschichte der Vegetation Schwedens (Leipzig, 1873); K. Ahlénius, Sverige, geografiskt-statistiskt betræffende (Stockholm); and for geology, A. G. Nathorst, Sveriges geologi (Stockholm). For more detailed accounts of the various districts see the publications of the Sveriges Geologiska Undersöknin, and also the volumes of the Geografiska Föreningen i Stockholm Förhandlingar.

Remains dating from the Stone Age are found scattered over the southern half of Sweden, but it is only along the south coast and in the districts bordering on the Cattegat that they occur in any considerable quantity. The antiquities of the Bronze Age are much more widely distributed and reach as far as the north of Helsingland. It is evident that the country must at that period have been inhabited by a people who knew the art of metal which they have acquired from the human remains found the population in general, and both the Stone and Bronze Ages seems to have been similar in type to that of the present day, and there is no clear evidence for the advent of a new race. The Iron Age probably began in the south of Sweden at any rate some three or four centuries before the beginning of the Christian era. (See further Scandinavian Civilization.)

The first historical notice relating to Sweden is contained in Tacitus, Germania, cap. 44. This book was probably published in a.d. 98 or 99 and in the passage mentioned we find the earliest mention of the people of the peninsula, the Swedes proper, Suiones (O. N. Svar, Swe., Swed. and Swar A. S. Sveon), who eventually gave their name to the whole country. According to Tacitus they were governed by a king whose power was absolute and comprehensive, and possessed a strong fleet which secured them from the fear of hostile incursions. Hence arms were not borne in times of peace but stored away under charge of a slave, and Tacitus suggests in explanation that the royal policy did not commit this trust to noble, Freeman or freedman. Their original territories were the Baltic coast and the peninsula later governed by Upland, Södermanland and Westergötland. Tacitus mentions another tribe, the Sittones, which he places next to the Suiones, but they have not been identified, and it is not clear from his description whether they lived within the peninsula or not. The only information he gives about them is that they were ruled over by a woman. Other early Roman writers, Mela and Pliny, mention the country under the name Scandinavia (Skåne), a name which in native records seems always to have been confined to the southernmost district in the peninsula. Little information, however, is given by these authorities with regard to the people.

The people next in importance to the Suiones in the peninsula (Swed. Gütar, O. N. Gautar, A. S. Geotar) are first mentioned by Ptolemy (under the form Goutai for Gautoi), together with a number of other tribal names, most of which unfortunately cannot be identified, owing to the corrupt state of the text. Ptolemy puts the Gütar in the southern part of the country, and from the earliest historical times their name has been given to the whole region between the Cattegat and the Baltic, exclusive of the provinces of Halland and Skåne which down to the 17th century always belonged to Denmark. The coast of the Cattegat north of the Göta Elv was reckoned in Norway. Götalnd consisted of the provinces of Västergötland and Östergötland divided from one another by Lake Vetter, together with Småland. In early times Västergötland seems to have been by far the most important. Vermland, the district to the north of Lake Vener and the
whole of the country to the north of Svealand seem to have been of small importance. Jämtland was always considered a part of Norway. After the time of Orðgenteow we hear no more of Sweden until the 6th century, when a surprisingly full account of its peoples is given by the Gothic historian Jordanes. He mentions both the Svear (Swethans) and the Götar together with other peoples, the names of several of which can be recognized in the district—names of later times, in spite of the numerous corruptions of the text. He praises the horses of the Svear and speaks of their great trade in furs of arctic animals which were transferred, from merchant to merchant until they reached Rome. About the other peoples of Sweden he gives a few details, chiefly of physical or moral characteristics, commenting upon the wild nature of the Visigauti, the mildness of the Finns, the lofty stature of the Vinovii and the meat and egg diet of the Rerfenae. Jordanes's statement regarding the prevalence of trade with Sweden is corroborated by the fact that many coins and bracteates of the period have been found in the country. Of these the coins are chiefly Roman and Byzantine gold pieces of the 5th century, the bracteates copies of Roman coins of the same period.

Procopius, the contemporary of Jordanes (Gothica, ii. 15) likewise gives an account of Sweden, which he calls Thule, but the only tribes which he names are the Skridephennio (A. S. Scríðenmas), a wild people of Finnish stock, and the Götar (Gautoi) whom he describes as "a nation abounding in men." For the same period we derive a considerable amount of information with regard to Swedish affairs from the Anglo-Saxon poem Beowulf. The hero himself belonged to the Greatas (i.e. in all probability Götar, though the identification is disputed by some scholars), his mother being the daughter of their king Hrethel. Haethcyn, the son and successor of this Hrethel, is said to have perished in a disastrous battle against the Svear, but his fall was avenged by his brother Hygelac in a subsequent engagement in which the Swedish king Olfur, son and successor of Hygelac. According to the poem Beowulf himself now became king of the Götar and assisted Eadgils in a campaign which resulted in the death of Onela and the acquisition of the throne by his nephew. What is said in the poem with regard to the end of Beowulf belongs to the realm of myth, and for three centuries after this time we have no reference to Swedish affairs in English or other foreign authorities. Moreover after the time of Beowulf and Jordanes there are very few references to the kingdom of the Götar and in Olaf Skattkonungr's time it was much reduced. The kingdom must have come to an end between the 6th and 10th centuries A.D., and probably quite early in that period.

The Ynglingatal, a poem said to have been composed by Thjóðólfr of Hvín, court-poet of Harold Fairhair, king of Norway, gives a genealogy of Harold's family, which it carries back to the early kings of the Svear. Snorri Sturluson (1178–1241) the Icelandic author using this poem as a basis and amplifying it from other sources, wrote the Ynglinga Saga, which traces back the history of the family, generation by generation, to its beginning. In this saga Æblis (the Eadgils of Beowulf), son of Öttar is one of the most prominent figures. The account given of him is in general in keeping with the statements in Beowulf, though the nature of his relations with Ali (Onela) has been misunderstood. The decisive battle between the two kings is said to have taken place on the frozen surface of Lake Wener. Öngenteow appears to have been entirely forgotten in Norse tradition and his place is taken by a certain Egil. The saga further states that Æblis was an enthusiastic horse-bredner and that he met with his death through a fall from his horse. This point is of interest in connexion with the notice of Jordanes, mentioned above, with regard to the horses of the Svear. Other northern authorities such as Saxo and the Hroths Saga Kraka represent Æblis in a very unfavourable light as niggardly and addicted to sorcery.

The Ynglingatal and Ynglinga Saga enumerate Æblis's ancestors to no less than seventeen generations, with short accounts of each. We have no means of checking the genealogy from other sources, and the majority of the characters are probably to be regarded as mythical. The origin of the family is traced to the god Frey, son of Níðr, who is said to have founded Upsala, the ancient capital of Sweden. His reign is represented as a golden age of peace and prosperity and the great wealth of the sanctuary is said to have taken its beginning from the offerings at his tomb. His full name appears to have been Ævnigfrír or Ingunar Freyr and his descendants are collectively termed Ynglingar, though we also occasionally meet with the name Skillingar, which corresponds with the name Skillingar borne by the Swedish royal family in Beowulf.

After the time of Æblis the Ynglingar remained in possession of Upsala for four generations according to the saga. Ultimater, the treachery and the murderous disposition of the king named Ingiald led to his overthrow by a prince from Skåne, called Ívarr Vífaðaði. His son Olafr Trételega withdrew to Vermland, which he brought into a state of cultivation, though he was subsequently sacrificed by his subjects in a time of famine. It is stated in the saga that the Swedish kings were believed to have control over the seasons like their ancestor, the god Frey, and traces of this belief seem to have lingered in the country down to the times of Gustavus Vasa. The sons of Olafr Trételega moved westward into Norway, and if we may trust the saga, the Swedish kingdom never again came into the possession of their family.

The subsequent kings of Sweden are said to have been descended from Ívarr Vífaðaði. The most prominent figures in this family are Harald Hilditönn Ívarr's grandson and his introduc
tion at Christianity. The story of the battle between these two at Bråvik, in which Harald lost his life, is one of the most famous in northern literature. But the position of these kings with regard to Sweden is far from clear. Their home is probably to be placed on the Cattegat rather than on the Baltic. The same is true also of Ragnar Leifbrók, who is said to have been the son of Ívarr Hringr. About the year 830 the missionary bishop Ansgar made his first expedition to Sweden. He made his way to Birca on the Mälar. The king whom he found reigning there is called Björn (Bern) and is generally identified with the king Björn for whom Bragi the Old composed the poem called Ragnaradrýpa. On his subsequent journeys to Sweden Ansgar encountered kings called Olafr and Önundr. He appears to have met with considerable immediate success in his missionary enterprises, although there is no evidence to show that the churches he founded long survived his death, and no serious mission seems to have been attempted for more than a century afterwards.

During the 9th century extensive Scandinavian settlements were made on the east side of the Baltic, and even as early as the reign of Louis I. we hear of piratical expeditions on the Black Sea and on the Caspian. The famous expeditions of Rurik and Askold which resulted in the origin of the Russian monarchy appear to have taken place towards the middle of the 9th century, but it has not been found possible to connect these names with any families known to us from Swedish tradition. Proofs of extensive Scandinavian settlement in Russia are to be found partly in the Russian names assumed by the Dnieper rapids by Constantine Porphyrogenitus, partly in references to this people made by foreign representatives at the court of Byzantium. The fact that many of the names which occur
in Russian chronicles seem to be peculiarly Swedish suggests
that Sweden was the home of the settlers, and the best authorities
consider that the original Scandinavian conquerors were Swedes
who had settled on the east coast of the Baltic.

In the time of Harold Fairhair, probably about the beginning
of the 10th century, we hear of a king named Eric the son of
Emund at Upsala, whose authority seems to have
reached as far as Norway. Later in the century
there is record of a king named Bjorn a Haugi
who is said to have been the son of Eric and to have reigned
fifty years. Bjorn's sons and successors were Olaf and Eric the Victorious.
Systorbjorn Starkf, of Olaf the Victorious, and
Flodd, who came to England with Eric after his father's death,
made himself a stronghold at Jomsborg in Pomerania and
spent some years in piratical expeditions. Eventually he betook him-
self to Harold Bluetooth, then king of Denmark, and endeav-
oured to secure his assistance in gaining the Swedish throne
by force of arms. Although he failed in this attempt he was
not deterred from attacking Eric, and a battle took place between
the two at the Fyrise (close to Upsala) in which Systborm was
defeated and killed. Eric himself died ten years after this battle,
apparently about 993. According to the story he had obtained
victory over Bolin in return for a promise made him by Eric the Victorious,
but had in the meantime himself
established himself as the
overlord of the north, in spite of the king's own inactivity. She lost her lands east of the Baltic, but received as
compensation in Norway part of Trondheim and the district
of Hadeland. The latter king of Norway, probably
Olaf Tryggvason, had married his sister Ingibiorg to Ragnvald,
earl of Vestergotland, on condition that he should receive
baptism, and the Swedish king's wife was also a Christian, though
he himself was not baptized until 1008 by Sigfrid at Husaby.
A quarrel arose in the last years of the 10th century between
Olaf Skottkonung and Olaf Tryggvason. The latter had applied
for the hand of Sigrid, the widow of Eric the Victorious, but had
then himself received her refusal to become a Christian. In the year
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was formed between the king of Sweden, Sweyn Forkbeard,
king of Denmark, and Earl Eric of Lade, and the allies waylaid
their enemy off the coast near Rigen and overthrew him in
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## SWEDEN

Bremen in his *History* (iv. 26) apparently dates from the period immediately preceding these events. He describes the temple as one of great splendour and covered with gilding. In it stood the statues of the three chief deities, Thor, Odin and Frico (by whom he probably means Frey). Every nine years a great festival was held there to which embassies were sent by all the peoples of Sweden. A large number of cakes and even meats were sacrificed. Many such temples, the neighbourhood of the temple was a grove of peculiar sanctity in which the bodies of the victims were hung up. After the introduction of Christianity the importance of Upsala began to decline, and owing to its intimate associations with the old religion the kings no longer made it their residence.

### Authorities for Early History.—Tacitus, *Germania*, cap. 44; Claudius Ptolemaeus, *Geographica* ii. 11 ad fin.; Jordanes, *De origine actibusque gentis Goticae* iii. 5; *Hildebrandus, De bello gotico*, ii. 15; Bouchot, *Kerbeits, Vita S. Angarii in monumento Germaniae historicae*, i. 683–725 (Hanover, 1829); King Alfred's translation of *Orosius* iii. 11; Adam of Bremen, *Gesta Hammaburgensium ecclesiae pontificum* iii. and iv.; *Vulgata Sacra*, with the poem *Ynglingatal* contained in the *Heimskringla*; *Olaf's Saga Tryggvasonar* and *Olaf's Saga Hrani Helgi*, both contained in *Heimskringla* and in *Fornminnir*; *Sagor gramaticarum scissae Danum*; a collection of later Swedish Chronicles contained in *Rerum scandinavum scriptores*, vol. iii. (ed. Annerstedt, Upsala, 1871 and 1876); *Sveriges historia*, vol. i. (Monteius & Hildebrand, Stockholm, 1875–1877); Thomsen, *The Relations between Ancient Russia and Scandinavia and the Origin of the Russian State* (Oxford and London, 1877).

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### Separation of the Estates.

Between 1319 and 1344 the Riksdag was held twice a year. The union was broken in 1380, and the Estates met separately in Sweden in 1381, and in Norway in 1382. This was the beginning of the so-called *First Union with Norway*. Eric and of the Norwegian princess Ingeborg, who had inherited the throne of Norway from his grandfather Haakon V., was in the same year elected king of Sweden (Convent of Oslo). A long minority weakened the royal influence in both countries, and Magnus lost both his kingdoms before his death. The Swedes, irritated by his misrule, superseded him by his nephew, Albert of Mecklenburg (1363). In Sweden, Magnus's partialities, and necessities led directly to the rise of a powerful landed aristocracy, and, indirectly, to the growth of popular liberties. Forced by the unrelenting of the magnates to lean upon the middle classes, the king summoned (1359) the first Swedish Riksdag, on which occasion representatives from the towns were invited to appear along with the nobles and bishops. Gustav made it a condition that the king was forced to go a step farther and, in 1371, to take the first constitutional oath. In 1388, at the request of the Swedes themselves, Albert was driven out by Margaret, regent of Denmark and Norway; and, at a convention of the representatives of the three Scandinavian kingdoms held at Kalmar (1397), Margaret's great-nephew, Eric of Pomerania, was elected the common king, but the liberties of each of the three realms were expressly reserved and confirmed. The union was to be a personal, not a political union.

### First Union of the Unions.

Neither Margaret herself nor her successors observed the stipulation that in each of the three kingdoms only natives should hold land and high office, and the efforts of Denmark (at that time by far the strongest of the three member of the union) to impose her will on the successor were only a series of semi-ruptures. The Swedes first broke away from it in 1444 under the popular leader Engelbrecht, and after his murder they elected Karl Knutsson Bonde their king under the title of Charles VIII. (1436). In 1441 Charles VIII had to retire in favour of Christopher of Holstein, who was already king of Denmark and Norway; but, on the death of Christopher (1448), a state of confusion ensued in the course of which Charles VIII was twice expelled and twice reinstated. Finally, on his death in 1470, the three kingdoms were reunited under Christian I. of Denmark, the pretates and higher nobility of Sweden being favourable to the union, though the great majority of the Swedish people always detested it as a foreign usurpation. The national party was represented by the three great *Riks- föreständare*, or presidents of the realm, of the Sture family (see *Sturup*), who, with brief intervals, from 1470 to 1520 successively defended the independence of Sweden against the Danish kings and kept the national spirit alive. But this combination was too casual and anomalous an institution to rally the nations round it permanently, and when the tyranny of Christian II. (p.r.) became intolerable the Swedish people elected Gustavus Vasa, 1523, as president who had already driven out the Danes (see *Denmark: History*), king of Sweden at Strengnas (June 6, 1523).

The extraordinary difficulties of Gustavus (see *Gustavus I*) were directly responsible for the eccentric development, both political and religious, of the new kingdom which his genius created. So precarious was the position of the young king, that he was glad to make allies wherever he could find them. Hence his desire to stand well with the Holy See. Only three months after his accession, he addressed letters to the pope begging him to appoint new bishops "who would defend the rights of the Church without detriment to the Crown." He was especially urgent for the confirmation of his nominee Johannes Magni as primate, in the place of the rebellious archbishop Gustavus Trolle, who as a convicted traitor had been formally deposed by the Riksdag and actually an outlawed exile. If the pope would confirm the election of his bishop and remove from the Church. Scarcely had these letters been despatched when the king received a papal bull ordering the immediate reinstatement of Gustavus Trolle. The action of the Curia on this occasion was due to its conviction of the imminent triumph of Christian II. and the instability of Gustavus's position. It was a conviction shared by the rest of Europe; but, none the less, it was another of the many blunders of the Curia at this difficult period. Its immediate effect was the loss of the Swedish Church. Gustavus could not accept as primate an open and
determined traitor like Trolle. He publicly protested, in the
sharpest language, that unless Johannes Magni were recognized
at Rome as archbishop of Upsala, he was determined,
of his own royal authority, henceforth to order the
Church in his realm to the glory of God and the satisfaction of all Christian men. But the Holy
See was immovable, and Gustavus broke definitely with Rome. He
began by protecting and promoting the Swedish reformers
Olavus and Laurentius Petri, and Laurentius Andreae. The
new teaching was allowed to spread, though at first unostenta-
tiously and gradually. A fresh step in the direction of Lutheran-
ism was the translation of the New Testament into
Swedish, which was published in 1526. Simul-
taneously, a systematic attack was made upon the religious
abuses, beginning with the sequestration of the
monastery of Gripsholm in January 1526. But the affair
caused such general indignation that Gustavus felt obliged,
in May, to offer some justification of his conduct. A few months
later there was an open rupture between the king and his own
primate, who ultimately was frightened into exile by a sudden
accusation of treason. But the other bishops were also against
Gustavus, and, irritated by their conscientious opposition, the
king abandoned the no longer tenable position of a mode-
rator and came openly forward as an antagonist. In 1526 the
Catholic printing-presses were suppressed, and two-thirds of
the Church lands were appropriated to the payment of the
national debt. On the 18th of February 1527 two bishops,
the first martyrs of Catholicism in Sweden, were gibbeted at
Stockholm after a trial which was a parody of justice. This
act of violence, evidently designed to terrorize the Church into
submission, was effectual enough, for at the subsequent Riksdag
of Vesterås (June, 1527), the bishops durst not even present
a protest which they had privately prepared, and the assembly
itself was bullied into an absolute submission to the
royal will. The Riksdag of Vesterås, which transferred all ecclesiastical property to the
Crown. By the subsequent Vesterås Ordinance the
Swedish Church was absolutely severed from Rome. Never-
theless, the changes so made were mainly administrative.
There was no modification of doctrine, for the general resolution
that God's Word should be preached plainly and purely was not contrary to the teaching of the ante-Tridentine Church. Even
at the synod of Örebro, summoned in February 1529, "for the
better regulation of church ceremonies and discipline according
to God's Word," there was no formal protest against Rome; and the old ritual was retained for two years longer, though it
would be explained as symbolical. Henceforth the work of the
Reformation continued uninterrupted. In 1531 Laurentius
Petri was elected the first Protestant primate of Sweden. Subse-
quently matters were much complicated by the absolutist
tendencies of Gustavus. From 1539 onwards there was a breach
between him and his own prelates in consequence of his arbitrary
appropriation of the Church's share of the tithes, in direct
violation of the Vesterås Recess. Then Gustavus so curtailed
the power of the bishops (ordinances of 1539 and 1540) that they
had little of the dignity left them, and even that he was
displeased with. After 1543 the prelates appointed by
him, without any pretense of previous election by the cathedral
chapters, were called ordinaries, or superintendents. Finally,
at the Riksdag of Vesterås, in 1544, though no definite
cession of faith was formulated, a final breach was made
with the traditions of the old religion.
Thus the Reformation in Sweden was practically the work
of one strong man, acting (first from purely political and latterly
from purely economical reasons) for the good of the state as
he understood it. In this Gustavus acted contrary to the
religious instincts of the vast majority of the Swedish nation;
for there can be no doubt at all that the Swedes at the beginning
of the 17th century were not only still devoted to the old Church,
but violently anti-Protestant. This popular Romanism was
the greatest of all Gustavus's difficulties, because it tended to
alienate the Swedish peasants.

For the last hundred years the peasants had been a leading
factor in the political life of the land; and perhaps in no other
contemporary European state could so self-reliant
a class of yeomen have been found. Again and
again they had defended their own and the national liberties
against foreign foes. In the national assemblies, too, their voice
had always been powerful, and not infrequently predominant.
In a word, they were the sound kernel of the still but partially
developed Swedish constitution, the democratic safeguard
against the monarchical tendency which was enveloping the
rest of Europe. Gustavus's necessities had compelled him to
break with the ecclesiastical traditions of Sweden; and they
also compelled him, contrary to his masterful disposition,
that he would not be the first to tremble. Moreover, his
military undoubtedly was his natural allies, but, from the nature of the case,
they tended to become his most formidable rivals. They prided
themselves on having "set King Gus in the high seat," but they
were quite ready to unseat him if his rule was not to their liking,
and there were many things with which they were by no means
contented. This anomalous state of things was responsible
for the half-dozen peasant risings which with Gustavus had
to contend from 1525 to 1543. In all these rebellions the religious
difficulty figured largely, though the increasing fiscal burdens
with which Gustavus taxed the Swedes and the peasants, and their private
dependence on the national liberties or to crush altogether
Catholic aspirations. At the time of his death the Riksdag
was already a power in the state, and a Catholic reaction in
Sweden was by no means an impossibility, if only the Catholics
had been able to find capable leaders.

Gustavus's foreign policy at first aimed at little more than
self-preservation. Only with the pecuniary assistance of the
wealthy merchants of Lübeck had he been able to
establish himself originally; and Lübeck, in return,
was admitted to Sweden at a later date, as was Spain, as a 
means to exploit her American colonies. When, with the aid
of Denmark, Gustavus at last freed himself from this greedy
incubus (see Denmark; GUSTAVUS I; CHRISTIAN III) by
the truce of the 28th of August 1537, Sweden for the first time
in her history became the mistress of her own waters. But
even so she was but of subordinate importance in Scandinav-
ian politics. The hegemony of Denmark was indisputable,
and Gustavus regarded that power with an ever-increasing
suspicion which augured ill for peace in the future. The
chief cause of dispute was the quartering by the Danish king of
the troops of Swedes and Danes, the Dano-Norwegian shield, which
was supposed to indicate a claim of sovereignty. Still more
offensive was the attitude of Sweden's eastern neighbour Muscovy,
with whom the Swedish king was nervously anxious to stand
on good terms. Gustavus attributed to Ivan IV., whose resources
he unduly magnified, the design of establishing a universal
monarchy round the Baltic.

Nevertheless events were already occurring which ultimately
 compelled Sweden to depart from her neutrality and lay
the foundations of an overseas empire. In the last
year of Gustavus's life (1560), the ancient military
order of the Sword, amalgamated, since 1537, with the
more powerful order of the Teutonic Knights, had by the seculari-
ization of the latter order into the dukedom of Prussia (1525)
become suddenly isolated in the midst of hostile Slavonians.
It needed but a jolt to bring down the crazy anachronism, and
the jolt came when, in 1558–60, floods of Moscovites poured over the land, threatening the whole province with destruction. In his despair the last master of the order, Gotthard von Ketteler, appealed to all his mild, civilized neighbours to save him, and his dominions were quickly partitioned between Poland, Denmark and Sweden. Sweden's original share of the spoil was Reval, which, driven to extremities, placed itself beneath the protection of the Swedish crown in March 1561. From the moment that Sweden got a firm footing in Estonia by the acquisition of Reval she was committed to a policy of combat and aggrandisement. To have retreated would have meant the ruin of her Baltic trade, upon which the national prosperity so much depended. Her next-door neighbours, Poland and Russia, were necessarily her competitors; fortunately they were also each other's rivals; obviously her best policy was to counterpoise them. To accomplish this effectually she required to have her hands free, and the composition of her long-outstanding differences with Denmark by the Treaty of Stettin on the 13th of December 1570 (see DENMARK: History), which put an end to the Dano-Swedish war of 1563–70, the chief political event of the reign of Eric XIV. (1560–1568), the eldest son and successor of Gustavus Vasa, was therefore a judicious act on the part of the new king of Sweden, John III. (1568–1592). Equally judicious was the anti-Russian league with Stephen Bathory, king of Poland, concluded in 1578. The war between Russia and Sweden for the possession of Estonia and Livonia (1571–77) had been uninterruptedly disastrous to the latter. and, in the beginning of 1577, a countless Russian host sat down before Reval, Sweden's last stronghold in those parts. The energetic intervention of Bathory, however, speedily turned the scales in the opposite direction. Six months after his humiliating peace with the Polish monarch, Ivan IV, was glad to conclude a truce with Sweden also on a uni possidentis basis at Pilsna (Aug. 5, 1582).

The amicable relations between Sweden and Poland promised, at first, to be permanent. Sixteen years before his accession to the throne, John III, then duke of Finland, had wedded Catherine Jagiellonica, the sister of Sigismund II, king of Poland (Oct. 4, 1562). Duke Sigismund, the fruit of this union, was brought up by his mother in the Catholic religion, and, on the 19th of August 1587, he was elected king of Poland. Sixteen days later the Articles of Kalmar, signed by John and Sigismund, regulated the future relations between the two countries when, in process of time, Sigismund should succeed his father as king of Sweden. The two kingdoms were to be in perpetual alliance, but each of them was to retain its own laws and customs. Sweden was also to enjoy her religion, subject to such changes as a general council might make; but neither pope nor council was to claim or exercise the right of releasing Sigismund from his obligations to his Swedish subjects. During Sigismund's absence from Sweden that realm was to be ruled by seven Swedes, six elected by the king and one by his uncle Duke Charles of Sudermania, the leader of the Swedish Protestants. No new tax was to be levied in Sweden during the king's absence, but Sweden was never to be administered from Poland. Any necessary alterations in these articles were only to be made with the common consent of the king, Duke Charles, the senate and the gentry of Sweden.

The endeavours of Swedish statesmen to bind the hands of their future king were due to their fear of the rising flood of the Catholic reaction in Europe. Under Eric XIV. the Reformation in Sweden had proceeded on much the same lines as during the reign of his father, retaining all the old Catholic customs not considered contrary to Scripture. Naturally, after 1544, when the Council of Trent had formally declared the Bible and tradition to be equal and authoritative sources of all Christian doctrine, the contrast between the old and the new teaching became more obvious; and in many countries a middle party arose which aimed at a compromise by going back to the Church of the Fathers. King John III., the most learned of the Vasa, and somewhat of a theological expert, was largely influenced by these "middle" views. As soon as he had mounted the throne he took measures to bring the Swedish Church back to "the primitive Apostolic Church and the Swedish Catholic faith"; and, in 1574, persuaded a synod assembled at Stockholm to adopt certain articles framed by himself on what we should call a High Church basis. In February 1575 a new Church ordinance, approximating still more closely to the patristic Church, was presented to another synod, and accepted thereat, but very unwillingly. In 1576 a new liturgy was issued on the model of the Roman missal, but with considerable modifications. To a modern High Anglican these innovations seem innocent enough, and, despite the opposition of Duke Charles and the ultra-Protestants, they were adopted by the Riksdag of 1577. These measures ireally encouraged the Catholic party in Europe, and John III. was ultimately persuaded to send an embassy to Rome to open negotiations for the reunion of the Swedish Church with the Holy See. But though the Jesuit Antonio Possevino was sent to Stockholm to complete John's "conversion," John would only consent to embrace Catholicism under certain conditions which were never kept, and the only result of all these subterfuge negotiations was to incense the Protestants still more against the new liturgy, the use of which by every congregation in the realm without exception was, nevertheless, decreed by the Riksdag of 1582. At this period Duke Charles and his Protestant friends were clearly outnumbered by the promoters of the via media. Nevertheless, immediately after King John's death, a synod summoned to Upsala by Duke Charles rejected the new liturgy and drew up an anti-Catholic confession of faith (March 5, 1593). Holy Scripture and the three primitive creeds were declared to be the true foundations of Christian faith, and the Augsburg Confession was adopted. That Sigismund, now the lawful king of Sweden, should regard the summoning of a Civil War. the synod of Upsala without his previous knowledge as Expulsion of a direct infringement of the Riksdag, which he had Proclamation of previously refused him that office) made a civil war inevitable. The battle of Stångåbro (Sept. 25, 1595) decides the struggle in favour of Charles—and Protestantism. Sigismund fled from Sweden, never to return, and on the 19th of March 1600 the Riksdag of Linköping proclaimed the duke king, but not till the 6th of March 1604, however, after Duke John, son of John III., had formally renounced his hereditary right to the throne, did Charles IX. begin to style himself king. At the Riksdag of the same year, the estates committed themselves irrevocably to Protestantism by excluding Catholics from the succession to the throne, and prohibiting them from holding any office or dignity in Sweden. Henceforth, too, every recusant was to be deprived of his estates and reduced to beggary.

It was in the reign of Charles IX. that Sweden became not only a predominantly Protestant, but also a predominantly military monarchy. This momentous change, which was to give a martial colouring to the whole policy of Sweden for the next hundred and twenty years, dates from a decree of the Riksdag of Linköping establishing, at the urgent suggestion of Charles, a regular army; each district in the country being henceforward liable to provide and maintain a fixed number of infantry and cavalry for the service of the state. The immediate enemy was then Poland, now dynastically as well as territorially opposed to Sweden. The struggle took the character of a contest for the possession of the northern Baltic provinces. Estonia was recovered by the Swedes in 1600, but their
determined efforts (1601–9) to gain a foothold in Livonia were frustrated by the military ability of the grand hetman of Lithuania, Jon Karol Chodkiewicz. In 1608 hostilities were transferred to Russian territory. At the beginning of that year Charles had concluded an alliance with Tsar Basil IV. (g.v.) against their common foe, the Polish king; but when, in 1611, Basil was deposed by his own subjects and the whole tsardom seemed to be on the verge of dissolution, Sweden's policy towards Russia changed its character. Hitherto Charles had aimed at supporting the weaker Slavonic power against the stronger; but now that Muscovy seemed about to disappear from among the nations of Europe, Swedish statesmen naturally sought some compensation for the expenses of the war before Poland had had time to absorb everything. A beginning was made by the siege and capture of Kexholm in Russian Finland (March 2, 1611), and, on the 9th of July, Great Novgorod was occupied and a convention concluded with the magistrates of that wealthy city whereby Charles IX.'s second son Philip was to be recognized as tsar, unless, in the meantime, relief came to Great Novgorod from Moscow. But now, when everything depended on a continuation of minority Charles's impudent statement amounted to the title of "King of the Lapps of Nordland," which people properly belonged to the Danish Crown, involved him in another war with Denmark, a war known in Scandinavian history as the war of Kalmar because the Swedish fortress of Kalmar was the chief theatre of hostilities. Thus the Swedish forces were diverted from their real objective and transferred to another field where even victory would have been comparatively unprofitable. But it was disaster, not victory, which Charles IX. reaped from this foolishly entreprise. Still worse, the war of Sweden, which was concluded by Charles's son, Gustavus Adolphus, in the second year of his reign, by the peace of Kongsholm, (Jan. 20, 1613) imposed such onerous pecuniary obligations and such intense suffering upon Sweden as to kindle into a fire of hatred, which was to burn fiercely for the next two centuries, the long smouldering antagonism between the two sister nations of Scandinavia which dated back to the bloody days of Christian II.

The Russian difficulty was more easily and more honourably adjusted. When Great Novgorod submitted provisionally to the suzerainty of Sweden, Swedish statesmen had believed, for a moment, in the creation of a Trans-baltic dominion extending from Lake Ilmen northwards to Archangel and eastwards to Vologda. The rallying of the Russian nation round the throne of the new tsar, Michael Romanov, dissipated, once for all, this ambitious dream. By the beginning of 1616, Gustavus had become convinced of the impossibility of partitioning reunited Muscovy, while Muscovy recognized the necessity of buying off the invincible Swedes by some cession of territory. By the Peace of Stolbova (Feb. 27, 1617), the tsar surrendered to the Swedish king the provinces of Kexholm and Ingria, including the fortress of Nöteborg (the modern Schlüsselburg), the key of Finland, Russia, furthermore, renounced all claims upon Ethonia and Livonia, and paid a war indemnity of 20,000 roubles. In return for these concessions, Gustavus restored Great Novgorod and acknowledged Michael Romanov as tsar of Muscovy.

The same period which saw the extension of the Swedish Empire abroad, saw also the peaceful development of the Swedish constitution at home. In this, as in every other matter, Gustavus himself took the initiative. Nominally the Senate still remained the dominant power in the state; but gradually all real authority had been transferred to the crown. The Riksråd speedily lost its ancient character of a grand council representing the semi-feudal landed aristocracy, and became a bureaucracy holding the chief offices of state at the good pleasure of the king. The Riksdag also changed its character at the same time. Whilst in every other European country except England, the ancient popular representation by estates was about to disappear altogether, in Sweden under Gustavus Adolphus it grew into an integral portion of the constitution. The Riksdag ordinance of 1617 first converted a turbulent and haphazard mob of "riksgämen," huddling together like a flock of sheep "or drunken boors," into a dignified national assembly, meeting and deliberating according to rule and order. One of the nobility (first called the Landmärschall, or marshal of the Diet, in the Riksdag ordinance of 1526) was now regularly appointed by the king as the spokesman of the Riddarhus, or House of Nobles, while the primate generally acted as the talman or president of the chamber of estates. The Diet was to meet two times a year, and at a later day each of the three lower estates elected its own talman. At the opening of every session, the king submitted to the estates "royal propositions," or bills, upon which each estate proceeded to deliberate in its own separate chamber. The replies of the estates were delivered to the king at a subsequent session in congress. Whenever the estates differed amongst themselves, the king chose whatever opinion seemed best to him. The rights of the Riksdag were secured by the Konungsforbörjan, or assurance given by every Swedish king on his accession, guaranteeing the collaboration of the estates in the work of legislation, and they were also to be consulted on all questions of foreign policy. The king possessed the initiative; but the estates had the right of objecting to the measures of the government at the close of each session. It is in Gustavus's reign, too, that we first hear of the Hemliga Utskott, or "secret committee" for the transaction of extraordinary affairs, which was elected by the estates themselves.

The eleven Riksdags held by Gustavus Adolphus were almost exclusively occupied in finding ways and means for supporting the ever-increasing burdens of the Polish and German wars. And to the honour of the Swedish people it is said that from first to last, they showed a religious and patriotic zeal which shrunk from no sacrifice. It was to this national devotion quite as much as to his own qualities that Gustavus owed his success as an empire-builder.

The wars with Denmark and Russia had been almost exclusively Scandinavian wars; the Polish war was of worldwide significance. It was, in the first place, a struggle for the Baltic littoral, and the struggle was intensified by the knowledge that the Polish Vasas denied the right of succession, guaranteeing the collaboration of the estates in the work of legislation, and they were also to be consulted on all questions of foreign policy. The king possessed the initiative; but the estates had the right of objecting to the measures of the government at the close of each session. It is in Gustavus's reign, too, that we first hear of the Hemliga Utskott, or "secret committee" for the transaction of extraordinary affairs, which was elected by the estates themselves.

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and, in June 1629, the king gladly accepted the lucrative truce of Altmark. By this truce Sweden was, for six years, to retain possession of her Livonian conquests, besides holding Elbing, the Vistula delta, Braunsberg in West, and Pillau and Memel in East Prussia, with the right to levy tolls at Pillau, Memel, Danzig, Liebiau and Windau. From these tolls Gustavus derived, in 1629 alone, 500,000 rix-dollars, a sum equivalent to the whole of the extraordinary subsidies granted to him by the Riksdag. Thus Sweden held, for a time, the control of the principal trade routes of the Baltic up to the very confines of the empire; and the increment of revenue resulting from this commanding position was of material assistance to her during the earlier stages of the war in Germany, whither Gustavus transferred his forces in June 1630.

The motives of Gustavus in plunging into the Thirty Years' War and the details of the struggle as regards Sweden are elsewhere

**Sweden and where set forth (see Gustavus II.; Oxenstjerna the Thirty [Axel]; Banér [Johan]; Torstensson [Len]; Sart).** Here the only point to be insisted upon is the extreme precariousness of the Swedish position from first to last—a precariousness due entirely to inadequacy of material resources. In 1632 all Germany lay at the feet of Sweden; two years later a single disaster (Nördlingen) brought her empire to the verge of ruin. For the next seven years the German War as regards Sweden was a struggle for existence. She triumphed in the end, it is true, but it was a triumph due entirely to a lucky accident—the possession, during the crisis, of the greatest statesman and the greatest captain of the age. It was the exploits of Oxenstjerna and Banér which alone enabled Sweden to obtain even what she did obtain at the great Westphalian peace congress in 1648. Her original demands were Silesia (she held most of the fortresses there), Pomerania (which had been in her possession for nearly twenty years), and a war indemnity of 20,000,000 rix-dollars. What she actually got was (1) Upper Pomerania, with the islands of Rügen and Usedom, and a strip of Lower Pomerania on the right bank of the Vistula, including the towns of Stettin, Garz, Damm and Golnow, and the island of Wollin, with the right of succession to the rest of Lower Pomerania in the case of the extinction of the Brandenburg Hohenzollerns; (2) the town of Wismar with the districts of Poel and Neukolster; (3) the secularized bishoprics of Bremen and Verden; and (4) 5,000,000 rix-dollars. These German possessions were to be held as fiefs of the empire; and in respect thereof Sweden was to have a vote in the imperial Diet and to "direct" the Lower Saxon Circle alternately with Brandenburg. France and Sweden, moreover, became joint guarantors of the treaty with the emperor, and Sweden suffered with the carrying out of its provisions, which was practically effected by the executive congress of NitreMbarg in 1650.

Sweden's reward for the exertions and sacrifices of eighteen years was meagre, almost paltry. Her newly won possessions were both small and scattered, though, on the other hand, she had secured the practical control of the three principal rivers of north Germany—the Oder, the Elbe and the Weser—and reaped the full advantage of the tolls levied on those great commercial arteries. The jealousy of France and the impatience of Queen Christina were the chief causes of the inadequacy of her final recompense. Yet, though the immediate gain was small, she had not dissipated her blood and treasure altogether in vain. Her vigorous intervention had saved the cause of religious liberty in Europe; and this remains, for all time, her greatest political achievement. Henceforth till her collapse, seventy years later, she was the recognized leader of Continental Protestantism. A more questionable benefit was her rapid elevation to the rank of an imperial power, an elevation which imposed the duty of remaining a military monarchy, armed cap-a-pie for every possible emergency. Every one recognizes now that the poverty and weakness of Sweden united her for such a tremendous destiny. But in the middle of the 17th century the incompatibility between her powers and her pretensions was not so obvious. All her neighbours were either decadent or exhausted states; and France, the most powerful of the Western powers, was her firm ally.

For the moment, however, Sweden held the field. Everything depended upon the policy of the next few years. Very careful statesmanship might mean permanent domination. Queen Christina, 1644-1654. The motives of Gustavus Adolphus's two immediate successors, Christina and Charles X., shook the flimsy fabric of his empire to its very base. Christina's extravagance was financial. At the time of her abdication the state was on the verge of bankruptcy, and the financial difficulty had superintended a serious political agitation. The mass of the Swedish people was penetrated by a justifiable fear that the external, artificial greatness of their country might, in the long run, be purchased with the loss of their civil and political liberties. In a word, the natural equilibrium of Swedish society was seriously threatened by the preponderance of the nobility; and the people at large looked to the new king to redress the balance. A better arbiter between the various estates than Charles X., 1654-1660, it would have been difficult to find. It is true that, primarily a soldier, his whole ambition was directed towards military glory; but he was also an unusually sharp-sighted politician. He attempted to believe that only by force of arms could Sweden retain the dominion which by force of arms she had won; but he also grasped the necessity that there must be no disunion at home if she were to continue powerful abroad. The most pressing question of the day, the so-called Reduktion, or restitution of the alienated crown lands, was adjusted provisionally at the Riksdag of 1655. The king proposed that the actual noble holders of crown property should either pay an annual sum of 200,000 rix-dollars, to be allowed for out of any further crown lands subsequently falling in to them, or should surrender a fourth of the expectant property itself to the estimated amount of 600,000 rix-dollars. The sundry attempted to escape the necessity as far as possible by stipulating that the 6th of November 1612, the day of Gustavus Adolphus's death, should be the extreme limit of any retroactive action on the part of the crown in regard to alienated crown property, and that the present subsidy should be regarded as "a perpetual ordinance" unalterably to be observed by all future sovereigns—in other words, that there should be no further restitution of alienated crown property. Against this interpretation of the subsidy bill the already over-taxed lower estates protested so energetically that the Diet had to be suspended. Then the king intervened personally; not to quell the commotions, as the senate insisted, but to compel the nobility to give way. He proposed that the whole matter should be thoroughly investigated by a special committee before the meeting of the next Riksdag, and that in the meantime a contribution should be levied on all classes proportionately. This equitable arrangement was accepted by the estates forthwith.

Charles X. had done his best to obviate the effects of the financial extravagance of Christina. It may well be doubted, however, whether his own extravagant desire for military glory was not equally injurious to his country. In three days he had succeeded in persuading the Swedish estates of the lucrative expediency of his unnecessary and immoral attack on Poland (see Poland: History); but when he quitted Stockholm for Warsaw, on the 10th of July 1654, he little imagined that he had embarked on an adventure which was to contribute far more to his glory than to the advantage of his country. How the Polish War expanded into a general European war; how Charles's miraculous audacity again and again ravished favours from Fortune and Nature (e.g. the passage of the Belts) when both those great powers combined against him; how, finally, he emerged from all his difficulties triumphant, indeed, but only to die of sheer exhaustion not six months afterwards.

Christina's reign dates, properly, from 1644 when she attained her majority. From 1652 to 1654 Axel Oxenstjerna was virtually the ruler of Sweden.
in his thirty-eighth year—all this has elsewhere been described (see Charles X., king of Sweden; CZARNIECKI [STEPHEN]; Frederick III., king of Denmark). Suffice it to say that, immediately after his death, the regency appointed to govern Sweden during the minority of his only son and successor, Charles XI., a child four years old, hastened to come to terms with Sweden's numerous enemies, which now included Russia, Poland, Brandenburg and Denmark. The Peace of Oliva (May 3, 1660), made under French mediation, put an end to the long feud with Poland and, at the same time, ended the quarrel between Sweden and the German empire, and the emperor and the elector of Brandenburg on the other. By this peace, Sweden's possession of Livonia, and the elector of Brandenburg's sovereignty over east Prussia, were alike confirmed; and the king of Poland renounced all claim to the Swedish crown. As regards Denmark, the Peace of Oliva signified the desertion of her three principal allies, Poland, Brandenburg and the emperor, and thus compelled her to reopen negotiations with Sweden direct. The differences between the two states were finally adjusted by the peace of Copenhagen (May 15, 1660), ceding the three Baltic provinces to Sweden but receiving back the Norwegian province of Trondhjem and the isle of Bornholm which she had surrendered by the peace of Roskilde two years previously. Denmark was also compelled to recognize, practically, the independence of the dukes of Holstein-Gottorp. The Russian War was terminated by the Peace of Kardis (July 2, 1661), confirmatory of the Peace of Stolbova, whereby the tsar surrendered to Sweden all his Baltic provinces—Ingria, Esthonia and Kealholm.

Thus Sweden emerged from the war not only a military power of the first magnitude, but also one of the largest states of Europe, possessing about twice as much territory as modern Sweden. Her area embraced 16,800 geographical square miles, a mass of land 7,000 sq. m. larger than the modern German Empire. Yet the Swedish Empire was rather a geographical expression than a state with natural and national boundaries. Modern Sweden is bounded by the Baltic; during the 17th century the Baltic was merely the bond between her various widely dispersed dominions. All the islands in the Baltic, except the Danish group lying between the southern and eastern estuaries of the German rivers (for the Niemen and Vistula are properly Polish rivers) debouched in Swedish territory, within which also lay two-thirds of Lake Ladoga and one-half of Lake Peipus. Stockholm, the capital, lay in the very centre of the empire, whose second greatest city was Riga, on the other side of the sea. Yet this vast empire contained but half the population of modern Sweden—being only 2,500,000, or about 140 souls to the square mile. Further, Sweden's new boundaries were of the most insecure description, inasmuch as they were anti-ethnographical, parting asunder races which naturally went together, and behind which stood powerful neighbours of the same stock ready, at the first opportunity, to reunite them.

Moreover, the commanding political influence which Sweden had now won was considerably neutralized by her loss of moral prestige. On Charles X.'s accession in 1655, Sweden's neighbours, though suspicious and uneasy, were at least not adversaries, and might have been converted into allies of the new great power who, if she had mulcted them of territory, had, anyhow, compensated them for the loss with the by no means contemptible deus ex machina of religious liberty. At Charles X.'s death, five years later, we find Sweden, herself bred to exhaustion point, surrounded by a broad belt of desolated territory and regarded with ineradicable hatred by every adjacent state. To sink in five years from the position of the champion of Protestantism to that of the common enemy of every Protestant power was a degradation not to be compensated by any amount of military glory. Charles's subsequent endeavour, in stress of circumstances, to gain a friend by dividing his Polish conquests with the aspiring elector of Brandenburg was a reversal of his original policy and only resulted in the establishment on the southern confines of Sweden of a new rival almost as dangerous as Denmark, her ancient rival in the west.

In 1660, after five years of incessant warfare, Sweden had at length obtained peace and with it the opportunity of organizing and developing her newly won empire. Unfortunately, the regency which was to govern her during the next fifteen years was unequal to the difficulties of a situation which might have taxed the resources of the wisest statesmen. Unity and vigour were scarcely to be expected from a many-headed democracy, and the conflicting and contrary opinions speedily gave rise to contending factions. There was the high-aristocratic party with a leaning towards martial adventure headed by Magnus de la Gardie (q.v.), and the party of peace and economy whose ablest representative was the liberal and energetic Johan Gyllenstjerna (q.v.). After a severe struggle, de la Gardie's party prevailed; and its triumph was marked by that general decline of personal and political morality which has given to this regency its unenviable notoriety. Sloth and carelessness speedily invaded every branch of the administration, destroying discipline and leading to a general neglect of business. Another characteristic of the de la Gardie government was its gross corruption, which made Sweden the obsequious hireling of that foreign power which had the longest purse. This shameful "subsidy policy" dates from the Treaty of Fontainebleau, 1661, by a secret paragraph of which Sweden, in exchange for a considerable sum of money, undertook to support the French candidate on the first vacancy of the Polish throne. The complications ensuing from Louis XIV.'s designs on the Spanish Netherlands led to a bid for the Swedish alliance, both from the French king and his adversaries. After much hesitation on the part of Sweden, the French government, the anti-French faction prevailed; and in April 1668 Sweden acceded to the Triple Alliance, which finally checkmated the French king by bringing about the Peace of Aix-la-Chapelle. For the next four years Sweden remained true to the principles of the Triple Alliance; but, in 1672, Louis XIV. succeeded in isolating the Dutch republic and regaining his ancient ally, Sweden. By the Treaty of Stockholm (April 14, 1672), Sweden became, for the next ten years, a "mercenarius Galliae," pledging herself, in return for 400,000 crowns per annum in perpetuity and to discipline and leaving to a greater extent to the personal expeditions of the German princes. Under the alliance, the Swedish army only remained in the field, was charged with 5,000 men, any German princes who might be disposed to assist Holland. In 1674 Louis XIV. peremptorily called upon Sweden to fulfil her obligations by invading Brandenburg. In the course of May 1675 a Swedish army advanced into the Mark, but on the 18th of June was defeated at Fehrbellin, and hastily retreated to Demmin. The Fehrbellin affair was a mere skirmish, the actual casualties amounting to less than 800 men, but it rudely divested Sweden of her nimbus of invincibility and was the signal for a general attack upon her, known as the Scanian War. In the course of the next three years her empire seemed to be crumbling away everywhere. In 1675 Pomerania and the bishopric of Bremen were overrun by the Brandenburgers, Austrians and Danes. In December 1677 the elector of Brandenburg captured Stettin. Stralsund fell on the 15th of October 1678. Greifswald, Sweden's last possession on the Continent, was lost on the 5th of November. A defensive alliance with Sobieski (August 4, 1677) was rendered ineffectual by the annihilation of Sweden's sea-power (battle of Oland, June 17, 1676; battle of Fehmarn, June 1677) and the difficulties of the Polish king. Two accidents at this crisis alone saved Sweden from ruin—the splendid courage of the young king who, resolutely and successfully, kept the Danish invaders at bay (see CHARLES XI., king of Sweden), and the diplomatic activity of Louis XIV. In March 1677 a peace congress began its sessions at Nijmegen; and in the beginning of April 1678 the French king dictated the terms of a general pacification. One of his chief conditions was the complete restitution of Sweden. A strong Sweden was necessary to the accomplishment of his plans. He suggested, however, that Sweden should rid herself of her enemies by
making some “small cession” to them. This Charles XI. refused to do, whereupon Louis took it upon himself to conclude peace on Sweden’s account without consulting the wishes of the Swedish king. By this Treaty of Nijmegen, (Feb. 7) and of St Germain (June 29, 1679) Sweden virtually received full restitution of her German territory. On the 2nd of September by the Peace of Fontainebleau (confirmed by the subsequent Peace of Lund, Oct. 4, 1679), Denmark was also forced to retrocede her conquests. It is certain that Sweden herself could never have extorted such favourable terms, yet “the insufferable tutelage” of France on this occasion inspired Charles XI. with so much distaste that it resulted in a strong anti-French bias (see CHARLES XI.; OXENSTJERNA, BENEDICT).

The remainder of the reign of Charles XI. is remarkable for a revolution which converted the government of Sweden into a semi-absolute monarchy. The king emerged from the war convinced that if Sweden were to retain her position as a great power she must radically reform her whole economical system, and, above all, circumvent the predominant and mischievous influence of an aristocracy which thought far more of its privileges than of its public duties. He felt that he could now draw upon the confidence and liberality of the lower orders to an unlimited extent, and he proceeded to do so. The Riksdag which assembled in Stockholm in October 1680 begins a new era of Swedish history. On the motion of the Estate of Peasants, which had a long memory for aristocratic abuses, the question of the recovery of the alienated crown lands was brought before the Riksdag, and, despite the stubborn opposition of the magnates, a resolution of the Diet directed that all crownships, baronies, domains, and other estates producing an annual rent of more than £50 per annum should revert to the Crown. The same Riksdag decided that the king was not bound by any particular constitution, but only by law and the statutes. Nay, they added that he was not even obliged to consult the council of state, but was to be regarded as a sovereign lord, responsible to God alone for his actions, and requiring no intermediary between himself and his people. The council thereupon acquiesced in its own humiliation by meekly accepting a royal brief changing its official title from Rimskad (council of state) to Kungigard (royal council)—a visible sign that the senators were no longer the king’s colleagues but his servants.

Thus Sweden, as well as Denmark, had become an absolute monarchy, but with this important difference, that the right of the Swedish people, in parliament assembled, to be consulted on all important matters was recognized and acted upon. The Riksdag, completely overshadowed by the throne, was during the reign of Charles XI. to do little more than register the royal decrees; but nevertheless it continued to exist as an essential part of the machinery of government. Moreover, this transfer of authority was voluntary on the people, knowing the king to be their best friend, trusted him, and happily co-operated with him cheerfully. The Riksdag of 1682 proposed a fresh Reduktion, and declared that the whole question of how far the king was empowered by the law of the land to bestow fefts, or, in case of urgent national distress, take them back again, was exclusively his majesty’s affair. In other words, it made the king the disposer of his subjects’ temporal property. Presently this new principle of autocracy was extended to the king’s legislative authority also, for, on the 9th of December 1682, all four estates, by virtue of a common declaration, not only confirmed him in the possession of the legislative powers enjoyed by his predecessors, but even conceded to him the right of interpreting and amending the common law.

The recovery of the alienated crown lands occupied Charles XI. for the rest of his life. It was conducted by a commission which was ultimately converted into a permanent department of state. It acted on the principle that the titles of all private landed estate might be called in question, inasmuch as at some time or other it must have belonged to the Crown; and the burden of proof of ownership was held not to lie with the Crown which made the claim, but with the actual owner of the property. The amount of revenue accruing to the Crown from the whole Reduktion it is impossible to estimate even approximately; but by these means, combined with the most careful management and the most rigid economy, Charles XI. contrived to reduce the national debt from £2,587,000 to £500,000.

These operations represent only a part of Charles XI.’s gigantic activity. Here we have only space sufficient to glance at the reorganization of the national armaments. The king, on regaining his personal independence in 1679, re-established the indeelingsverk introduced by Charles IX.—a system of military tenure whereby the national forces were bound to the soil. Thus there was the rusthäll tenure, under which the tenants, instead of paying rent, were obliged to equip and maintain a cavalry soldier and horse, while the knektbläser supplied duly equipped foot soldiers. These indeelings soldiery were provided with holdings on which they lived in times of peace. Formerly, ordinary conscription had existed alongside this indeeling, or distribution system; but it had proved inadequate as well as highly unpopular; and, in 1682, Charles XI. came to an agreement with the peasantry whereby an extended indeeling system was to be substituted for general conscription. The navy, of even more importance to Sweden if she were to maintain the dominion of the Baltic, was entirely remodelled; and, the recent war having demonstrated the unsuitability of Stockholm as a naval station, the construction of a new arsenal on a gigantic scale was simultaneously begun at Karlskrona. After a seventeen years’ struggle against all manner of financial difficulties, the twofold enterprise was completed. At the death of Charles XI. Sweden could boast of a fleet of forty-three three-deckers (maned by 11,000 men and armed with 2648 guns) and one of the finest arsenals in the world.

Charles XI. had carefully provided against the contingency of his successor’s minority; and the five regents appointed by him, if not great statesmen, were at least practical politicians who had not been trained in his austere school in vain. At home the Reduktion was cautiously pursued, while abroad the successful conclusion of the great peace congress at Ryswick was justly regarded as a signal triumph of Sweden’s pacific diplomacy (see OXENSTJERNA FAMILY). The young king was full of promise, and had not been permitted gradually to gain experience and develop his naturally great talents beneath the guidance of his guardians, as his father had intended, all might have well for Sweden. Unfortunately, the sudden, noiseless revolution of the 6th of November 1697, which made Charles XII. absolute master of his country’s fate in his fifteenth year (see CHARLES XII.), and the league of Denmark, Saxony and Russia, formed two years later to partition Sweden (see PATkul, JOHANN KNEIBOLD; PETER THE GREAT; CHARLES XII.), precipitated Sweden into a sea of troubles in which she was finally submerged.

From the very beginning of the Great Northern War Sweden suffered from the inability of Charles XII. to view the situation from anything but a purely personal point of view. His determination to avenge himself on enemies overwhelmed every other consideration. Again and again during these eighteen years of warfare it was in his power to dictate an advantageous peace. After the dissipation of the first coalition against him by the peace of Trondvall (Aug. 18, 1700) and the victory of Narva (Nov. 20, 1700), the Swedish chancellor, Benedict Oxenstjerna, rightly regarded the universal bidding for the favour of Sweden by France and the maritime powers, then on the eve of the War of the Spanish Succession, as a golden opportunity of “ending this present lean war and making his majesty the arbiter of Europe.” But Charles, intent on dethroning Augustus of Poland, held haughtily aloof. Subsequently in 1701 he rejected a personal appeal from William III. to conclude peace on his
own terms. Five years later (Sept. 24, 1706) he did, indeed, conclude the Polish War by the peace of Altranstädt, but as this treaty brought no advantage to Sweden, not even compensation for the expenses of six years of warfare, it was politically condemnable. Moreover, two of Sweden's Baltic provinces, Esthonia and Ingria, had been seized by the tsar, and a third, Livonia, had been well-nigh ruined. Yet even now Charles, by a stroke of the pen, could have compensated everything he had lost. In 1707 Peter was ready to retrocede everything except St Petersburg and the line of the Neva, and again Charles preferred risking the whole to saving the greater part of his Baltic possessions (for details see CHARLES XII.; PETER THE GREATEST). When at last, after the catastrophe of Poltava (June 1709) and the flight into Turkey, he condescended to use diplomatic methods, it was solely to prolong, not to terminate, the war. Even now he could have made honourable terms with his numerous enemies. The resources of Sweden were still very far from being exhausted, and, during 1710 and 1711, the gallant Magnus Stenbock (q.v.) upheld her military supremacy in the north. But all the efforts of the Swedish government were wrecked on the determination of Charles XII. to surrender nothing. Thus be rejected advantageous offers of mediation and alliance made to him, during 1712, by the maritime powers and by Prussia; and, in 1714, he scouted the friendly overtures of Louis XIV. and the emperor, so that when peace was finally concluded between France and the Empire, at the congress of Baden, Swedish affairs were, by common consent, left out of consideration. When, on the 14th of September 1714, he suddenly returned to his dominions, Stralsund and Wismar were all that remained to his continental possessions; while by the end of 1715 Sweden, now fast approaching the last stage of exhaustion, was at open war with England, Hanover, Russia, Prussia, Saxony and Denmark, who had formed a coalition to partition her continental territory between them. Nevertheless, at this the eleventh hour of her opportunities, Sweden might still have saved something from the wreck of her empire if Charles had behaved like a reasonable being (see CHARLES XII.; PETER THE GREATEST; GÖRTZ, GEORG HEINRICH VON; OSTERBÖCK, ANDREAS); but he would have shown no disposition to play off Russia against England, and his sudden death before Fredrikshald (Dec. 11, 1718) left Sweden practically at the end of her resources and at the mercy of her enemies. At the beginning of 1719 pacific overtures were made to England, Hanover, Prussia and Denmark. By the treaties of Stockholm (Feb. 20, 1719, and Feb. 1, 1720) Hanover obtained the bishoprics of Bremen and Verden for herself and Stettin for her confederate Prussia. By the treaty of Frederiksborg or Copenhagen (March 5, 1720) his dominions were increased by the cession of Esthonia and Livonia, the Finnish province of Kexholm and the fortress of Viborg. Finland west of Viborg and north of Kexholm was restored to Sweden. She also received an indemnity of two millions of thalers and a solemn undertaking of non-interference in her domestic affairs. It was not the least of Sweden's misfortunes after the Great Northern War that the constitution, which was to compensate her for all her past sacrifices, should contain within it the elements of many of her future calamities. Early in 1720 Charles XII.'s sister, Ulrica Leonora, who had been elected queen of Sweden immediately after his death, was permitted to abdicate in favour of her husband, Frederick I., the prince of Hesse, who was elected king under the title of Frederick I.; and Sweden was thus at the same time, converted into the most limited monarchy of monarchies. All that was vested in the people as represented by the Riksdag, consisting, as before, of four distinct estates, nobles, priests, burgesses and peasants, sitting and deliberating apart. The conflicting interests and mutual jealousies of these four independent assemblies made the work of legislation exceptionally difficult. No measure could now become law till it had obtained the assent of three at least of the four estates; but this provision, which seems to have been designed to protect the lower orders against the nobility, produced evils far greater than those which it professed to cure. Thus, measures might be passed by a bare majority in three estates, when a real and substantial majority of all four estates in congress might be actually against it. Or, again, a dominant action in any three of the estates might enact laws highly detrimental to the interests of the remaining estate—a danger the more to be apprehended as in no other country in Europe were class distinctions so sharply defined as in Sweden.

Each estate was ruled by its talman, or speaker, who was now elected at the beginning of each Diet, but the archbishop was, ex officio, the talman of the clergy. The landmästare, or speaker of the House of Nobles, presided when the estates met; but, in the castle of Stockholm, the owner of the Riksdag, was also present, in virtue of his office, as the hemliga skott, or secret committee. This famous body, which consisted of 50 nobles, 25 priests, 25 burgesses, and, very exceptionally, 25 peasants, possessed during the session of the Riksdag not only the supreme executive but also the supreme judicial and legislative functions. It prepared all bills for the Riksdag, created and disposed all ministries, controlled the foreign policy of the nation, and claimed and often exercised the right of superseding the ordinary courts of justice. During the parliamentary recess, however, the executive remained in the hands of the rad, or senate, which was responsible to the Riksdag alone.

It will be obvious that there was no room in this republican constitution for a constitutional monarch in the modern sense of the word. The crowned puppet who possessed a casting vote in the riksdag, of which he was the nominal president, and who was allowed to create peers once in his life (at his coronation), was rather a state decoration than a sovereignty.

At first this cumbersome and complicated instrument of government worked tolerably well under the firm but cautious control of the chancellor, Count Arvid Beernhard Horn (1674-1729). In his discharge of this trust between 1719 and 1720, Horn reversed the traditional policy of Sweden by keeping France at a distance and drawing near to Great Britain, for whose liberal institutions he professed the highest admiration. Thus a twenty years' war was succeeded by a twenty years' peace, during which the nation recovered so rapidly from its wounds that it began to forget them. A new race of politicians was springing up. Since 1719, when the influence of the few great territorial families had been merged in a multitude of needy gentlemen, the first estate had become the nursery and afterwards the stronghold of an opposition at once noble and democratic, which found its natural leaders in such men as Count Carl Gyllenborg and Count Carl Gustaf Tassin (q.v.). These men and their followers were never weary of ridiculing the timid caution of the aged statesman who sacrificed everything to perpetuate an inglorious peace and derisively nicknamed his adherents "Night-caps" (a term subsequently softened into "Caps"), themselves adopting the sobriquet "Hats," from the three-cornered hat worn by officers and gentlemen, which was considered happily to hit off the manly self-assertion of the opposition. These epithets instantly caught the public fancy and had already become party badges when the estates met in 1728. This Riksdag was to mark another turning-point in Swedish
history. The Hats carried everything before them; and the aged Horn was finally compelled to retire from a scene where, for three and thirty years, he had played a leading part.

The policy of the Hats was a return to the traditional alliance between France and Sweden. When Sweden descended to her natural position as a second-rate power the French alliance became too costly a luxury. Horn had clearly perceived this; and his cautious neutrality was therefore the soundest statesmanship. But the politicians who had ousted Horn thought differently. To them Sweden's glory was a thing of the past. They aimed at restoring Sweden to her former position as a great power. France, naturally, hailed with satisfaction the rise of a faction which was content to be her armament-bearer in the north; and the golden streams which flowed from Versailles to Stockholm during the next two generations were the political life-blood of the Hat party.

The first blunder of the Hats was the hasty and ill-advised war with Russia. The European complications consequent upon the almost simultaneous deaths of the emperor Charles VI. and Anne, empress of Russia, seemed to favour their ambitious schemes, and despite the frantic protests of the Caps, a project for the invasion of Russian Finland was rushed through the premature Riksdag of 1740. On the 20th of July 1741 war was formally declared against Russia; a month later the Diet was dissolved and the Hat landstingskåk set off to Finland to take command of the army. The first blow was not struck till six months after the declaration of war; and it was struck by the enemy, who routed the Swedes at Villmanstrand and captured that frontier fortress. Nothing else was done on either side for six months more; and then the Swedish generals made a "tact truce" with the Russians through the mediation of the French ambassador at St Petersburg. By the time that the "tact truce" had come to an end the Swedish forces were so demoralized that the mere rumour of a hostile attack made them retire panic-stricken to Helsingfors; and before the end of the year all Finland was in the hands of the Russians. The fleet, disabled by an epidemic, was, throughout the war, little more than a floating hospital.

To face the Riksdag with such a war as this upon their consciences was a trial from which the Hats naturally shrank; but, to do them justice, they showed themselves better parliaments than their predecessors, and when the conduct of the war was skillfully evaded by obtaining precedence for the succession question (Queen Ulrica Leonora had lately died childless and King Frederick was old); and negotiations were thus opened with the new Russian empress, Elizabeth, who agreed to restore the greater part of Finland if her cousin, Adolphus Frederick of Holstein, were elected successor to the Swedish crown. The Hats eagerly caught at the opportunity of recovering the grand duchy and their own prestige along with it. By the peace of Åbo (May 7, 1743) the terms of the treaty were accepted; and only that small part of Finland which lay beyond the Kymmene was retained by Russia.

In March 1751 old King Frederick died. His slender prerogatives had gradually dwindled down to vanishing point. Adolphus Frederick (g.v.) would have given even less trouble than his predecessor but for the ambitious promptings of his masterful consort Louisa Ulrica, Frederick the Great's sister, and the tyranny of the estates, who seemed bent upon driving the meekest of princes into rebellion. An attempted monarchal revolution, planned by the queen and a few devoted young nobles in 1756, was easily and remorselessly crushed; and, though the unhappy king did not, as he anticipated, share the fate of Charles Stuart, he was humiliated as never monarch was humiliated before.

The same years which beheld this great domestic triumph of the Hats saw also the utter collapse of their foreign "system." At the instigation of France they plunged recklessly into the Seven Years' War; and the result was ruinous. The French subsidies, which might have sufficed for a six weeks' demonstration (it was generally assumed that the king of Prussia would give little trouble to a European coalition), proved quite inadequate; and, after five unsuccessful campaigns, the unhappy Hats were glad to make peace and ignominiously withdraw from a little war which had cost the country 40,000 men and £2,500,000. When the Riksdag met in 1760, the indignation against the Hat leaders was so violent that an impeachment seemed inevitable; but once more the superiority of their parliamentary tactics prevailed, and when, after a session of twenty months, the Riksdag was brought to a deadlock by the mutual consent of both the exhausted factions, the Hat government fell once more without a blow. But the day of reckoning could not be postponed for ever; and when the estates met in 1765 it brought the Caps into power at last. Their leader, Ture Rudbeck, was elected marshal of the Diet over Frederick Axel von Fersen (q.v.), the Hat candidate, by a large majority; and, out of the hundred seats in the secret committee, the Hats succeeded in getting only ten.

The Caps struck at once at the weak point of their opponents by ordering a budget report to be made; and it was speedily found that the whole financial system of the Hats was based upon stockless imprudence and wilful misrepresentation, and that the only fruit of their long rule was an enormous addition to the national debt and a depreciation of the note circulation to one-third of its face value. This revelation led to an all-round retrenchment, carried into effect with a drastic thoroughness which has earned for this parliament the name of the "Reduktion Riksdag." The Caps succeeded in transferring £250,000 from the pockets of the rich to the empty exchequer, reducing the national debt by £575,179, and establishing some sort of equilibrium between revenue and expenditure. They also introduced a few useful reforms, the most remarkable of which was the liberty of the press. But their most important political act was to throw their lot definitely in with Russia, so as to counterpoise the influence of France. Sweden was not then as now quite outside the European Concert. Although no longer a great power, she still had many of the responsibilities of a great power; and if the Swedish alliance had considerably depreciated in value, it was still a marketable commodity. Sweden's peculiar geographical position made her virtually invulnerable for six months out of the twelve, her Norwegian bases upon stickless imprudence and were reinforced by the very heart of the moribund empire, while her Finish frontier was not many leagues from the Russian capital.

A watchful neutrality, not venturing much beyond defensive alliances and commercial treaties with the maritime powers, was therefore Sweden's safest policy, and this the older Caps had always followed out. But when the Hats became the armament-bearers of France in the north, a protector strong enough to counteract French influence became the cardinal exigency of their opponents, the younger Caps, who now flung themselves into the arms of Russia, overlooking the fact that even a pacific union with Russia was more to be feared than a martial alliance with France. For France was too distant to be dangerous. She sought an ally in Sweden and it was her endeavour to make that ally as strong as possible. But it was as a future prey, not as a possible ally, that Russia regarded her ancient rival in the north. In the treaty which partitioned Poland there was a secret clause which engaged the contracting powers to uphold the existing Swedish constitution as the swiftest means of subverting Swedish independence; and an alliance with the credulous Caps, "the Patriots" as they were called at St Petersburg, guaranteeing their constitution, was the corollary to this secret understanding. Thus while the French alliance of the warlike Hats had destroyed the prestige of Sweden, the Russian alliance of the peaceable Caps threatened to destroy her very existence.

Fortunately, the domination of the Caps was not for long. The general distress occasioned by their drastic reforms had found expression in swarms of pamphlets which bit and stung the Cap government, under the protection of the new press laws. The senate retaliated by an order in council (which the
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king refused to sign) declaring that all complaints against the measures of the last Riksdag should be punished with fine and imprisonment. The king, at the suggestion of the crown prince (see Gustavus III.), therupon urged the senate to summon an extraordinary Riksdag as the speediest method of relieving the national distress, and, on their refusing to comply with his wishes, abdicated his throne to secure the 21st of December 1768 Sweden was without a regular government. Then the Cap senate gave way and the estates were convoked for the 19th of April 1769.

On the eve of the contest there was a general assembly of the Hats at the French embassy, where the Comte de Modène furnished them with 6,000,000 livres, but not till they had signed in his presence an undertaking to reform the constitution in a monarchal sense. Still more energetic on the other side, the Russian minister, Ivan Osternia, became the treasurer as well as the chairman of the Caps, and scattered the largesse of the Russian empress with a lavish hand; and so lost to all feeling of patriotism were the Caps that they openly threatened all who ventured to vote against them with the Muscovite vengeance, and fixed Norrköping, instead of Stockholm, as the place of meeting for the Riksdag as being more accessible to the Russian fleet. But it soon became evident that the Caps were playing a losing game; and, when the Riksdag met at Norrköping on the 19th of April, they found themselves in a minority in all four estates. In the contest for the marshalate of the Diet the leaders of the two parties were again pitted against each other, when the verdict of the last Riksdag was exactly reversed, Fersen defeating Rudbeck by 2,34, though Russia spent no less a sum than £1,15,000 to secure the election of the latter.

The Caps had short shrift, and the joint note which the Russian, Prussian and Danish ministers presented to the estates protesting, in menacing terms, against any “reprisals” on the part of the triumphant faction, only hastened the fall of the government. The Cap senate resigned en masse to escape impeachment, and an exclusively Hat ministry took its place.

On April 1, the 1st of June the Riksdag Riksdagen was dissolved as it was generally called, removed to the capital; and it was now that the French ambassador and the crown prince Gustavus called upon the new senators to redeem their promise as to a reform of the constitution which they had made before the elections. But when, at the 1st of June, they half-heartedly brought the matter forward, the Riksdag suddenly seemed to be stricken with paralysis.

Impediments multiplied at every step; the cry was raised: “The constitution is in danger”; and on the 30th of January 1770 the Reaction ministry, formed and reconstituted to an abortive, it is not more than a temporary, a few days, was dissolved. The constitutional, attempt of the new government to actualize its pact with France, and had received solemn assurances of assistance from Louis XV. In case he succeeded in re-establishing monarchical rule in Sweden. France undertook, moreover, to pay the outstanding subsidies to Sweden, amounting to one and a half millions of livres annually, beginning from January 1772; and Vergennes, one of the great names of French diplomacy, was to be sent to circumvent the designs of Russia at Stockholm as he had previously circumvented them at Constantinople. Immediately after his return to Stockholm, Gustavus endeavored to reconstitute the jarring factions by inducing the leaders to form a composition committee to adjust their differences. In thus mediating he was sincere enough, but all his pacific efforts were frustrated by their jealousy of him and of each other. Still worse, the factions now intrenched still further on the prerogative. The new crown oath contained three revolutionary clauses. The first aimed at making abdications in the future impossible by binding the king to reign uninterruptedly. The second obliged him to abide, not by the tension of all the estates together, as hitherto, but by that of the majority only, with the view of enabling the actually dominant lower estates (in which was a large Cap majority) to rule without, and even in spite of, the nobility. The third clause required him, in all cases of preference, to be guided not “principally,” as hitherto, but “solely” by merit, thus striking at the very root of aristocratic privilege. It was clear that the ancient strife of Hats and Caps had become merged in a conflict of classes; the situation was still further complicated by the ominous fact that the non-noble majority was also the Russian faction.

All through 1771 the estates were wrangling over the clauses of the crown oath. A second attempt of the king to mediate between them foundered on the suspicions of the estate of burgesses; and, on the 24th of February 1772, the nobility yielded from sheer weariness. The non-noble Cap majority now proceeded to attack the senate, the last stronghold of the Hats, and, on the 25th of April, succeeded in ousting their opponents. It was now, for the first time, that Gustavus, reduced to the condition of a roi fainéant, began seriously to consider the possibility of a revolution; of its necessity there could be no doubt. Under the sway of the new dominant faction, Sweden, already the vassal, could not fail speedily to become the victim of Russia. She was on the point of being absorbed in that Northern System, the invention of the Russian minister of foreign affairs, Nikita Panin (q.v.), which that patient statesman had made it the ambition of his life to realize. Only a swift and sudden coup d’état could save the independence of a country isolated from the rest of Europe by a hostile league. The details of the famous revolution of the 19th of August 1772 are elsewhere set forth (see Gustavus III.; Toll, Johan Kristoffer; Srenstporten, Jakob Magnus). Here we can only dwell upon its political importance and consequences.

The new constitution of the 20th of August 1772, which Gustavus imposed upon the terrified estates at the bayonet’s point, converted a weak and disunited republic into a strong but limited monarchy, in which the balance of power inclined, on the whole, to the side of the monarch. The estates could only assemble when summoned by him; he could dismiss them whenever he thought fit; and their deliberations were to be confined exclusively to the propositions which he might think fit to lay before them. But these very extensive powers were subjected to many important checks. Thus, without the previous consent of the estates, no new law could be imposed, no old law abolished, no offensive war undertaken, no extraordinary war subsidy levied. The estates alone could tax themselves; they had the absolute control of the Bank of Sweden, and the inalienable right of controlling the national expenditure. Thus the parliament held the purse; and this seemed a sufficient guarantee both of its independence and its frequent convention. The senate, not the Riksdag, was the chief loser of the exchange; and, inasmuch as hereafter the senators were appointed by the king, and were to be responsible to him alone, a senate in opposition to the Crown was barely conceivable.

Abroad the Swedish revolution made a great sensation. Catherine II. of Russia saw in it the triumph of her arch-enemy France, with the prolongation of the costly Turkish War as its immediate result. But the absence of troops on the Finnish border, and the bad condition of the frontier fortresses, constrained the empress to listen to Gustavus’s pacific assurances, and stay her hand. She took the precaution, however, of concluding a fresh secret alliance with Denmark, in which the Swedish revolution was significantly described as an act of violence constituting a casus foederis, and justifying both powers in seizing the first favourable opportunity for intervention to restore the Swedish constitution of 1720.
In Sweden itself the change was, at first, most popular. But Gustavus’s first Riksdag, that of 1778, opened the eyes of the deputies to the fact that their political supremacy had departed. The king was now their sovereign lord; and, for all his courtesy and gentleness, the jealousy with which he guarded and the vigour with which he enforced the prerogative plainly showed that he meant to remain so. But it was not till after eight years more had elapsed that actual trouble began. The Riksdag of 1778 had been obsequious; the Riksdag of 1786 was mutinous. It rejected nearly all the royal measures outright, or so modified them that Gustavus himself withdrew them. When he declared the estates adjourned from the throne held out no prospect of their speedy revocation.

Nevertheless, within three years, the king was obliged to summon another Riksdag, which met at Stockholm on the 26th of January 1789. His attempt in the interval to rule without a parliament had been disastrous. It was only by a breach of his own constitution that he had been able to declare war against Russia (April 1788); the conspiracy of Anjula (July) had paralysed all military operations at the very opening of the campaign; and the sudden invasion of his western provinces by the Danes, almost simultaneously (Sept. 1788), seemed to crush the hopes of the Diet. In the contrast, at this crisis, between his self-sacrificing patriotism and the treachery of the Russophil aristocracy was so striking that, when the Riksdag assembled, Gustavus found that the three lower estates were ultra-royalist, and with their aid he succeeded, not without running great risks (see Gustavus III; Nordin, Gustaf; Wallqvist, Olaf), in crushing the opposition of the nobility by a second coup d’etat (Feb. 16, 1789), and passing the famous Act of Union and Security which gave the king an absolutely free hand as regards foreign affairs and the command of the army, and made further treason impossible. For this the nobility never forgave him. It was impossible, indeed, to resist openly so highly gifted and so popular a sovereign; it was only by the despicable expedient of assassination that the last great monarch of Sweden was finally removed, to the infinite detriment of his country.

The ensuing period was a melancholy one. The aristocratic classes loudly complained that the young king, Gustavus IV., still a minor, was being brought up among crypto-Jacobins; while the middle classes, deprived of the stimulating leadership of the anti-aristocratic “Prince Charming,” and becoming more and more inoculated with French political ideas, drifted into an antagonism not merely to hereditary nobility, but to hereditary monarchy likewise. Everything was vacillating and uncertain; and the general instability was reflected even in foreign affairs, now that the master-hand of Gustavus III. was withdrawn.

The renewed efforts of Catherine II. to interfere in Sweden’s domestic affairs were, indeed, vigorously repulsed, but without tact or discretion, so that the good understanding between the two countries was seriously impaired, especially when the prodigities of Gustaf Reuterholm (q.v.), who then virtually ruled Sweden, induced him to adopt what was generally considered an indelicately friendly attitude towards the government at Paris. Despite the execution of Louis XVI. (Jan. 21, 1793), Sweden, in the hope of obtaining considerable subsidies, recognized the new French republic; and secret negotiations for contracting an alliance were actually begun in May of the same year, till the menacing protests of Catherine, supported as they were by all the other European powers, finally induced Sweden to suspend them.

The negotiations with the French Jacobins exacerbated the hatred which the Gustavians already felt for the Jacobin councillors of the duke-regent (see Charles XIII., king of Sweden). Snarling beneath their grievances and seriously believing that not only the young king’s crown but his very life was in danger, they formed a conspiracy, the soul of which was Gustaf Mauritz Armfelt (q.v.), to overthrow the government, with the aid of a Russian fleet, supported by a rising of the Dalecarlians. The conspiracy was discovered and vigorously suppressed.

The one bright side of this gloomy and sordid period was the rapprochement between the Scandinavian kingdoms during the revolutionary wars. Thus, on the 27th of March 1794, a neutrality compact was formed between Denmark and Sweden; and their united squadrons patrolled the North Sea to protect their merchantmen from the British cruisers. This approximation between the two governments was happily followed by friendly feelings between the twofold Sofia and the Swedish chamber of the duc de Mogor. Presently Reuterholm renewed his coquetry with the French court, which was officially recognized by the Swedish government on the 23rd of April 1795. In return, Sweden received a subsidy of £5,600; and a treaty between the two powers was signed on the 14th of September 1795. On the other hand, an attempt to regain the friendship of Russia, which had broken off diplomatic relations with Sweden, was frustrated by the refusal of the king to accept the bride, the grand duchess Alexandra, Catherine II.’s granddaughter, whom Reuterholm had provided with the promise that it was Reuterholm’s last official act. On the 1st of November 1796, in accordance with the will of his father, Gustavus IV., now in his eighteenth year, took the government into his own hands.

The government of Gustavus IV. (q.v.) was almost a pure autocracy. At his very first Riksdag, held at Norrköping in March 1800, the nobility were compelled, at last, to ratify Gustavus III.’s detested Act of Union and Security, which hitherto they had steadily refused to do. Shortly after this Riksdag rose, a notable change took place in Sweden’s foreign policy. In December 1800 Denmark Sweden and Russia acceded to a second Armed Neutrality of the North, directed against Great Britain; and the arsenal of Karlskrona, in all probability, was only saved from the fate of Copenhagen by the assassination of the emperor Paul, which was followed by another change of system in the north. Hitherto Sweden had kept aloof from continental complications; but the arrest and execution of the duc d’Enghien in 1804 inspired Gustavus IV. with such a hatred of Napoleon that when a general coalition was formed against the French emperor he was one of the first to join it (Dec. 3, 1804), pledging himself to send an army corps to cooperate with the English and Russians in driving the entire fleet of Holland and Hanover. But his senseless quarrel with Frederick William III. of Prussia detained him in Pomerania; and, when at last (December 1805) he led his 6000 men towards the Elbe district the third coalition had already been dissipated by the victories of Ulm and Austerlitz. In 1806 a rupture between Sweden and Prussia was only prevented by Napoleon’s assault upon the latter power. After Jena Napoleon attempted to win over Sweden, but Gustavus rejected every overture. The result was the total loss of Pomerania, and the Swedish army itself was only saved from destruction by the ingenuity of J. K. Toll (q.v.).

At Tilsit the emperor Alexander I. had undertaken to convert all “Russia’s geographical enemy,” as Napoleon designated Sweden, to accede to the newly established Continental System. Gustavus IV. naturally rejected all the proposals of Alexander to close the Baltic against the English; but took no measures to defend Finland against Russia, though, during the autumn of 1807, it was notorious that the tsar was preparing to attack the grand duchy. On the 21st of February 1808 a Russian army crossed the Finnish border without any previous declaration of war. On the 2nd of April the king ordered a general levy of 30,000 men; but while two army corps, under Armfelt and Toll, together with a British contingent of 10,000 men under Moore, were stationed in Scania and on the Norwegian border in anticipation of an attack from Denmark, which, at the instigation of Napoleon, had simultaneously declared war against Sweden, the little Finnish army was left altogether unsupported. The conquest of Finland, after
an heroic struggle against overwhelming odds, is elsewhere recorded (see Finland: History). Its immediate consequence in Sweden proper was the deposition of Gustavus of Sweden IV. (March 13, 1809), who was clearly incapable of governing. The nobility took advantage of this opportunity to pay off old scores against Gustavus III, by excluding not only his unhappy son but also that son's whole family from the succession—an act of injustice which has never been adequately deplored. But indeed the whole of this intermedie period is full of dark subterranean plots and counterplots, still inexplicable, as, for instance, the hideous Fersen murder (June 20, 1810) (see Fersen, Hans Axel von) evidently intended to terrorize the Gustavians, whose loyalty to the ancient dynasty was notorious. As early as the 3rd of June 1809 the duke regent was proclaimed king, Charles XIII, 1809–1818. Under the title of Charles XIII. (q.v.), after accepting the new liberal constitution, which was ratified by the Riksdag the same day.

The new king and his first cabinet, in no way likely to interfere with the liberal revolution which had placed him on the throne. Peace was what the exhausted nation now required; and negotiations had already been opened at Fredrikshavn. But the Russian demands were too humiliating, and the war was resumed. But the defeats of Sävarskr e and Ratan (Aug. 19, 1809) broke the spirit of the Swedish army; and peace was obtained by the sacrifice of Finland, the Åland islands, "the fore-posts of Stockholm," as Napoleon rightly described them, and Vesterbotten as far as the rivers Torned and Muonio (treaty of Fredrikshavn, Sept. 17, 1809).

The throne, for Charles XIII. was both in firm and childless, was settled, after the mysterious death of Bernadotte (May 28, 1810) of the first elected candidate, Prince Charles Augustus of Augustenburg, by the selection of the French marshal, Bernadotte (see Charles XIV., king of Sweden), who was adopted by Charles XIII. and received the homage of the estates on the 5th of November 1810.

The new crown prince was very soon the most popular and the most powerful man in Sweden. The infirmity of the old king, and the discontents in the council of state placed the government and especially the control of foreign affairs almost entirely in his hands; and he boldly adopted a policy which was antagonistic indeed to the wishes and hopes of the old school of Swedish statesmen, but, perhaps, the best adapted to the circumstances. Finland he at once gave up for lost. He knew that Russia would never voluntarily relinquish the grand duchy, while Sweden could not hope to retain it permanently, even if she reconquered it. But the acquisition of Norway might make up for the loss of Finland; and Bernadotte, now known as the crown prince Charles John, argued that it might be an easy matter to persuade the anti-Napoleonic powers to punish Denmark for her loyalty to France by wresting Norway from her. Napoleon he rightly distrusted, though at first he was obliged to submit to the emperor's dictation. Thus on the 13th of November 1810, the Swedish government was forced to declare war against Great Britain, though the British government was privately informed at the same time that Sweden was not a free agent and that the war would be a mere demonstration. But the pressure of Napoleon became more and more intolerable, culminating in the occupation of Pomerania by French troops in 1812. The Swedish government therefore concluded a secret convention with Russia (treaty of Petersburg, April 5, 1812), undertaking to send 30,000 men to operate against Napoleon in Germany in return for a promise from Alexander guaranteeing to Sweden the possession of Norway. Too late Napoleon endeavoured to outbid Alexander by offering to Sweden Finland, all Pomerania and Mecklenburg, in return for Sweden's active co-operation against Russia.

The Orebro Riksdag (April–August 1812), remarkable besides for its partial repudiation of Sweden's national debt and its reactionary press laws, introduced general conscription into Sweden, and thereby enabled the crown prince to carry out his ambitious policy. In May 1812 he mediated a peace between Russia and Turkey, so as to enable Russia to use all her forces against France (peace of Bucharest); and on the 18th of July, at Ørebro, peace was also concluded between Great Britain on one side and Russia and Sweden on the other. These two treaties were, in effect, the corner-stones of a fresh coalition against Napoleon, and were confirmed on the outbreak of the Franco-Russian War by a conference between Alexander and Charles John at Stockholm, on the 21st of August 1812, where he undertook to place an army corps of 33,000 men at the disposal of the Swedish crown prince for the conquest of Norway.

The treaty of Åbo, and indeed the whole of Charles John's foreign policy in 1812, provoked violent and justifiable criticism among the better class of politicians in Sweden. The immorality of indemnifying Sweden at the expense of a weaker friendly power was obvious; and, while Finland was now definitively sacrificed, Norway had still to be won. Moreover, Great Britain and Russia very properly insisted that Charles John's first duty was to the anti-Napoleonic coalition, the former-power ignoring the objection to the expenditure of her subsidies on the nefarious Norwegian adventure before the common enemy had been crushed. Only on his very ungracious compliance did Great Britain also promise to countenance the union of Norway and Sweden (treaty of Stockholm, March 3, 1813); and, on the 23rd of April, Russia gave her guarantee to the same effect. The Swedish crown prince rendered several important services to the allies during the campaign of 1813 (see Charles XIV., king of Sweden); but, after Leipzig, he went his own way, determined at all hazards to cripple Denmark and secure Norway. Moreover, "robbed of his "job" (as Helvig put it) of the nearest wishes of the Norwegians themselves, and how, finally (Nov. 14, 1814), Norway as a free and independent kingdom was united to Sweden under a common king, is a subject elsewhere described (see Denmark; Norway; Charles XIV., king of Sweden; Christian VIII., king of Denmark).

Charles XIII. died on the 5th of February 1818, and was succeeded by Bernadotte under the title of Charles XIV. John.

The new king devoted himself to the promotion of several ambitious projects, notably the construction of a canal absorbing the greater portion of the twenty-four millions of dalers voted for the purpose. The external debt of Sweden was gradually extinguished, the internal debt considerably reduced, and the budget showed an average annual surplus of 700,000 dalers. With returning prosperity the necessity for internal reform became urgent in Sweden. The antiquated Riksdag, where the privileged estates predominated, while the cultivated middle class was practically unrepresented, had become an insuperable obstacle to all free development; but, though the Riksdag of 1840 itself raised the question, the king and the aristocracy refused to entertain it. Yet the reign of Charles XIV. was, on the whole, most beneficial to Sweden; and, if there was much just cause for complaint, his great services to his adopted country were generally acknowledged. Abroad he maintained a policy of peace based mainly on a good understanding with Russia. Charles XIV.'s son and successor King Oscar I. was much more liberally inclined. Shortly after his accession (March 4, 1844) he laid several projects of reform before the Riksdag; but the estates would do little more than abolish the obsolete marriage and inheritance laws and a few commercial monopolies. As the financial situation necessitated a large increase of taxation, there was much popular discontent, which culminated in riots in the streets of Stockholm (March 1848). Yet, when fresh proposals for parliamentary reform were laid before the Riksdag in 1849, they were again rejected by three out of the four estates. As regards foreign politics, Oscar I. was strongly anti-German. As on the outbreak of the Dano-Prussian War of 1848–49, Sweden sympathized warmly with Denmark. Hundreds of Swedish volunteers hastened to Schleswig-Holstein. The Riksdag voted 2,000,000 dalers for additional armaments. It was Sweden, too, who mediated the truce of Malmö (Aug. 26, 1845), which
helped Denmark out of her difficulties. During the Crimean War Sweden remained neutral, although public opinion was decidedly anti-Russian, and sundry politicians regarded the conjunction as favourable for regaining Finland.

Oscar I. was succeeded (July 27, 1859) by his son, Charles XV. (q.v.), who was already aced as regent during his father's illness. He succeeded, with the invaluable assistance of the minister of justice, Baron Louis Gerhard de Geer (q.v.), in at last accomplishing the much-needed reform of the constitution. The way had been prepared in 1860 by a sweeping measure of municipal reform; and, in January 1863, the government brought in a reform bill by the terms of which the Riksdag was henceforth to consist of two chambers, the Upper House being a sort of aristocratic senate, while the membership of the Lower House was to be elected triennially by popular suffrage. The new constitution was accepted by all four estates in 1865 and promulgated on the 22nd of January 1866. On the 1st of September 1866, the first elections under the new system were held; and on the 10th of January 1867, the new Riksdag met for the first time. With this one great reform Charles XV. had to be content; in all other directions he was hampered, more or less, by his own creation. The Riksdag refused to sanction his favourite project of a reform of the Swedish army on the Prussian model, for which he had ample time, partly from motives of economy, partly from an apprehension of the king's martial tendencies. In 1864 Charles XV. had endeavoured to form an anti-Prussian league with Denmark; and after the defeat of Denmark he projected a Scandinavian union, in order, with the help of France, to oppose Prussian predominance in the north—a policy which naturally collapsed with the overthrow of the French Empire in 1870. He died on the 18th of September 1872, and was succeeded by his brother, the duke of Gottland, who reigned as Oscar II. (R. N. B.)

The economic condition of Sweden, owing to the progress in material prosperity, was much better in 1871 than in any former year. The results of the Franco-German War, which had ended in 1871, were not satisfactory. Politically, however, the outlook was not so favourable. In their results, the reforms inaugurated during the preceding reign did not answer expectations. Within three years of the introduction of the new electoral laws De Geer's ministry had forfeited much of its former popularity, and had been forced to resign. In the vital matter of national defence no common understanding had been arrived at, and during the conflicts which had raged round this question, the two warring parties, the Peasants, who had set up the system of taxation, for a reorganization of the army based on a stammtrupp system (regular army), by the enlistment of hired soldiers, and for naval reforms. In this last connexion the most suitable types of vessels for coast defence as for offence were determined upon. But Count Posse, deserted by his own party over the army bill, resigned, and was succeeded on the 16th of May 1884 by Oscar Themtouder, who had been minister of finance in the previous cabinet. The new premier succeeded in persuading the Riksdag to pass a bill increasing the period of service with the colours in the army to six years and that in the militia to forty-two days, and as a set-off a remission of half the corn tax.

Influenced by the economic reaction which took place in 1879 in consequence of the state of affairs in Germany, where Prince Bismarck had introduced the protectionist system, a Protective protectionist party had been formed, which tried to gain adherents in the Riksdag. It is true that in the Riksdag of 1882 the commercial treaty with France was renewed, but since 1885 the protectionist party was prepared to begin the combat, and a duty on corn, which had been proposed in the Riksdag of the same year, was rejected by only a slight majority. During the period of the unusually low price of corn of 1886, which greatly affected the Swedish farm, the Riksdag, by a gain ground to such an extent that its final triumph was considered as certain within a short time. During the Riksdag of the same year, however, the premier, Themtouder, emphatically declared himself against the protectionist party, and while the parties in the Second Chamber were equal in number, the proposed tax on corn was rejected in the First Chamber. In the Riksdag of 1887 there was a majority for protection in the Second Chamber, and in the first the majority against the tax was so small that the tax on corn would have triumphed in a combined meeting of the two chambers. The government, availing itself of its formal right not to dissolve the chamber in which it had the support of a majority, therefore dissolved only the Second Chamber (March 1887).

The new Riksdag assembled in May with a free trade majority
in the Second Chamber, but nothing in connexion with the great question of customs was settled. In the meantime, the powerful majority in the Second Chamber split into two groups—the new “Landtmanna” party, which approved protection in the interests of agricultural classes; and a somewhat smaller group, the old “Landtmanna” party, which favoured free trade.

The victory of the free traders was not, however, destined to be of long duration, as the protectionists obtained a majority in both chambers in the next Riksdag (1888). To the First Chamber protectionists were almost exclusively elected, and in the Second all the twenty-two free traders representing Stockholm were overruled by one of their number not having paid his taxes a few years previously, which prevented his being eligible. Instead, then, of twenty-two free traders representing the majority of the Stockholm electors, twenty-two protectionists, representing the minority, were elected, and Stockholm was thus represented in the Riksdag by the choice of a minority in the capital. This singular way of electing members for the principal city in the kingdom could not fail further to irritate the parties. One result of the Stockholm election came at a convenient time for the Themptauer workshops. The financial affairs of the kingdom were found to be in a most unsatisfactory state. In spite of reduced expenses, a highly estimated revenue, and the contemplated raising of taxes, there was a deficit, for the payment or discharge of which the government would be obliged to demand supplementary supplies. The Themptauer ministry resigned.

The king retained, however, for a time several members of the ministry, but it was difficult to find a premier who would be able, during the transition from one system to another, to command sufficient authority to control the parties. At last Baron Gillis Bildt, who, while Swedish ambassador in Berlin, had witnessed the introduction by Prince Bismarck of the agrarian protectionist system in Germany, accepted the premiership, and it was under his auspices that the two chambers imposed a series of duties on necessaries of life. The new taxes, together with an increase of the excise duty on spirits, soon brought a surplus into the state coffers. At a council of state (Oct. 12, 1888) the king declared his wishes as to the way in which this surplus should be used. He desired that it should be applied to a fund for insurance and old age pensions for workmen and old people, to the lightening of the municipal taxes by state contributions to the schools and workhouses, to the abolition of the land taxes, and of the obligation of keeping a horse and man for military service, and, lastly, to the improvement of the shipping trade; but the Riksdag decided to devote it to other objects, such as the payment of the deficit in the budget, the building of railways and augmentation of their material, as well as to improvements in the defences of the country.

Baron Bildt resigned as soon as the new system seemed settled, making room for Baron Gustav Akerbjelm. The latter, however, also soon resigned, and was succeeded on the 10th of July 1891 by Erik Gustav Bostrom, a landed proprietor. The protectionist system gained in favour on the expiry of the commercial treaty with France in 1892, as it could now be extended to articles of industry. The elections of 1890, when the metropolis returned free traders and Liberals to the Second Chamber, certainly effected a change in the latter, as the representatives of the towns and the old “Landtmanna” party joined issue and established a free-trade majority in the chamber, but in the combined meetings of the two chambers the compact protectionist majority in the First Chamber turned the scale. The customs duties were, however, altered several times in accordance with market prices and ruling circumstances. Thus in 1892, when the import duty on unground corn was reduced from 25. 10d. to 15. 10d., and that on ground corn from 45. 9d. to 25. 10d. for 100 kilogrammes, the same duties were also retained for the following year. They were also retained for 1893 at the request of the government, which desired to keep faith with their promise that while the new organization of the army was going on no increase of duties on the necessaries of life should take place. This measure caused much dissatisfaction, and gave rise to a strong agrarian movement, in consequence of which the government, in the beginning of 1895, before the assembling of the Riksdag, made use of its right of raising the two duties on corn just referred to, 35. 7d. and 7s. 2d., which were afterwards somewhat reduced as far as seed corn for sowing purposes was concerned.

The question of customs duties now settled, that of national defence was taken up afresh, and in the following year the government produced a complete scheme for the abolition of the land tax in the course of ten years, in exchange for a compensation of ninety days’ drill for those liable to military service, “measures to retain the old military system of the country and to strengthen the defences of Norland, and the government bill for a reorganization of the army was accepted by the Riksdag in an extraordinary session. But it was soon perceived that the new plan was unsatisfactory and required recasting, upon which the minister of war, Baron Rappe, resigned, and was succeeded by Colonel von Crustebjorn, who immediately set to work to prepare a complete reorganization of the army, with an increase of the time of active service on the lines of general compulsory service. The Riksdag of 1900, in addition to grants for the fortifications at Boden, in the province of Norrbotten, and the fortresses, provided for the expenditure of objects, voted a considerable grant for an experimental mobilization, which fully exposed the defects and faults of the old system. In the Riksdag of 1901 E. G. Bostrom resigned, and was succeeded by Admiral F. W. von Otter, who introduced a new bill for the army reorganization, the most important item of which was the increase of the period of training to 365 days. The cost in connexion with the new scheme was expected to amount to 22 millions of kronor. The Riksdag, however, did not accept the new plan in its full extent. The time of drilling was reduced to 240 days for the infantry, to 300 days for the navy, while for the cavalry and artillery the time fixed was 365 days. The plan, thus modified, was then accepted by the government.

After the elections in 1890, the alliance already mentioned between the old “Landtmanna” party and the representatives of the towns had the result that the Liberals in the Second Chamber, to whom the representatives of the towns mostly belonged, were now in a position to decide the policy which the two united parties should follow. In order to prevent this, it was proposed to readjust the number of the members of the Riksdag. The question was only settled in 1893, when a bill was on the Russian model, and the members of the Riksdag in the First Chamber at 150, and in the Second at 230, of which 150 should represent the country districts and 80 the towns. The question of protection being now considered settled, there was no longer any reason for the continued separation of the two “Landtmanna” parties, who at the beginning of the Riksdag of 1895 joined issue and became once more a compact majority in the Second Chamber, as they had been up to the Riksdag of May 1887. The influence of the country representatives was thus re-established in the Second Chamber, but now the demands for the extension of the franchise came more and more to the front, and the premier, Bostrom, at last felt bound to do something to meet these demands. He accordingly introduced in the Riksdag of 1896 a very moderate bill for the extension of the franchise, which was, nevertheless, rejected by both chambers, all similar proposals by private members meeting the same fate. When at last the bill for the reorganization of the army, together with a considerably increased taxation, was accepted by the Riksdag of 1901, it was generally acknowledged that, in return for the increased taxation, it would only be just to extend the right of taking part in the political life and the legislative work of the country to those of the population who hitherto had been excluded from it. The government eventually laid a proposal for the extension of the franchise before the Riksdag of 1902, the chief feature of which was that the elector should be twenty-five years of age, and that married men over forty years should be entitled to two votes. The Riksdag, however, finally agreed to a proposal by Bishop Billing, a member of the First Chamber, that an address should be presented to the king asking for a full inquiry into the question of extending the franchise for the election of members to the Second Chamber.
In 1897 the Riksdag had received among its members the first socialist representative in the person of R. H. Brautigam, the leader of the Swedish Social Democrats. The Socialists, who had formerly confined their activity to questions affecting the working classes and their wages, took, however, in 1902 an active part in the agitation for the extension of the franchise. Processions of many thousands of workmen were organized, in Stockholm and in other towns of the kingdom, just before the Riksdag began the discussion on the above-mentioned bill of the government, and when the bill was introduced in the chambers a general and well-organized strike took place and continued during the three days the debate on the bill lasted. As this strike was of an exclusively political kind, and was intended to put pressure on the chambers, it was generally disapproved, and failed in its object.

The prime minister, Admiral von Otter, resigned shortly after the end of the session, and was succeeded by Boström, the ex-premier, who at the request of the king again assumed office.

The relations with Norway during King Oscar's reign had great influence on political life in Sweden, and more than once it seemed as if the union between the two countries was on the point of being wrecked. The dissensions chiefly had their origin in the demand by Norway for separate consuls and foreign ministers, to which reference is made under Norway. At last, after vain negotiations and discussions, the Swedish government in 1895 gave notice to Norway that the commercial treaty which till then had existed between the two countries and had lapsed in July 1897 would, according to a decision in the Riksdag, cease, and as Norway at the time had raised the customs duties, a considerable diminution in the exports of Sweden to Norway took place. The Swedish minister of foreign affairs, Count Lewenhaupt, who was considered as too friendly disposed towards the Norwegians, resigned, and was replaced by Count Ludvig Douglas, who represented the opinion of the majority in the First Chamber.

When, however, the Norwegian Storting, for the third time, passed a bill for a national or "pure" flag, which Richard Oscar I. considered as an insult to the Swedish consular service, Douglas resigned in his turn and was succeeded by the Swedish minister at Berlin, Lagerheim, who managed to pilot the questions of the union into more quiet waters. He succeeded all the better as the new elections to the Riksdag of 1900 showed clearly that the Swedish people was not inclined to follow the ultrconservative or so-called "patriotic" party, which resulted in the resignation of the two leaders of that party, Professor Oscar Alin and Count Marshal Patrick Reuterdal as members of the First Chamber. On the other hand, ex-Professor E. Carlsson, of the High School of Gothenburg, succeeded in forming a minority cabinet, Count Marschall Patrick Reuterdal as President of the Council, which had, besides being in favour of the extension of the franchise, advocated the full equality of Norway with Sweden in the management of foreign affairs.

The state of quietude which for some time prevailed with regard to the relations with Norway now was not, however, to be of long duration. The question of separate consuls for Norway soon came up again. In 1902 the Swedish government proposed that negotiations in this matter should be opened with the Norwegian government end that a joint commission of representatives from both countries, should be appointed to consider the question of a separate consular service without in any way interfering with the existing administration of the diplomatic affairs of the two countries. The result of the negotiations was published in a so-called "communiqué," dated the 24th of March 1903, in which, among other things, it was proposed that the relations of the separate consuls to the joint ministry of foreign affairs and the embassies should be arranged by identical laws, which could not be altered or repealed without the consent of the governments of the two countries. The proposal for these identical laws was accepted by the Norwegian government. As the proposal was submitted, did not meet with the approval of the Swedish government. The latter in their reply proposed that the Swedish foreign minister should have such control over the Norwegian consuls as to prevent the latter from exceeding their authority. This proposal, however, the Norwegian government found unacceptable, and explained that, if such control were insisted upon, all further negotiations would be purposeless. They maintained that the Swedish demands were incompatible with the sovereignty of Norway, as the foreign minister was Swede and the proposed Norwegian consular service, as a Norwegian institution, could not be placed under a foreign authority. A new proposal by the Swedish government was likewise rejected, and in February 1905 the Norwegians broke off the negotiations.

Notwithstanding this an agreement did not appear to be out of the question. All efforts to solve the consular question by itself had failed, but it was considered that an attempt might be made to establish separate consuls in combination with a joint administration of diplomatic affairs on a full unionistic basis. Crown Prince Gustaf, who during the illness of King Oscar was anointed regent, took the initiative of renewing the negotiations between the two countries, and on the 4th of April in a combined Swedish and Norwegian council of state made a proposal for a reform both of the administration of diplomatic affairs and of the consular service on the basis of full equality between the two kingdoms, with the express reservation, however, of a joint foreign minister—Swedish or Norwegian—as a condition for the existence of the union. This proposal was approved of by the Swedish Riksdag on the 3rd of May 1905. In order that no obstacles should be placed in the way for renewed negotiations, Mr Boström, the prime minister, resigned, and was succeeded by Ramstedt. The proposed negotiations were not, however, renewed.

On the 23rd of May the Norwegian Storting passed the government's proposal for the establishment of separate Norwegian consuls, and as King Oscar, who again had resumed the reins of government, made use of his constitutional right to veto the bill, the Norwegian ministry tendered their resignation. The king, however, declared he could not now accept their resignation, whereupon the ministry at a sitting of the Norwegian Storting on the 7th of June placed their resignation in its hands. The Storting thereupon unanimously adopted a resolution stating that, as the king had declared himself unable to form a government, the constitutional royal power "ceased to be operative," whereupon the ministers were requested, until further instructions, to exercise the power vested in the king, and as King Oscar thus had ceased to act as "the king of Norway," the union with Sweden was in consequence dissolved.

In Sweden, where they were least of all prepared for the turn things had taken, the action of the Storting created the greatest surprise and resentment. The king solemnly protested against what had taken place and summoned an extraordinary session of the Riksdag of June to consider what measures should be taken with regard to the question of the union, which had arisen suddenly through the revolt of the Norwegians on the 7th of June. The Riksdag declared that it was not opposed to negotiations being entered upon regarding the conditions for the dissolution of the union if the Norwegian Storting, after a new election, made a proposal for the repeal of the Act of Union between the two countries, or, if a proposal to this effect was made by Norway after the Norwegian people, through a plebiscite, had declared in favour of the dissolution of the union. The Riksdag further resolved that 100 million kroner (about £550,000) should be held in readiness and be available as the Riksdag might decide. On the resignation of the Ramstedt ministry Mr Lundeberg formed a coalition ministry consisting of members of the various parties in the Riksdag, after which the Riksdag was prorogued on the 3rd of August.

After the plebiscite in Norway on the 13th of August had decided in favour of the dissolution of the union and after the Storting had requested the Swedish government to co-operate with it for the repeal of the Act of Union, the Riksdag, in its annual convention, convened at Karlstad on the 31st of August. On the 23rd

1 For further details see NORWAY: History.
of September the delegates came to an agreement, the principal points of which were: that such disputes between the two countries which could not be settled by direct diplomatic negotiations, and which did not affect the vital interests of either country, should be referred to the permanent court of arbitration at the Hague, that on either side of the southern frontier a neutral zone of about fifteen kilometres width should be established, and that within eight months the fortifications within the Norwegian part of the zone should be destroyed. Other clauses dealt with the rights of the Laplanders to graze their reindeer alternatively in either country, and with the question of transport of goods across the frontier by rail or other means of communication, so that the traffic should not be hampered by any import or export prohibitions or otherwise.

From the 2nd to the 19th of October the extraordinary Riksdag was again assembled, and eventually approved of the arrangement come to by the delegates at Karlstad with regard to the dissolution of the union as well as the government proposal for the repeal of the Act of Union and the recognition of Norway as an independent state. An alteration in the Swedish flag was also decided upon, by which the mark of union was to be replaced by an azure-blue square. An offer from the Norwegian Stortingh to elect a prince of the Swedish royal house as king in Norway was declined by King Oscar, who now on behalf of himself and his successors renounced the right to the Norwegian crown. Mr Lundeborg, who had accepted office only to settle the question of the dissolution of the union, now resigned and was succeeded by a Liberal government, with Mr Karl Staaff as prime minister.

The question of the extension of the franchise, which was a burning one, was to be the principal measure of the Staaff government. It brought in a bill for manhood suffrage at elections for the Second Chamber, together with single member constituencies and election on the absolute majority principle. The bill was passed by the Second Chamber on the 15th of May 1906, by 134 to 94 votes, but it was rejected by the First Chamber by 126 to 18. The latter chamber instead passed a bill for manhood suffrage at elections for the Second Chamber, on the condition that the elections for both chambers should take place on the basis of proportional representation. Both chambers thereupon decided to ask the opinion of the king with regard to the simultaneous extension of the franchise to women at elections for the Second Chamber. The government bill having, however, been passed by the Second Chamber, the prime minister proposed to the king that the Riksdag should be dissolved and new elections for the Second Chamber take place in order to hear the opinion of the country, but as the king did not approve of this Mr Staaff and his government resigned.

A Conservative government was then formed on the 29th of May by Mr Lindman, whose principal task was to find a solution of the suffrage question which both chambers could accept. A government bill was introduced, proposing the settlement of the question on the basis of the bill carried by the First Chamber in the Riksdag of the preceding year. A compromise, approved of by the government, was adopted by the First Chamber on the 14th of May 1907 by 110 votes against 29 and in the Second Chamber by 128 against 98. By this act proportional representation was established for both chambers, together with universal manhood suffrage at elections for the Second Chamber, on the condition of the qualifications for eligibility for the First Chamber and a reduction of the electoral term of this chamber from nine to six years, and finally payment of members of the First Chamber, who hitherto had not received any such emolument. King Oscar II. died on the 9th of December 1907, sincerely regretted by his people, and was succeeded as king of Sweden by his eldest son, Prince Gustaf. During King Oscar's reign many important social reforms were carried out by the legislature, and the country developed in all directions. In the Riksdag of 1894 a new patent law was adopted, the age at which women should be held to attain their majority was fixed at twenty-one years and the barbarous prison punishment of "bread and water" abolished. In order to meet the cost of the new army organization the Riksdag of 1902 increased the revenue by progressive taxation, but only for one year. Bills for the improvement of the social conditions of the people and in the interests of the working classes were also passed. During the five years 1884—1889 a committee was appointed with the question of workmen's insurance, and thus the government made proposals for its settlement, on the last occasion adopting the principle of invalidity. The basis for insurance against accidents, illness or old age. The Riksdag, however, delayed coming to a decision, and contented itself by earmarking money for an insurance fund. At last the Riksdag of 1901 accepted a Bill for insurance against accidents which also extended to agricultural labourers, in connexion with the establishment of a state institution for insurance. The bill for protection against accidents, as well as for the limitation of working hours for women and children, was passed, together with one for the appointment of special factory inspectors. When in 1897 King Oscar celebrated his jubilee against the plan of the Narbutowsky, which had been organized in Stockholm offered a convincing proof of the progress the country had made in every direction.

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**SWEDISH LITERATURE.**

Swedish literature, as distinguished from compositions in the common norrerna tunga of old Scandinavia, cannot be said to exist earlier than the 13th century. Not until the period of the Reformation was its development in any degree rapid or copious. The form in which Swedish exists as a written language (see SCANDINAVIAN LANGUAGE) is the series of manuscripts known as Landshöadsagernar, or "The Common Laws." These are supposed to be the relics of a still earlier age, and it is hardly believed that we even possess the first that was put down in writing. The most important and the most ancient of these codes is the "Elder West Göta Law," reduced to its present form by the law-man Eschk about 1250. Another of great interest is Magnus Eriksson's "General Common Law," which was written in 1347. These ancient codes have been collected and edited by the learned jurist, K. J. Schneyer (1775—1888) as Consys turis Svea-Gotorom antiqii (4 vols., 1827—1849). The chief ornament of medieval Swedish literature is Um styrelse kununga ok höfthoga ("On the Conduct of Kings and Princes"), first printed by command of Gustavus II. Adolphus, in 1634. The writer is not known; it has been conjecturally dated 1325. It is a handbook of moral and political teaching, expressed in terse and vigorous language. St Bridge, or Birgitta (1303—1373), an historical figure of extraordinary interest, has left her name attached to several important religious works, in particular to a collection of Uppenbarelse ("Revelations"), in which her visions and ecstatic
meditations are recorded, and a version, the first into Swedish, of the five books of Moses. This latter was undertaken, at her desire, by her father-confessor Matthias (d. 1350), a priest at Linköping. The translation of the Bible was continued a century later by a monk named Johannes Budde (d. 1482).

In verse the earliest Swedish productions were probably the folk-song. The age of these, however, has been commonly exaggerated. It is doubtful whether any still exist which are as old, in their present form, as the 13th century. The bulk are now attributed to the 15th, and many are doubtless much later still. The last, such as "Axel och Valborg," "Liten Karin," "Kämpen Grimborg," and "Habor och Signild," deal with the adventures of romantic medieval romance. Almost the only positive clue we hold to the date of these poems is the fact that on one occasion one of them, written in Old Swedish, was "credited" to the 12th century, written by Thomas, bishop of Strängnäs, who died in 1443. Thomas, who left other poetical pieces, is usually called the first Swedish poet. There are three rhyming chronicles in medieval Swedish, all anonymous. The earliest, Erickskronikan, is attributed to 1320; the romance of Karl Magnus, Nyta Karlskrönikan, describing the period between 1387 and 1452, which is sometimes added to the earlier work, dates from the middle of the 15th century; and the third, Sturekrönikorna, was probably written about 1500. The collection of rhymed romances which bears the name of Queen Ephiphanius' Song must have been written before the death of the Norwegian queen in 1312. They are versions of three medieval stories taken from French and German sources, and dealt with the Chevalier au lion, of Chrestien de Troyes, with Duke Frederick of Normandy, and with Flores and Blanchefer. They possess very slight poetic merit in their Swedish form. A little later the romance of King Alexander was translated by, or at the command of, Bo Jonsson Grip; this is more meritorious. Bishop Thomas, who died in 1443, wrote many political songs; and a number of narrative poems date from the close of the century. A brilliant and pathetic relic of the 15th century is the "Lied" of Sigurd von Floda, addressed in 1498 by Ingrid Persdotter, a nun of Vadstena, to the young knight Axel Nilsson. The first book printed in the Swedish language appeared in 1495.

The 16th century added but little to Swedish literature, and that little is mostly connected with the newly-founded university of Upsala. The Renaissance scarcely made itself felt in Scandinavia, and even the Reformation failed to waken the genius of the country. Psalms and didactic spiritual poems were the main products of Swedish letters in the 16th century. Two writers, the brothers Petri, sons of a smith at Orebro, take an easy prominence in so barren a period. Olaus Petri (1493-1552) and his history of Sweden, a mystery-play, Tobiae covenant, which is the first Swedish drama, and three psalm-books, the best known being published in 1530 under the title of Några gudhelige visor ("Certain Divine Songs"). His Chronicle was based on a number of sources, in the treatment of which he showed a discrimination which makes the work still useful. Laurentius Petri, who was a man of calmer temperament, was archbishop of all Sweden, and edited or superintended the translation of the Bible published at Upsala in 1540. He also wrote many psalms. Laurentius Andreae, 1532, had previously prepared a translation of the New Testament, which appeared in 1526. He was a polemical writer of prominence on the side of the Reformers. Finally, Petrus Niger (Peder Svervit), bishop of Vesterås (d. 1562), wrote a chronicle of the life of Gustavus I. up to 1553, in excellent prose. The same writer left unpublished a history of the bishops of Vesterås, his predecessors. The latter half of the 16th century is a blank in Swedish literature.

With the accession of Charles IX., and the consequent development of Swedish greatness, literature began to assert itself in more vigorous forms. The long life of the royal librarian, Johannes Bure or Bureaus (1568-1632), formed a link between the age of the Petri and that of Stjernhjelm. He was a learned man of the school of modern sciences, but his interest was mainly philosophical and jurisprudence; he was a wanderer in the world, and embalmed in his work the spirit of the Reformation, which was his noblest work, a universal philosophy in a multitude of unreadable volumes. But he was a patient antiquary, and advanced the knowledge of ancient Scandinavian mythology and language very considerably. He awakened curiosity and roused a public sympathy with letters; nor was it without significance that two of the greatest Swedes of the century, Gustavus Adolphus and the poet Stjernhjelm, were his pupils. The reign of Charles IX. saw the rise of secular drama in Sweden. The first comedy was The Tale of Magus Olai and Aetheropus (d. 1607), a coarse but witty piece on the story of Pyramus and Thisbe, acted by the schoolboys of the college of Arboga in 1610. This play is the Ralph Roister Doister of Swedish literature. A greater dramatist was Johannes Messenius (1570-1636), who was the son of a miller near Vadstena and had been carefully educated abroad by the Jesuits. Being discovered plotting against the government during the absence of Gustavus in Russia, he was condemned to imprisonment for life—that is, for twenty years. Before this disaster he had been professor of jurisprudence in Upsala, where his first historical comedy Dina was performed in 1611 and the Roman War, 1614. He published two novels, one on the history of his country in fifty plays; he completed and produced six. These dramas are not particularly well arranged, but they form a little body of theatrical literature of singular interest and value. Messenius was a genuine poet; the lyrics he introduces have something of the charm of the old ballads. He wrote abundantly in prison; his magnum opus was a history of Sweden in Latin, but he has also left, in Swedish, two important rhyme-chronicles. Messenius was imitated by a little crowd of playwrights. Nikolaus Holger Catonius (d. 1652) wrote a fine tragedy on the Trojan War, Trojenborgh, in which he excelled Messenius as a dramatist. Andreas Prytz, who died in 1659, a bishop of Linköping, produced several religious chronicle plays from Swedish history. Jacobus Rondeliius (d. 1662) wrote a curious "Christian tragi-comedy" of Judas redivivus, which contains some amusing scenes from daily Swedish life. Another good play was an anonymous Holofernes and Judith (edited at Upsala, 1895, by O. Sylvan). These plays were all acted by schoolboys and university youths, and when they went out of fashion among these classes the drama in Sweden almost entirely ceased to exist. Two historians of the reign of Charles IX., Erik Gorranson, Tezel (d. 1611), the Aspödahl Skrifter, wrote monographs. The chamberllor Magnus Gabriel de la Gardie (1622-1686) did much to promote the study of Swedish antiquities. He founded the College of Antiquities at Upsala in 1667, and bought back the Gothic Codex argenteus which he presented to the university library.

The reign of Gustavus Adolphus was adorned by one great writer, the most considerable in all the early history of Sweden. The title of "the Father of Swedish poetry" has been universally, awarded to Göran Lilja, better known by his adopted name of Georg Stjernhjelm (q.v.; 1586-1672). Stjernhjelm was a man of almost universal attainment, but it is mainly in verse that he has left his stamp upon Swedish literature. His greatest work is the Sveriges föritters riksgudom ("The King of the Swedes"") and his Sveriges herrestammar ("The House of Sweden")

1Skanska folkvisor, edited by E. G. Geijer and A. A. Afzelius (3 vols., Stockholm, 1879).
2See Cederhielm, Om Erikskrönikan (1890).
3Editions of these chronicles and romances have been issued by the "Svenska Fornskrift Sällskapet" (Stockholm): Jean Lejonridaren (ed. Stephens), Hertig Fredrik of Normandie (ed. Ahlstrand) Flores och Blanchefer (ed. G. E. Klemming), Alexander (ed. Klemming), Carl Magnus (ed. Klemming, in Föreorbiten från medeltiden).

4Selections from his writings were edited by G. E. Klemming, (Upsala, 1883-1888).

5Edla, for a learned society (Upsala, 1886, &c.) by H. Schück.
SWEDEN [LITERATURE]

The country of his language. He found the language Swedish and halting, and he moulded it into perfect smoothness and elasticity. His master, Buraeus, had written a few Swedish hexameters by way of experiment. Stjernhjem took the form and made it national.

The claim of Stjernhjem to be the first Swedish poet may be contested by a younger man, but a slightly earlier writer, Peter von Rosenhane (1632-1678) was a reformer on quite other lines. If Stjernhjem studied Opitz, Rosenhane took the French poets of the Renaissance for his models, and in 1650 wrote a cycle of one hundred sonnets, the earliest in the language; these were published under the title Venerid in 1668. Rosenhane printed in 1668 a "Complaint of the Swedish Language" in thirteen hundred rattling rhyming lines, and in 1682 a collection of eighty songs. He was a metrist of the artistic order, skilful, learned and unimpassioned. His zeal for the improvement of the literature of his country was beyond question. Most of the young poets, however, followed Stjernhjem rather than Rosenhane. As personal friends and pupils of the former, the brothers Columbus deserves special attention. They were sons of a musician and poet, Jonas Columbus (1586-1663). Each wrote copiously in verse, but Johan (1640-1684), who was professor of poetry at Upsala, almost entirely in Latin, while Samuel (1642-1679), especially in his Odas poeticae, showed himself an apt and fervid imitator of the Swedish hexameters of Stjernhjem, to whom he was at one time secretary, and whose Hercules he dramatized. His works were included by P. Hansell in vol. ii. of Semlae vitterhets-arsken, &c.

Of a rhyming family of Hjarne, it is enough to mention one member, Urban Hjarne (1641-1724), who introduced the new form of classical tragedy from France, in a species of transition from the masques of Stjernhjem to the later regular rhymed dramas. His best play was a Rosimunda. Lars Johansson (1542-1674), who called himself "Lucidor the Unfortunate," has been the subject of a whole tissue of romance, most of which is fabulous. It is true, however, that he was stabbed, like Marlowe, in a midnight brawl at a tavern. His poems were posthumously collected as Flowers of Helicon, Plucked and Distributed on various occasions by Lucidor the Unfortunate. Stripped of the myth which had attracted so much attention to his name, Lucidor proves to be an occasional rhymer of a very low order. Haquin Spigel (1654-1714), the famous archbishop of Upsala, wrote a long didactic epic in alexandrines, God's Labour and Rest, with an introductory ode to the Deity in rhymed hexameters. He was also a good writer of hymns. Another ecclesiastic, the bishop of Skara, Jesper Svobgod (1605-1735), wrote sacred verses, but is better remembered as the father of Stjernhjem's brother Petter. His lively and lighthearted character and his pastoral vein in his ingenious lyrics Elenandra and Lycylius, he was professor of poetry, that is to say, of the art of writing Latin verses, at Upsala. Olof Wexionius (1665-1692) published his Sinne-Afsl, a collection of graceful miscellaneous pieces, in 1684, in an edition of only 100 copies. Its existence was presently forgotten, and the name of Wexionius had dropped out of the history of literature, when Hansell recovered a copy and reprinted its contents in 1863.

We have hitherto considered only the followers of Stjernhjem; we have not noticed an important writer who followed in the footsteps of Rosenhane. Gunno Eurelius, Dahlstjerna, Afterwards ennobled with the name of Dahlstjerna (q.v.; 1661-1709), early showed an interest in the poetry of Italy. In 1690 he translated Guarini's Pastor Fido, and in or just after 1697 published, in afolio volume without a date, his Kungo-Sald, the first original poem in ottava rima produced in Swedish. This is a bombastic and vainglorious epic in honour of Charles XI, whom Eurelius adored; it is not, however, without great merits, richness of language, flow of metre, and the breadth of a genuine poetic enthusiasm. He published his little collection of sonnets when his great master died. Johan Paulinus Liljestedt (1655-1732), a Finn, was a graceful imitator of Ronsard and Guarini. Johan Runius (1679-1713), called the "Prince of Poets," published a collection entitled Dduaim, in which there is nothing to praise, and with him the generation of the 17th century closes. Talent had been shown by certain individuals, but no healthy school of Swedish poetry had been founded, and the latest imitators of Stjernhjem had lost every vestige of taste and independence. In protest the 17th century produced but little of importance in Sweden. Gustavus Adolphus (1594-1632) was the most polished writer of its earlier half, and his speeches take an important place in the development of the language. The most original mind of the next age was Olof Rudbeck (1630-1702), the famous author of Atlant eller Manhem. He spent nearly all his life in Upsala, building anatomical laboratories, conducting musical concerts, laying out botanical gardens, arranging medical lecture rooms—in a word, expending ceaseless energy on the practical improvement of the university. He was a genius in all the known branches of learning; at twenty-three his physiological discoveries had made him famous throughout Europe. His Atlant (or Atlantika) appeared in fourfolio volumes, in Latin and Swedish, in 1675-1698; it was an attempt to summon all the authority of the past, all the sages of Greece and the bards of Iceland, to prove the inherent and indisputable greatness of the Swedish nation, in which the fabulous Atlantis had been at last discovered. It was the literary expression of the majesty of Charles XI., and of his autocratical dreams for the destiny of Sweden. From another point of view it is a monstrous hoard of rough-hewn antiquarian learning, which, however, sometimes quoted from, and never read. Olof Verulius (1618-1682) had led the way for Rudbeck, by his translations of Icelandic sagas, a work which was carried on with greater intelligence by Johan Peringskold (1634-1700), the editor of the Heimskringla (1667), and J. Hadorph (1630-1693). The French philosopher Descartes, who died at Christina's court at Stockholm in 1650, found his chief, though posthumous, disciple in Andreas Rydelius (1671-1738), bishop of Lund, who was the master of Dalin, and thus connects us with the next epoch. His chief work, Nidico framsatsfningar ... (5 vols.) appeared in 1718. Charles XII., under whose special patronage Rydelius wrote, was himself a metaphysician and physiologist of merit.

A much more brilliant period followed the death of Charles XII. The literature of France and England took the place of that of Germany and Italy. The taste of Louis XIV., tempered by the study of Addison and Pope, gave its tone to the academical court of Queen Louise Ulrica, who founded in 1758 the academy of literature, which developed later into the academy of literature, history and antiquities.

Most of the early and brilliant contemporaries of Dalin became completely a slave to the perquisites of literature, to the unities and graces of classical France. Nevertheless this was a period of great intellectual stimulus and activity, and Swedish literature took a solid shape for the first time. This Augustan period in Sweden closed somewhat abruptly about 1765. Two writers in verse connect it with the school of the preceding century. Jacob Frese (1692-1728), a Finn, whose poems were published in 1726, was an elegiac writer of much grace, who foreshadowed the idyllic manner of Creutz. Atterbom pronounces Frese the best Swedish poet between Stjernhjem and Dalin. Samuel von Triewald (1688-1743) played a very imperfect Dryden to Dalin's Pope. He was the first Swedish satirist, and introduced Boileau to his countrymen. His Satire upon our Stupid Poets may still be read with entertainment.1 Both in verse and prose Olof von Dalin (q.v.; 1708-1763) takes a higher place than any writer since Stjernhjem. He was inspired by the study of his great English contemporaries. His Swedish Argus (1733-1734) was modelled on Addison's Spectator, his Thoughts about Critics (1736) on Pope's Essay on Criticism, his Tale of a Horse on Swift's Tale of a Tub. Dalin's style, 1The works of the three writers between Stjernhjem and Dalin were edited by P. Hansell (Upsala, 1856, &c.) as Samlaede vitterhetsoverfor af svenska forfarare.
whether in prose or verse, was of a finished elegance. As a prose writer Dalin is chiefly memorable for his History of the Swedish Kingdoms (4 vols., 1746–1762). His great epic, Swedish Freedom (1742) was written in alexandrines of far greater smoothness and vigour than had previously been attempted. When in 1737 the new Royal Swedish Theatre was opened, Dalin led the way to a new school of dramatists with his Brynhilda, a regular tragedy in the style of Crébillon père. In his comedy Of the Eunuch Man he introduced the manner of Molière, or more properly that of Holberg. His songs, his satires, his occasional pieces, without displaying any real originality, show Dalin’s tact and skill as a workman with the pen. He stole from England and France, but with the plagiarism of a man of genius; and his multifarious labours raised Sweden to a level with the other literary countries of Europe. They formed a basis upon which more national and more scrupulous writers could build their various structures. A foreign critic, especially an English one, will never be able to give Dalin so much credit as the Swedes do; but he was certainly an unsurpassable master of pastiche.

Fru Nordenflycht. Fru Nordenflycht (1718–1763) was the centre of a society which took the name of Tankbyggare Orden and ventured to rival Voltaire’s Société des Écrivains. In December 1746 it was left by Pelle Rosén von Rosenstein (1706–1773), in navigation by Admiral Fredrik Henrik af Chapman (d. 1808), in philology by Carl Aurivillus (d. 1786). But these and other distinguished savants whose names might be enumerated scarcely belong to the history of Swedish literature. The same may be said about that marvellous and many-sided genius, Emanuel Swedenborg (1688–1772), who, though the son of a Swedish poet, preferred to prophesy to the world in Latin.

What is called the Gustavian period is supposed to commence with the reign of Gustavus III. in 1771 and to close with his death (1792), the period of less than forty years was particularly rich in literary talent, and the taste of the people in literary matters widened to a remarkable extent. Journalism began to develop; the Swedish Academy was founded; the drama first learned to flourish in Stockholm; and literature began to take a characteristically national shape. This fruitful period naturally divides itself into two divisions, equivalent to the reigns of the two kings. The royal personages of Sweden have commonly been protectors of literature; they have strangely often been able men of letters themselves. Gustavus III. (1746–1792), the founder of the Swedish Academy and of the Swedish theatre, was himself a playwright of considerable ability. One of his prose dramas, Siri Bräde och Johan Gyllenborg, held the stage for many years. But his best work was his national drama of Gustaf Vasa (1783), written by the king in prose, and afterwards versified by Kellgren. In 1773 the king opened the national theatre in Stockholm, and on that occasion an opera of Thetis och Pelle was performed, written by himself. In 1786 Gustavus created the Swedish Academy, on the lines of the French Academy, but with eighteen members instead of forty. The first list of immortals, which included the survivors of a previous age and such young celebrities as Kellgren and Leopold, embraced all that was most brilliant in the best society of Stockholm; the king himself presided, and won the first prize for an oration. The works of Gustavus III. in six volumes were printed at Stockholm in 1802–1806.

The principal writers of the reign of Gustavus III. bear the name of the academical school. But Karl Mikael Bellman (q.v.; 1740–1795), the most original and one of the most able of all Swedish writers, an improvisatore of the first order, had nothing academical in his composition. The poet of his dithyrambic hymns sounded a strange note of nature amid the conventional music of the Gustavians. Of the academical poets Johan Gabriel Oxenstjerna (1750–1818), the nephew of Gyllenborg, was a descriptive idyllist of grace.

Glossarium suogothicum (1760), a historical dictionary with many valuable examples from the ancient monuments of the language. In doing this he was assisted by the labours of two other grammarians, Sven Hol (d. 1786) and Abraham Sahstedt (d. 1776). The chief historians were Sven Lagerberg (d. 1707–1787), author of a still valuable history of Sweden down to 1437 (Svea Rikes historia, 4 vols., 1769–1793); Olof Celsius (1716–1794), bishop of Lund, who wrote histories of Gustavus I. (1746–1753) and of Eric XIV. (1774); and Carl Gustaf Tessin (1605–1779) who wrote on politics and on aesthetics. Tessin’s Old Man’s Letters to a Young Prince were addressed to his pupil, afterwards Gustavus III. Count Anders Johan von Höpken (1712–1788), the friend of Louise Ulrica, was a master of rhetorical compliment in addresses and funeral orations.

In spirit all of the earlier poets of whom we have spoken did not flourish in Sweden. Among the tragic writers of the age we may mention Dalin, Gyllenborg, and Erik Wrangel (1686–1705). In comedy Reinhold Gustaf Modèe (d. 1752) wrote three good plays in rivalry of Holberg.

In science Linnaeus, or Karl von Linné (1707–1778), was the name of greatest genius in the whole century; but he wrote almost entirely in Latin. The two great Swedish chemists, Torbern Olof Bergman (1735–1784) and Karl Vilhelm Scheele (1742–1786), flourished at this time. In pathology a great voice was heard from Elias Rothen von Rosenstein (1706–1773), in navigation by Admiral Fredrik Henrik af Chapman (d. 1808), in philology by Carl Aurivillus (d. 1786). But these and other distinguished savants whose names might be enumerated scarcely belong to the history of Swedish literature. The same may be said about that marvellous and many-sided genius, Emanuel Swedenborg (1688–1772), who, though the son of a Swedish poet, preferred to prophesy to the world in Latin.
He translated *Paradise Lost*. A writer of far more power and versatility was Johan Henrik Kellgren (q.v.; 1751–1790), the leader of taste in his time. He was the first writer of the end of the century in Sweden, and the second undoubtedly was Karl Gustaf af Leopold (1756–1829), "the blind see Tiresias-Leopold," who lived on to represent the old school in the midst of romantic times. Leopold attracted the notice of Gustavus III. by a volume of *Erotic Odes* (1783). The king gave him a pension and rooms in the palace, admitting him on intimate terms. He was not equal to Kellgren in general poetical ability, but he is great in didactic and satiric writing. He wrote a satire, the *Enebomad*, against a certain luckless Per Enebom, and a classic tragedy of *Virginia*. Gudmund Göran Adlerbeth (1751–1818) made translations from the classics and from the Norse, and was the author of a successful tragic opera, *Cora och Alonso* (1782). Anna Maria Lenngren (1754–1817) was a very popular sentimental writer of graceful domestic verse, chiefly between 1792 and 1798. She was less French and more national than most of her contemporaries; she was a Swedish Mrs Hemans. Much of her work appeared anonymously, and was generally attributed to her contemporaries Kellgren and Leopold.

Two writers of the academic period, besides Bellman, and a generation later than he, kept apart, and served to lead up to the romantic revival. Bengt Lidner (1759–1793), a melancholy and profoundly elegiac writer, had analogies with Novalis. He interrupted his studies at the university by a voyage to the East Indies, and returned to Stockholm after many adventures. In spite of the patronage of Gustavus III. he continued to lead a disordered, wandering life, and died in poverty. A short narrative poem, *The Death of the Countess Spastora* (1783), has retained its popularity. Lidner was a genuine poet, and his lack of durable success must be set down to faults of character, not to lack of inspiration. His poems appeared in 1788. Thomas Thorild (1759–1808) was a much stronger nature, and led the revolt against prevailing taste with far more vigour. But he is an irregular and inartistic versifier, and it is mainly as a prose writer, and especially as a very original and courageous critic, that he is now mainly remembered. He settled in Germany and died as a professor in Greifswald. Karl August Ehrensvard (1745–1800) may be mentioned here as a critic whose aims somewhat resembled those of Thorild. The creation of the Academy led to a great production of aesthetic and philosophical writing. Among critics of taste may be mentioned Nils Rosén von Rosenstein (1752–1824); the rhetorical bishop of Linköping, Magnus Lönberg (1758–1808); and Count Georg Adlersparre (1760–1809). Rosén von Rosenstein embraced the principles of the encyclopaedists while he was attached to the Swedish embassy in Paris. On his return to Sweden he became tutor to the crown prince, and held in succession a number of important offices. As the first secretary of the Swedish Academy he exercised great influence over Swedish literature and thought. His prose writings, which include prefaces to the works of Kellgren and Lidner, and an eloquent argument against Rousseau's theory of the injurious influence of art and letters, rank with the best of the period. Kellgren and Leopold were both of these writers.

The excellent lyrical poet Frans Mikael Franzén (q.v.; 1772–1847) and a belated academian Johan David Valerius (1776–1822), fill up the space between the Gustavian period and the domination of romantic ideas from Germany. It was Lorenzo Hammersköld (1785–1827) who in 1803 introduced the views of Tieck and Schelling by founding the society in Upsala called "Vitterhetens Vänner," and by numerous critical essays. His chief work was *Svenska bilderlitteratur* (1818, &c.) a history of Swedish literature. Hammersköld's society was succeeded in 1807 by the famous "Aurora förbundet," founded by two youths of genius, Per Atterbom. Daniel Amadeus Atterbom (1790–1855) and Vilhelm Fredrik Palmblad (1788–1852). These young men had at first to endure bitter opposition and ridicule from the academic writers then in power, but they supported this with cheerfulness, and answered back in their magazines *Polyphem* and *Forsoras* (1810–1813). They were named "Forsoristerna" ("Phosphorists") from the latter. Another principal member of the school was Karl Frederik Dahlgren (q.v.; 1791–1844), a humorist who owed much to the example of Bellman. Fru Julia Nyberg (1792–1859) under the title of Ephrasyne, was their tenth Muse, and wrote agreeable lyrics. Among the Phosphorists Atterbom was the man of most genius. On the side of the Academy they were vigorously attacked by Per Adam Wallmark (1777–1838), to whom they replied in a satire which was the joint work of several of the romanticists, *Markall's Sleepless Nights*. One of the innovators, Atterbom, eventually forced the doors of the Academy itself.

In 1811 certain young men in Stockholm founded a society for the elevation of society by means of the study of Scandinavian antiquity. This was the Gothic Society, which began to issue the magazine called *Iduna* as its organ. Of its patriotic editors the most prominent was Erik Gustaf Geijer (q.v.; 1783–1847), but he was presently joined by a young man slightly older than himself, Esaias Tegnér (q.v.; 1782–1846), afterwards bishop of Växjö, the greatest of Swedish writers. Even more enthusiastic than either in pushing to its last extreme the worship of ancient myths and manners was Per Henrik Ling (1776–1859), now better remembered as the father of gymnastic science than as a poet. The Gothic Society eventually included certain younger men than these—Arvid August Afselius (1785–1871), the first editor of the Swedish folk-songs; Gustaf Vilhelm Gamaelius (1789–1877), who has been somewhat pretentiously styled "The Swedish Walter Scott," author of the historical novel of *Tord Bonde*; Baron Bernhard von Beskow (q.v.; 1796–1868), lyric and dramatist; and Karl August Nicander (1799–1839), a lyric poet who approached the Phosphorists in manner. The two great lights of the Gothic school are Geijer, mainly in prose, and Tegnér, in his splendid and copious verse. Johan Olaf Wallin (1779–1839) may be mentioned in the same category, although he is really distinct from all the others.

He was archbishop of Upsala, and in 1819 he published the national hymn-book of Sweden; of the hymns in this collection, 126 are written by Wallin himself.

From 1810 to 1840 was the blossoming-time in Swedish poetry, and there were several writers of distinguished merit who could not be included in either of the groups enumerated above. Second only to Tegnér in genius, the brief life and mysterious death of Erik Johan Stagelius (1793–1820) have given him a place among all that is connected with his name. His first publication was the epic of *Vladimir the Great* (1817); to this succeeded the romantic poem *Blonda*. His singular dramas, *The Bacchantes* (1822), *Sigurd Ring*, which was posthumous, and *The Martyrs* (1823), are esteemed by many critics to be his most original productions. His mystical lyrics, entitled *Ljifer i Saron* ("Lilies in Sharon"); (1820), and his sonnets, which are the best in Swedish, may be recommended as among the most delicate products of the Scandinavian mind. Stagelius has been compared, and not improperly, to Shelley. His work, which he called himself "Vitalis" (1794–1828), was another gifted poet, whose career was short and wretched. A volume of his poems appeared in 1820; they are few in number and all brief. His work divides itself into two classes—the one profoundly melancholy, the other witty or boisterous. Two humorous poets of the same period who deserve mention are Johan Anders Wadam (1777–1837), an improvisatore of the same class as Bellman, and Christian Erik Fahlcrantz (q.v.; 1790–1866).

Among the poets who have been mentioned above, the
majority distinguished themselves also in prose. But the period was not one in which Swedish prose shone with any special lustre. The first proasist of the time was, without question, the novelist, Karl Jonas Ludvig Almqvist, (q.v.; 1793–1866), around whose extraordinary personal character and career a mythical romance has already collected (see Almqvist). He was encyclopaedic in his range, although his stories preserve most charm; on whatever subject he wrote his style was always exquisite. Fredrik Cederberg (1784–1854), Jeff the vartor novel, in his Utan i Vassesby and Omskrättling. The historical novels of Gumaaloe have already been alluded to Sweden history supplied themes for the romances of Count Per Georg Sparre (1790–1871) and of Gustaf Henrik Mellin (1803–1876). But all these writers sink before the sustained popularity of the Finnish poet Fredrika Bremer (q.v.; 1801–1869), whose stories reached farther into the distant provinces of the world of letters than the writings of any other Sweden except Tegnér. She was preceded by Sofia Margareta Zelow, afterwards Baroness von Knorringer (1797–1848), who wrote a long series of popular didactic poems, the most popular of which was his "The One and the Other." As an historian of Swedish literature Per Wieselgren (1800–1877) composed a valuable work, and made other valuable contributions to history and bibliography. In history we meet again with the great name of Geijer, with that of Jonas Hallenberg (1748–1834), and with that of Anders Magnus Strinnholm (1786–1862), whose labours in the field of Swedish history were extremely valuable. Geijer and Strinnholm prepared the way for the most popular of all Swedish historians, Anders Fryxell (1795–1881), whose famous Berättelser ur svenska historien appeared in parts during a space of nearly sixty years, and awakened a great interest in Swedish history and legend.

In 1850 the first poet of Sweden, without a rival, was Johan Ludvig Runeberg (q.v.; 1804–1877), whose reputation rivals that of Tegnér. Bernhard Elias Malmström (1816–1863), who was a professor of aesthetics at the university of Upsala, was the author of many important books on art, poetry and taste, notably a monograph on Fransén. His poetry, although small in volume, gives him a place beside Runeberg. A volume of elegies, Angeliska (1840), established his fame, and two volumes of poems published in 1845 and 1847 contain a number of ballads, romances and songs which keep their hold on Swedish literature. He was an exact and discriminating critic, and inclined to severity in his strictures on the romanticists. The other leading verse-writers were Karl Vilhelm Böttiger (1807–1878), the son-in-law and biographer of Tegnér, who, in addition to his lyrical poetry, chiefly of the sentimental kind, wrote an admirable series of monographs on Swedish men of letters; Johan Börjeson (1790–1860), the head of the Phosphorists, author of various romantic dramas; Vilhelm August Deltof von Braun (1813–1860), a humorous lyricist; "Talis Qualis," whose real name was Karl Vilhelm August Strandberg (1818–1877); Oscar Patrick Sturzen-Becker (1812–1866), better known as "Orvar Odd," a lyrical poet who was also the author of a series of amusing sketches of everyday life; and August Teodor Blanche (1811–1868), the popular dramatist. Blanche produced a number of farces and comedies which were announced as pictures from real life. His pieces abound in comic situations, and some of them, Magister Black-stad, "Vem är det i huvudet?" i "Vem är det?" (1845), the famous vremvminhet (1848) and others, maintain their reputation. Fredrik August Dahlgen (1816–1895) gained a great reputation as a dramatist by his national opera, Verlovningarne (1846). He is also the author of translations from Shakespeare and Calderon, and of considerable historical works. Other notable plays of the period were the En Komedii of J. C. Jolin (1818–1884) and the Brölopet på Ulfså (1865) of Frans Hedberg (1828–1908). But Runeberg is the only great poetical name of this period.

In prose there was not even a Runeberg. The best novelist of the time was Emile Flygare-Carlén (1807–1892). The art was sustained by Karl Anton Wetterberg (1804–1859), who called himself "Onkel Adam," by August Blanche the dramatist, and by Marie Sofie Schwartz (1816–1892). Fru Schwartz (née Birat) wrote novels demonstrating the rights of the poor against the rich, of which The Man of Birth and the Woman of the People (Eng. trans., 1868) is a good example. Lars Johan Hierta (1806–1872) was the leading journalist, Johan Henrik Thomander, bishop of Lund (1798–1865), the greatest orator, Matthias Alexander Cæstrén (1813–1852) a prominent man of science, and Karl Gustaf af Forsell (1782–1848), the principal statistician of this not very brilliant period. Elias Lönnrot (q.v.; 1802–1884) is distinguished as the Finnish professor who discovered and edited the Kalevaka.

The most popular poet at the close of the 19th century was the patriotic Finn, Zakris Topelius (q.v.; 1818–1885). Of less importance were Karl Herman Sätherberg (1811–1877), a romantic poet who was also a practising physician of distinction; the elegiac poet Johan Nyblom (1815–1886); and the poet, novelist, and dramatist Fredrik Hedberg (d. 1908), who in his old age made many concessions to the modern taste. He found a vehement polemical defence of the poems of the bishop of Strängnäs, Adam Teodor Strömberg (1820–1888), were collected by Wirsén, and created some sensation. A typical academian was the poet, antiquary and connoisseur, Nils Fredrik Sander (1828–1900). The improvisator of Gluntarne, Gunnar Wennerberg (q.v.; 1817–1901) survived as a romantic figure of the past. Still older was the poetess Wilhelmina Nordström (1815–1902), long a schoolmistress in Finland. The aesthetic critic and poet, Carl Rupert Nyblom (1832–1907), continued the studies, translations and original pieces which had created him a reputation as one of the most accomplished general writers of Sweden. His wife, Helen Nyblom, was well known as a novelist. A. T. Gellerstedt (b. 1836), an archbishop of position, was known as a poet of small range but of very fine quality. Among writers of the earlier generation were Achatius Johan Kahl (1794–1888), the biographer of Tegnér; Per Erik Bergfalk (1798–1890), the critic and supporter of Geijer; the distinguished historian and academian, Karl Johan Schlyter (1795–1888) and the historical writers, Fredrik Ferdinand Carlsson (1811–1887), Vilhelm Erik Svedså (1816–1886), and Martin Weibull (1835–1902). The range of their sympathies also extended beyond the modern to the intellectual life of the country. But the interest of such veteran reputations is eclipsed by the more modern school.

The serenity of Swedish literature was rudely shaken about 1884 by an incursion of realism and by a stream of novel and violent imaginative impulse. The controversy between the old and the new schools raged so fiercely, and the victory has remained so obviously in the hands of the latter, that it is difficult, especially for a foreigner, to hold the balance perfectly even. It will therefore be best in this brief sketch to say that the leader of the older school was Viktor Rydberg (q.v.; 1828–1895) and that he was ably supported by Carl Snolisky (q.v.; 1841–1904) who at the beginning of the 20th century was the principal living poet of the bygone generation in Sweden. Snolisky was prominent for the richness of his lyrical style, his cosmopolitan interests and his great width of culture. Carl David af Wirsén (b. 1842) distinguished himself, and made himself very unhappy, by his dogged resistance to every species of nesdance in Swedish thought, or art, or literature. A man of great talent, he was a violent reactionary, and suffered from the consequences of an attitude so unpopular. He found a vehicle for his criticism in the Post och Inrikes Tidskrifter, of which he was editor. He published his Lyrical Poems in 1876; New Lyrical Poems in 1880; Songs and Sketches in 1885.

Four influences may be mentioned as having acted upon young Sweden, and as having combined to release its literature from the old hard-bound conventions. These are English philosophy in the writings of Herbert Spencer, French realism
in the practice and the preaching of Zola, Norwegian drama mainly through Ibsen, and Danish criticism in the essays and monographs of Georg Brandes. Unquestionably the greatest name in recent Swedish literature is that of Johan August Strindberg (q.v.; b. 1849). His drama of Master Olaf (1885) began the revolutionary movement. In 1879 the success of his realistic novel, The Red Room, fixed universal attention upon his talent. It was the sensation caused in 1884 by the lawsuit brought against Strindberg's Married (a collection of short stories dealing realistically with some of the seamy sides of marriage) which brought to a head the rebellion against the elegant and superficial conventions which were strangling Swedish literature. He affronts every canon of taste, more by a radical absence, it would seem, of the sense of proportion than by any desire to shock. His distributes against woman suggest a touch of madness, and he was in fact at one time seized with an attack of insanity. He writes like a man whose view is distorted by physical or mental pain. His phraseology and his turns of invention are too empirically pseudoscientific for the simplicity of nature. With all these faults, and in spite of a terrible vulgarity of mind, an absence of humour, and a boundless confidence in the philosophy of Nietzsche, Strindberg is a writer of very remarkable power and unquestionable originality. His mind underwent singular transformations. After devoting himself wholly to realistic, and occasionally to the sort of mystico-pathological novels about life in the archipelago of Stockholm. This led him to a culte du moi, of which the strangest result was an autobiography of crude invective, A Fool's Confession (1893), the printing of which in Swedish was forbidden. He rapidly passed on, through books like Inferno (1897), the diary of a semi-lunatic, up into the sheer mysticism of To Damascus (1898), where he reconciles himself at last to Christianity. His best work is classic in its breadth of style, exquisite in local colour and fidelity to the national characteristic of Sweden.

A curious antidote to the harsh pessimism of Strindberg was offered by the delicate and fantastic temperament of Ola Hansson (b. 1860), whose poems came prominently before the public in 1884, and who, in Sensitiva amorosa (1887), preached a gospel of austere self-restraint. Hansson has been as ardent in the idolatry of woman as Strindberg has been in his hostility to the sex. Of those who have worked side by side with Strindberg, the most prominent and active was Gustaf af Geijerstam (b. 1859), in his curious and severely realistic studies of country life, Anna Pern-People (1885) and other volumes. In 1885 he produced a gloomy sketch of student life at Upsala, and the following year published a novel which made a great sensation. Since then Geijerstam has published more than forty volumes, and has become one of the most popular writers of the north of Europe. A melancholy interest surrounds the name of Victoria Benedictson (Ernst Ahlgren, 1850-1889), who committed suicide in Copenhagen after achieving marked success with her sketches of humble life in Från Slahe, and with the more ambitious works Money and Marianne. She was perhaps the most original of the many women writers of modern Sweden, and Money was hailed by Swedish critics as the most important work of fiction since Strindberg's Red Room. Her biography, a most affecting narrative, was published by Ellen Key, and her autobiography by Axel Lundegård (b. 1861), who, after some miscellaneous writing, produced in 1889 a curious novel of analysis called The Red Prince, and who, becoming a devoted clergyman, published a number of popular stories in a neo-romantic manner. In 1896-1900 he produced a historical trilogy, Struensea, tracing the career of the minister from his early years as a doctor in Altona to his final downfall. In 1904 appeared the first volume of a second historical trilogy, The Story of Queen Wetzipa. Fru Athild Aghrell (née Martin), who was born in 1849, produced a series of plays dealing with the woman question, Rescued (1883) and others. She also showed great ability as a novelist, among the best of her books being a series of sketches of country life (1884-1887). An historical novelist of unequal powers, but great occasional merit, is Mattilda Malling, née Kruse (b. 1864), whose romance about Napoleon (1894) enjoyed a huge success. Tor Hedberg (b. 1861) also began as a decided realist, and turned to a more psychological and idealist treatment of life. His most striking work was Judas (1886); he has written some execrable dramas. His essays in the novel has been those of Hilma Angerled-Strandberg (On the Prairie, 1895) and Gustaf Janson (Paradise, 1900). The most remarkable of the novelists of the latest group is Selma Lagerlöf (b. 1858), who achieved a great success with Gosta Berlings Saga in 1891-1892. She employs the Swedish language with an extraordinary richness and variety, and stands in the front rank of Swedish novelists. But perhaps the most cosmopolitan recent novelist of Sweden is Per Hallström (b. 1866), who spent much of his youth in America, and appeared as an imaginative writer first in 1891. He has published volumes of ballads, short stories, monologues, and sketches, fantastic and humorous, all admirable in style. His play, A Venetian Comedy, enjoyed a substantial success in 1904.

Among the recent lyrical poets of Sweden, the first to adopt the naturalistic manner was Albert Ulrik Båthå (b. 1853), whose earliest poems appeared in 1879. In his rebellion against the sweetness of Swedish convention he proved himself somewhat indifferent to beauty of form, returned to "early national" types of versification, and concentrated his attention on dismal and distressing conditions of life. He is a resolute, but, in his early volumes, harsh and rocky writer. In 1884-1885 his Båth was steadily productive. Karl Alfred Melin (b. 1849) has described in verse the life in the islands of the Stockholm archipelago. Among lyricists who have attracted attention in their various fields are Oskar Levertin (1862-1906) and Emil Kléen (1868-1898). Of these Levertin is the more highly coloured and perfumed, with an almost Oriental richness; Kléen has not been surpassed in the velvety softness of his language. But by far the most original and enjoyable lyrical genius of the later period is that of Gustaf Fröding (b. 1860), whom several contemporaries have called the "godfather of the new generation." He is a writer of some violent, humorous, amatory, and pathetic, produced a great sensation in 1891. Three other volumes followed in 1894, 1895 and 1897, each displaying to further advantage the versatility and sensuous splendour of Fröding's talent, as well as its somewhat scandalous recklessness. In 1897 he was struck down with insanity, and after three months' confinement in the asylum at Upsala, although he recovered his senses, all his joyousness and wildness had left him. He became gloomily religious, and in a new volume of poems he denounced all that he valued and esteemed before his conversion. A younger poet is K. G. Ossian-Nilsen (b. 1875), the author of several volumes of vigorous dramatic and satiric verse.

The writer who was exercising most influence in Sweden at the opening of the 20th century was Verner von Heidenstam (b. 1859). He started authorship with a book of verse in 1888, after which time he led a reaction against realism and pessimism, and has turned back to a rich romantic idealism in his novels of Endymion (1886) and Hans Atenus (1892), and in his stories (1897) of the time of Charles XII. Heidenstam also published interesting volumes of literary criticism, and he is a member of the very important literary circle around Ellen Key (b. 1849), a secularist lecturer of great fervour, became an author in biographical and critical studies of remarkable originality. She is distinguished from Selma Lagerlöf, who is simply an artist, by her exercise of pure intellect; she is a moral leader; she has been called "the Pallas of Sweden." She published in 1897 a biography of the Swedish author, Almqvist; in 1899 she collected her finest essays in the volume called Thought Pictures; in 1900 appeared, under the title Human Beings, studies of the Brownings and of Goethe; but the finest of Ellen Key's books is The Costers of Childhood (1901), a philosophical survey of the progress of elementary education in the last hundred years. She exercises a very remarkable power over the minds of the latest generation in Sweden. A polemical essayist of elaborate decorice of style is Hjalmar Söderberg (b. 1869), who has been influenced by Strindberg and by Anatole.
France. His ironic romance, *Martin Birck’s Youth*, created a sensation in 1901. Karl Johan Warburg (1852) has done good work both as an essayist and as an historian of literature. But in this latter field by far the most eminent recent name in Swedish literature is that of Professor Johan Henrik Schück (1859), who has made great discoveries in the 16th and 17th centuries, and who has published, besides a good book about Shakespeare, studies in which a profound learning is relieved by elegance of delivery. Warburg and Schück have written an essay, *Anne Charlotta Edgren-Leffler*, 1849—1893), possessed considerable dramatic talent, working under a direct impulse from Ibsen; but her greatest gift was as a novelist. The plays of Harald Johan Målander (1835—1900) have been popular in the theatres of Sweden and Finland since his first success with *Rosaco* in 1880. Another remarkable revival of belles-lettres has taken place in Sweden after a long period of inertness and conventionality. It is regrettable, for its own sake, that the Swedish Academy, which in earlier generations had identified itself with the manifestations of original literary genius, has closed its doors to new writers with such virulently pedantic indifference.

**Swedish Philosophy.**—Swedish philosophy proper began in the 17th century, with the distinguishedGeorg Bureau (1633-1712). The centre of the movement was J. Bilberg (1464-1717), who, in various theses and discussions, defended the new ideas against the scholastic Aristotelianism of the orthodox churchmen. A. Rydelsius (1671-1738), an intimate friend of Charles XII, endeavoured to find a common ground for the opposing schools, and the Leibniz-Wolffian philosophy was maintained by N. Wallerius (1706-1764). Together with the Church, and especially of the German rationalists, they strove to expand the philosophy of the Enlightenment under the influence of English and French ideas—J. H. Kellgren (1751-1795), K. G. af Leopold (1756-1829), T. Thorild (1759-1808), A. K. Ehrensvärd (1760-1830)—and the Swedes, being by birth and occupation a nation of a peculiarly warlike character, contributed to the art of war. D. B. Böthius (1751-1810), whose work paved the way for a great idealistic speculative movement headed by B. Höijer (1767-1812), the poet F. D. A. Atterbom (1790-1855), a follower of Schelling, and J. J. Berdén (1825), the great Swedish exponent of Hegelianism. All the above thinkers reflected the general development of European thought. There exists, however, a body of thought which is the product of the peculiar genius of the Swedish people, namely, the development of the individual soul in accordance with a coherent social order and a strong religious spirit. This *Personal Philosophy* owes its development to K. J. Boström (p. xii) and, throughout the development of the so-called *idealist* or *idealistic* philosophy, a distinctive character from the investigations of N. F. Bilberg (1767-1837), S. Grubbe (1786-1853) and E. G. Geijer (p. xix) (1783-1847), all professors at Upsala. Boström’s philosophy is logically expressed and, like most great conceptions, eternal, eternal and unchangeable. Being, whose existence is absolute, absolute and external to the finite world of time and space. It has for a long time exercised almost unquestioned authority over Swedish thought, religious and philosophical. It is strong in its unequivocal insistence on the personal purity and responsibility, and in the uncompromising simplicity of its fundamental principle. Boström wrote little, but his views are to be found in the works of the two great philosophers who followed him. The older group includes S. Ribbing (1816-1899), C. Y. Sahlin (1824), K. Chasson (1827-1899), H. E. Edelfeld (1830), the eldest father of the New Sweden philosophy, and his works, C. A. Nybract (1821-1899) and P. J. H. Leander (1831), and in the younger group, another, but adhering in the main to the same tradition, are E. O. Burman (1845), K. R. Geijer (1849), L. H. Åberg (1851-1900) and H. A. Nordin (1856-1930), of Gothenburg, and P. E. Liljeström (1856), of Lund. Of these Nybract compiled a lucid account of Swedish philosophy from the beginning of the 16th century up to and including Boström; Ribbing (Philosophi 1864) and Leander (Subjectiviteten) treated the principle of subjectivism as a whole; the former is allied to Greek. P. Vikner (1837-1888) broke away from the Boströmian tradition and followed out a path of his own in a more pronounced religious spirit. V. Rydberg (p. xii) (1828-1895) closely followed Boström and was one of the most influential spirits that did much to crystallize and extend the principles of idealism. Among prominent modern writers may also be mentioned H. Larsson and P. Runesson (1863-1938) and A. V. Malmström (1859-1934) of Stockholm.

**Authorities.**—*Swenska litteraturhistoria* (1660) by O. Schefferus (1621-1679) is the first serious attempt at a bibliography of Swedish literature. The *Svenska tidskr och skildr* (Upsala, 1841-1855) contains an admirable series of portraits of Swedish writers up to the end of the reign of Gustavus III.; many of Atterbom’s judgments are reversed in the *Grundrissen der Svenska litteraturhistoria* (1866-1868) of B. E. Malmström; and a body of excellent criticism of the subsequent period was supplied by W. M. Bostrom’s *Svenska litteraturhistoria* (1853, new ed. by Sondern, 1853), which remains a classic exposition of the views of the school. The letters as it reflects the life of the nation is dealt with by C. R. Nyholm (1891) of Stockholm. The *Svenska litteraturhistoria* (1865-1868) has been published by the Swedish Central Bureau of Statistics for the Parish Exhibition (English ed., Stockholm, 1904); P. Swedenberg, *Geschichte der skandinavischen Litteratur*, vol. vii. of *Die Welt Litteratur in Einzeldarstellungen* (Leipzig, 3 pts., 1886-1886); Oscar Levitin, *Svenska Gesalter* (1904).
his time. His work on palaeontology shows him the predecessor of all the Scandinavian geologists, and his contributions in this field alone would have been sufficient to perpetuate his fame. He was also a great physicist and had arrived at the nebular hypothesis of the formation of the planets and the sun long before Kant and Laplace. His theory of light and those of the atomic cosmology were equally astonishing. He wrote a lucid account of the phenomena of phosphorescence, and added a molecular magnetic theory which anticipated some of the chief features of the hypothesis of to-day. The great French chemist, Dumas, gives him the credit for the first attempt to establish a system of crystallography. He was the first to employ mercury for the air-pump, and devised a method of determining longitude at sea by observations of the moon among the stars. He suggested the use of experimental tanks for testing the powers of ship models, invented an electric lamp free of visible flame, improved the common house-stove of his native land, cured smoky chimneys, took a lively interest in machine-guns and even sketched a flying machine.

This flying machine consisted of a light frame covered with strong canvas and provided with two large oars or wings moving on a horizontal axis, and so arranged that the upstroke met with no resistance. He spoke proudly of the flying power with which he knew the machine would not fly, but suggested it as a start and was confident that the problem would be solved. He also suggested that the canvas by being made thicker than to the actuality, for it requires greater force and less weight than exists in a human body. The science of mechanics might perhaps suggest a means, namely, a strong spiral spring. If these advantages and requisite atoms were real, perhaps in time some one might know how better to utilize our sketch and cause some addition to be made so as to accomplish that which we can only suggest. Yet there are sufficient proofs and examples from nature that such flights can take place without danger, although when the first trials are made you may have to pay for the experience, and not mind an arm or leg.

In 1734 he also published Prodromus philosophiae rationalis, in which he treated of the relation of the finite to the infinite, and of the soul to the body, seeking to establish a nexus in each case as a means of overcoming the difficulty of their relation. From this time he applied himself to the problem of discovering the nature of soul and spirit by means of anatomical studies. In all his researches he acknowledged and contended for the existence and the supremacy of the spiritual and the divine. He travelled in Germany, France and Italy, in quest of the most eminent teachers and the best books dealing with the human frame, and published, as the results of his inquiries among other works, his Oeconomia regni animalis (London, 1740-1741) and Regnum Animalium (the Hague, 1744-1745; London, 1745). In no field were Swedenborg's researches more noteworthy than in those of physiological science. In 1901, Professor Max Neuber of Vienna called attention to the modern views made by Swedenborg in relation to the functions of the brain. The university of Vienna appealed to the Royal Swedish Academy for a complete issue of the scientific treatises, and this resulted in the formation of a committee of experts who have been entrusted with the task. It is clear that Swedenborg showed (150 years before any other scientist) that the motion of the brain was synonymous with the respiration and not with the action of the heart and the circulation of the blood, a discovery the full bearings of which are still far from being realized. He had arrived at the modern conception of the activity of the brain as the combined activity of its individual cells. The cerebral cortex, and, more definitely, the cortical elements (nerve cells), formed the seat of the activity of the soul, and were ordered into departments according to various functions. His views as to the physiological functions of the spinal cord are also in agreement with recent research, and he anticipated many of the pre-eminent offices of the denticulate glands which students of the present time are only beginning to discover.

Up to middle age Swedenborg's position was that of a scholar, a scientist, a practical administrator, a legislator, and a preacher of unending change was coming over him, which led him to leave the domain of physical research for that of psychical and spiritual inquiry. Neither by geometrical, nor physical, nor metaphysical principles had he succeeded in reaching and grasping the infinitely great and the spiritual, or in elucidating their relation to man and man's organism, though he had caught glimpses of facts and methods which he thought only required confirmation and development. Late in life he wrote to Dr. George Bering, "I was introduced to the Lord first into the natural sciences, and thus prepared, and, indeed, from the year 1710 to 1745, when heaven was opened to him." This latter great event is described by him in a letter to Thomas Hartley, rector of Winwick, as "the opening of his spiritual sight," "the manifestation of the Lord to him in person," "his introduction into the spiritual world." Before his illumination he had been instructed by dreams, and enjoyed extraordinary visions, and heard mysterious conversations. According to his own account, the Lord filled him with His spirit to teach the doctrines of the church by the mouth of angels, and to draw him to do this work, opened the sight of his spirit, and so let him into the spiritual world, permitting him to see the heavens and the hells, and to converse with angels and spirits for years, but he never received anything relating to the doctrines of the church from any angel but from the Lord alone while he was reading the word (True Christian Religion, No. 779). He elsewhere speaks of his office as principally an opening of the spiritual sense of the word. His friend Rolsahm reports, from Swedenborg's own account to him, the circumstances of the first extraordinary talk with the Lord, when He appeared to him and said, "I am God the Lord, the Creator of all things, of the whole of the world. I have chosen thee to unfold the spiritual sense of the Holy Scripture. I will Myself dictate to thee what thou shalt write." From that time he gave up all worldly learning and laboured solely to expound spiritual things. In the year 1747, to the great regret of his colleagues, he resigned his post of assessor of the board of mines that he might devote himself to his higher vocation, requesting only to be allowed to receive as a pension the half of his salary. He took up after his study of Hebrew, and began his voluminous works on the interpretation of the Bible and the organization of the True Christian religion, which were published in Sweden, Holland and London, in the composition of his works and their publication, till his death, which took place in London on the 29th of March 1772. He was buried in the Swedish church in Princes Square, in the parish of St George's-in-the-East, and on the 7th of April 1768 his remains were removed at the request of the Swedish government to Stockholm.

Swedishborg was a man who won the respect, confidence and love of those who came into contact with him. Though he might disbelieve in his visions, they feared to ridicule them in his presence. Those who talked with him felt that he was truth itself. He never disputed on matters of religion, and if obliged to defend himself, did so with perfect gentleness and in a way that was so simple in the extreme; his diet consisted chiefly of bread and milk and large quantities of coffee. He paid no attention to the distinction of church high and low. He had his own house, while his servants were often disturbed at night by hearing what he called his conflicts with evil spirits. But his intercourse with spirits was often perfectly calm, in broad daylight, and with all his faculties awake. Three extraordinary instances are produced by his friends and followers in proof of his seership and admission into the unseen world. But there exists no account at first hand of the exact facts, and Swedenborg's own reference to one of these respects limits of time and place in this manner of the world. Thus, for example, in 1763, Emanuel Kant was struck by them in 1765, but in 1785, after further inquiries, concluded that two of them had no other foundation than common reports (genius Sagen). See Keilbach's edition of Kant's Traume eines Geistesreisenden (Leipzig, 1889).

As a theologian Swedenborg never attempted to preach or to found a sect. He believed that members of all the churches could now live happily together. His theological writings roughly fall into four groups: (1) books of spiritual philosophy, including The Divine Love and Wisdom, The Divine Providence, the Aristotelian and the Body, Conjugial Love, (2) Esoteric, including Arcana Celestia (giving the spiritual sense of Genesis and Exodus), The Apocalypse Revealed, The Apocalypse Explained; (3) Doctrinal, including The True Jerusalem, The True Christian Religion, The Doctrine of the Church, The Holy Scriptural Doctrines, The Doctrine of Charity, The True Christian Religion, Canons of the New Church; (4) Eschatological, including Heaven and Hell, and The Last Judgment. About forty volumes are available in English, and many have been translated into most
of the European languages as well as into Arabic, Hindi and Japanese.

Swedenborg's theosophic system is most briefly and comprehensively described in the book The Divine Love and Wisdom. The point of view from which God must be regarded is that of His being the Divine Man. His esse is infinite love; His manifestation, form or body is infinite wisdom. Divine love is the self-subsisting life in the Divine Man, and the nature of God. It is the active principle, for it gives life to all things and makes them alive. The two worlds of nature and spirit are perfectly distinct, but they are intimately related by analogous substances, laws, and causes. In its continuity with the universe, the being of God is the same, but in the one they are natural and in the other spiritual. In God there are three infinite and created "degrees" of being, and in man and all things corresponding three degrees, finite and created. The highest degree in God is uncreated; or, as Swedenborg expresses it, the ends of all things are in the Divine Mind, the causes of all things in the spiritual world, and their effects in the natural world. By a love of each degree man comes into conjunction with them and the worlds of nature, spirit and God. The end of creation is that man may have this conjunction and become the image of his Creator and creation. In man are two receptacles for God—the will for "correspondences" in which to unfold the divine treasure of love and wisdom flowing into both so that they become human. Before the fall this influx was free and unhindered, and the conjunction of man with God and the creation complete, but from that time forth these correspondences are interrupted and God hid himself from man and the effects of the fall ensued. Swedenborg believes the purpose of revelation is to restore the connexion between Himself and man. He could not come in His unveiled divinity, for the "hells" would have the greatest desire to see it, but only to subjugate. Another purpose of Jehovah's incarnation was the manifestation of His divine love more fully than ever before. Swedenborg wholly rejects the orthodox doctrine of atonement; and the unity of God, as opposed to the division of the Trinity, is a feature of his teaching. Another distinctive feature is that Jehovah did not go back to heaven without leaving behind him a visible representative of Himself in the world of the Scripture. This word is an external representation of the spiritual—natural world of the celestial. And Swedenborg is the divinely commissioned expounder of this threecold sense of the word, and so the founder of the New Church, the par excellence of the last dispensation. That he might perceive and understand the spiritual and the celestial senses of the word he enjoyed immediate revelation from the Lord, was admitted into the angelic world, and had committed to him the key of correspondences with which to unfold the divine treasurers of love and wisdom. Swedenborg claimed also to have learnt by his admission into the spiritual world the true states of men in the next life, their rewards and punishments, and occupations of heaven and hell, the true doctrine of Providence, the origin of evil, the sanctity and sanctity of property, the power of God, and to have been a witness of the "last judgment," or the second coming of the Lord, which is a contemporary event. "All religion," he says, "is founded on the present and the future, and to do good is the kingdom of Heaven is a kingdom of uses." He exercised a great influence over S. T. Coleridge, Robert and Elizabeth Browning, Coventry Patmore, Henry Ward Beecher and Thomas Carlyle. And thus Swedenborg is now drawn to his doctrine of the relation of the elements of the universe to the membranes of the body.

Swedenborgianism, as professed by Swedenborg's followers, is based on the belief of Swedenborg's claims to have witnessed the last judgment, or the second advent of the Lord, with the inauguration of the New Church, through the new system of doctrine promulgated by him and derived from the Scriptures, into the true sense of which he was the first to be introduced. The "doctrine of the New Church as given in the Liturgy (which also contains the "Credences" and "Articles of Faith") are as follows:

1. There is a Divine Trinity; and that He is the Lord Jesus Christ.
2. That a saving faith is to believe on Him.
3. That evil is to be shunned, because they are of the devil and from evil.
4. That good actions are to be done, because they are of God and from God.

If these are to be done by a man as from himself, but that it ought to be believed that they are done from the Lord with him and by him.

Swedenborgians now constitute a widely spread and considerable society, the organization of which is a reformation and a zealous missionary activity (see New Jerusalem Church). See R. L. Tafel, Documents concerning the Life and Character of Emanuel Swedenborg, collected, translated and annotated (3 vols., Swedenborg Society, 1878-1879); J. Hyde, A Bridge is to be Drawn to Emanuel Swedenborg (743 pp., Swedenborg Society, London, 1883). Some of his writings, e.g., The Divine Providence and the Divine Love and Wisdom. The projects of the Church, the Society, and Heaven and Hell have been published in popular editions. A useful handbook of Swedenborg's theology is the Compendium of the Theological Writings of Emanuel Swedenborg (4 vols., London, 1885). Summaries of his system and writings are given in all the above biographies, also in Edmund Swift, Manual of the Doctrines of the New Church (London, 1882); and T. Parsons, Outlines of Swedenborg's Religions and Philosophical Doctrine (London, 1885). Swedenborgians believe that from independent points of view are "The Mystic," in R. W. Emerson's Representative Men (1830); Kant's Traume eines Geistersehers (1876); the best edition by Rehrbush, Leipzig, 1880; and Herder's "Emanuel Swedenborg," in his Adrastes (Werke zur Phil. und Gesch., xii. 110-125); J. J. V. Goerres's Emanuel Swedenborg, seine Visionen und sein Verkldnztzt zur Kirche (1877); A. Dorner's "Das Emanuel Swedenborg," in the German ed. of this and two translations of the International Swedenborg Congress (London, 1910), summarized in The New Church Magazine (August, 1910). See also Transactions of the International Swedenborg Congress (London, 1910), summarized in The New Church Magazine (August, 1910).

SWEETBREAD. A popular term for certain glands of animals, particularly when used as articles of food; these are usually the pancreas, the "stomach-sweetbread" of butchers, and the thymus, or "breast sweetbread." The term is also sometimes used to include the salivary and lymphatic glands (see Duckless Glands, Pancreas and Lymphatic System).

SWEET POTATO. This plant, known botanically as Ipomoea batatas, is a favorite in the New World. It is valued as a potato, or root potato, in many countries, especially the tropics, where the climate is as mild as at higher latitudes. The plant is not known in a truly wild state, nor has its origin been ascertained. A. de Candolle concludes that it is in all probability of American origin, where it has been cultivated from prehistoric times by the aborigines. It is mentioned by Gerard as the "potato," or "potatos," or "potatoes," in contradistinction to the "potatoes" of Virginia (Solanum tuberosum). He grew it in his garden, but the climate was not warm enough to allow it to flower, and in winter it perished and rotted. But as the appellation "common" is applied to them the roots must have been introduced commonly. Gerard tells us that he bought them from the planters, who were sold at higher prices, or at a higher discount, because he had an interesting account of the uses to which they were put, and in manner in which they were prepared as "sweetmeats," and the invigorating properties assigned to them. The allusions in the Merry Wives of Windsor and other Shakespeare's plays in all probability refer to this plant, and not to what we now call the "potato." The plants require a warm, sunny climate, long season, and a liberal supply of water during the growing season. For an account of the cultivation in North America, where large quantities are grown in the Southern states, see H. B. Watson, "The Crop of American Hospitality" (1909). Sir George Watt, Dictionary of the Economic Products of India (1890), gives an account of its cultivation in India, where some confusion has arisen by the use of the name batatas for the yam (g.e.); the author suggests that the introduction of the sweet potato into India is comparatively recent.

SWEET-SOP, or Sugar Apple, botanical name Anona squamosa, a small tree or shrub with thin oblong-ovate leaves, solitary gynoecium flowers and a yellowish-green fruit, like a shortened pine cone in shape with a tubercle corresponding to each of the carpels from the aggregation of which it has been formed. The fruit is 3 to 4 in. in diameter and contains a sweet, creamy yellow custard-like pulp. It is native to the New Indies and tropical America; it is much prized as a fruit, and has been widely introduced into the eastern hemisphere.
Another species, *A. maricola*, is the sour-sop, a small evergreen tree bearing a larger dark-green fruit, 6 to 8 in. long and 1 to 5 lb in weight, oblong or bluntly conical in shape, with a rough spiny skin and containing a soft white juicy sub-acid pulp with a flavour of turpentine. It is a popular fruit in the West Indies, where it is native, and is grown with special cultivation in Porto Rico. A drink is made from the juice. *A. reticulata* is the custard apple (*q.v.*) and *A. polystachus* the alligator apple.

SWELLENDAM, a town of South Africa, Cape province, in the valley of the Breede River, 192 m. by rail E. by S. of Cape Town. Pop. (1904), 2406, of whom 1139 were white. Swellendam is one of the older Dutch settlements in the Cape, dating from 1745, and was named after Hendrik Swellengrebel (then governor of the Cape) and his wife, whose maiden name was Damme. Early in 1795 the burghers of the town and district rose in revolt against the Dutch East India Company and proclaimed a “free republic,” and elected a sostyled national assembly. At the same time the burghers of Graaff Reinet also rebelled against the Cape authorities, who were powerless to suppress the insurrectionary movement. One of the claims of the “free republic” was “the absolute and unconditional slavery of all Hottentots and Bushmen.” In September of that year Cape Town surrendered to the British and the “National” party at Swellendam quietly accepted British rule.

The town is a trading centre of some importance, and in the surrounding district is much cattle raising and outstrip farming. The neighbourhood is noted for its abundance of evergreen f folklore.

SWETCHINE, MADAME (1782-1857), Russian mystic, whose maiden name was Soymanof, was born in Moscow, and under the influence of Joseph de Maistre became a member of the Roman Catholic Church in 1815. In the following year she settled in Paris where, until her death, she maintained a famous salon remarkable no less for its high courtesy and intellectual brillance than for its religious atmosphere. Though not physically beautiful she had a personality of rare spiritual charm, nurtured in the private chapel of her house. Her husband, General Swetchine, was a convert to Catholicism. Her *Life and Works* (of which the best known are *Old Age* and “Resignation”) were published by M. de Falloux (2 vols., 1860) and her *Letters* by the same editor (2 vols., 1861).


SWENY, J., KING OF DENMARK (1210-1214), son of Harold Blutho, the christianizer of Denmark, by his peasant mistress Aesa, according to the Joms Vikingsaga, though much more probably his mother was Queen Gundl, Harold’s consort. The lad was a miscreant and became a noted villainy and misfortune in alliance with the Jomsborg Viking, Palmboke, against his own father, who perished during the struggle (c. 986). Six years later he conducted a large fleet of warships to England, which did infinite damage, but failed to capture London. During his absence, Denmark was temporarily occupied by the Swedish king, Eric Sersd, on whose death (c. 994) Sweny recovered his patrimony. About the same time he repudiated his first wife Gundl, daughter of duke Miesko of Poland, and married King Eric’s widow, Sigrid. This lady who had been a nun, was noted for a disquieting strength of character. Two viceroy, earlier viceroy, wasSweny’s second to death by orders for their impertinence, and she refused the hand of Olaf Tryggvesson, king of Norway, rather than submit to baptism, whereupon the indignant monarch struck her on the mouth with his gauntlet and told her she was a worse pagan than any dog. Shortly afterwards she married Sweny, and easily persuaded her warlike husband to unite with Olaf, king of Sweden, against Olaf Tryggvesson, who fell in the famous sea-fight off Svolde (1000) on the west coast of Rügen, after a heroic resistance immortalized by the sagas, whereupon the confederates divided his kingdom between them. After his first English expedition Sweny was content to blackmail England instead of ravaging it, till the ruthless massacre of the Danes on St Brice’s day, the 3rd of November 1002, by Ethelred the Unready (Sweny’s sister was among the victims) brought the Danish king to Exeter (1003). During each of the following eleven years, the Danes, materially assisted by the universal and shameless disloyalty of the Saxons ealdormen, systematically ravaged England, and from 991 to 1014 the wretched land is said to have paid its invaders in ransom alone £158,000. Sweny died suddenly at Gainsborough on the 17th of February 1014. The data relating to his whole history are scanty and obscure, and his memory has suffered materially from the fact that the chief chroniclers of his deeds and misdeeds were ecclesiastics. It was certainly unfortunate that he began life by attacking his own father. It is undeniable that his favourite wife was the most stift-necked pagan of her day. His most remarkable exploit, Svolde, was certainly won at the expense of Christianity, resulting, as it did, in the death of the saintly Olaf. Small wonder, then, if Adam of Bremen, and the monkish annalists who follow him, describe Sweny as a grim and bloody semi-pagan, perpetually warring against Christian states. But there is another side to the picture. Viking though he was, Sweny was certainly a Christian viking. We know that he built churches; that he invited English bishops to settle in Denmark (notably Godibald, who did good work in Scania); that on his death-bed he earnestly commended the Christian cause to his son Canute. He was cruel to his enemies no doubt, but he never forgot a benefit. Thus he rewarded the patriotic of the Danish ladies who sacrificed all their jewels to pay the heavy ransom exacted from him by his cupbearers, the Jomsborg pirates, by enacting a law that their women should be of the same blood as their male relatives. Of his valour as a captain and his capacity as an administrator there can be no question. His comrades adored him for his liberality, and the frequent visits of Icelandic skalds to his court testify to a love of poetry on his part, indeed one of his own strophes has come down to us. As to his personal appearance we only know that he had a long cleft beard, whence his nickname of *Tingeskaeg or Fork-Beard.*

See Danmarks riges historie, Oldtiden og den ældre middelalder, pp. 354-355 (Copenhagen, 1897-1903).

SWIFT, JONATHAN (1667–1745), dean of St Patrick’s, Dublin, British satirist, was born at No. 7 Hoe’s Court, Dublin, on the 30th of November 1667, a few months after the death of his father, Jonathan Swift (1640–1667), who married after 1664 Abigaille Erick, of an old Leicestershire family. He was taken over to England as an infant and nursed at Whitehaven, whence he returned to Ireland in his fourth year. His grandfather, Thomas Swift, vicar of Goodrich near Ross, appears to have been a thoroughly foul-mouthed member of the church militant, who lost his possessions by taking the losing side in the Civil War and in 1659 afterwards became a pensioner of the Restoration court and went by the new title. He married Elizabeth, niece of Sir Erasmus Dryden, the poet’s grandfather. Hence the familiarity of the poet’s well-known “cooling-card” to the budding genius of his kinsman Jonathan: “Cousin Swift, you will never be a poet.” The young Jonathan was educated mainly at the charges of his uncle Godwin, a Tipperary official, who was thought to dole out his help in a somewhat grudging manner. In fact the apparently prosperous relative was the victim of unfortunate speculations, and chose rather to be reproached with avarice than with impudence. The youth was restless of spirit, who regarded as a mere misguided treatment, a bitterness became ingrained and began to corrode his whole nature; and although he came in time to grasp the real state of the case he never mentioned his uncle with kindness or regard. At six he went to Kilkenny School, where Congreve was a schoolfellow; at fourteen he entered pensioner at Trinity College, Dublin, where he seems to have neglected his opportunities. He was referred in natural philosophy, including mathematics, and obtained his degree only by a special but by no means infrequent act of indulgence. The patronage of his uncle galled him: he was dull and unhappy. We find in Swift few signs of precocious genius. As S. Gough mitiD. Young was one of the men who have become artists of the pen, college proved a stepmother to him. In 1688 the rich uncle, whose supposed riches had dwindled
so much that at his death he was almost insomnolent, died, having decayed, it would seem, not less in mind than in body and estate, and Swift sought counsel of his mother at Leicester. After a brief residence with his mother, who was needlessly alarmed at the idea of her son falling to some casual coquett, Swift towards the close of 1689 entered upon an engagement as secretary to Sir William Temple, whose wife (Dorothy Osborne) was distantly related to Mrs Swift. It was at Moor Park, near Farnham, the residence to which Temple had retired to cultivate apricots after the rapid decline of his influence during the critical period of Charles II's reign (1679-1681), that Swift's acquaintance with Esther Johnson, the "Stella" of the famous Journal, was begun. Stella's mother was living at Moor Park, as servant of dame de compagnie of Temple's strong-minded sister, Lady Gifford. In turn was twenty-six and a half years old, and the time, and a curious friendship sprang up between them. He taught the little girl how to write and gave her advice in reading. On his arrival at Moor Park, Swift was, in his own words, a raw, inexperienced youth, and his duties were merely those of accountant and amanuensis: his ability gradually won him the confidence of his employer, and he was entrusted with some important missions. He was introduced to William III. during that monarch's visit to Sir William's, and on one occasion accompanied the king in his walks round the grounds. In 1693 Temple sent him to try and convince the king of the inevitable necessity of treating those of his subjects who were so unfortunate as to be lunatics. The king was sceptical. Swift's vanity received a useful lesson. The king had previously taught him "how to cut asparagus after the Dutch fashion." Next year, however, Swift (who had in the meantime obtained the degree of M.A. ad eundem at Oxford)quit Temple, who had, he considered, delayed too long in obtaining him preferment. A certificate of conduct while under Temple's roof was required by all the Irish bishops he consulted before they would proceed in the matter of his ordination, and after five months' delay, caused by wounded pride, Swift had to kiss the rod and solicit in obtuse terms the privilege of being admitted to the degree of M.A. at the age of thirty a year. Forgiveness was easy to a man of Temple's elevation and temperament, and he not only despactched the necessary recommendation but added a personal request which obtained for Swift the small prebend of Kilroot near Belfast (January 1695), where the new incumbent carried on a premature flirtation with a Miss Jane Waring, whom he called "Varina." In the spring of 1696 he asked the reluctant Varina to wait until he was in a position to marry. Just four years later he wrote to her in terms of such calculated harshness and imposed such conditions as to make further intercourse virtually impossible. But in the meantime he had gained the esteem of Irish life and was glad to accept Temple's proposal for his return to Moor Park, where he continued until Temple's death in January 1699. During this period he wrote much and burned most of what he had written. He read and learned even more than he wrote. Moor Park took him away from brooding and glooming in Ireland and brought him into the corridor of contemporary history, an intimate acquaintance with which became the chief passion of Swift's life. His Pindaric Odes, written at this period or earlier, in the manner of Cowley, indicate the rudiments of a real satirist, but a satirist struggling with a sort of unengaging form and expression. Of more importance was his first essay in satiric prose which arose directly from the position which he occupied as domestic author in the Temple household. Sir William had in 1692 published his Essay upon Ancient and Modern Learning, transplanting to England a controversy begun in France by Fontenelle. Incidentally Temple had cited the letters of Phalaris as evidence of the superiority of the Ancients over the Moderns. Temple's praise of Phalaris led to an Oxford edition of the Epistles nominally edited by Charles Boyle. While this was preparing, William Wotton, in 1694, wrote his Reflections upon Ancient and Modern Learning, traversing Temple's general conclusions. Swift's Battle of the Books was written in 1697 expressly to refute this. Boyle's Vindication and Bentley's refutation of the authenticity of Phalaris came later. Swift's aim was limited to cooperation in what was then deemed the well-deserved putting down of Bentley by Boyle, with a view to which he represented Bentley and Wotton as the representatives of modern pedantry, transfixed by Boyle in a suit of armour given him by the gods as the representative of the "two noblest of things, sweetness and light." The satire remained unpublished until 1704, which was issued along with The Tale of a Tub. Next year Wotton declared that Swift had borrowed his Combat des livres from the Histoire poétique de la guerre nouvellement déclarée entre les anciens et les modernes (Paris, 1688). He might have derived the idea of a battle from the French title, but the resemblances and parallels between the two books are slight. Swift was manifestly extremely imperfectly acquainted with the facts of the case at issue. Such data as he displays may well have been derived from no authority more recondite than Temple's own correspondence.

In addition to £1000, Temple left to Swift the trust and profit of publishing his posthumous writings. Five volumes appeared in 1700, 1703 and 1709. The resulting profit was small, and Swift's editorial duties brought him into acrimonious relation with Lady Gifford. The dedication to King William was to have procured Swift an English prebend, but this miscarried owing to the negligence or indifference of Henry Sidney, earl of Romney. Swift then accepted an offer from Lord Berkeley, who in the summer of 1699 was appointed one of the lords justices of Ireland. Swift was to be his chaplain and secretary, but upon reaching Dublin Berkeley gave him one thousand guineas and persuaded him that it was an unfit post for a clergyman. The rich deanship of Derry then became vacant and Swift applied for it. The secretary had already accepted a bribe, but Swift was informed that he might still have the place for £1000. With bitter indignation Swift denounced the simony and threw up his chaplaincy, but he was ultimately reconciled to Berkeley by the presentation to the rectory of Agher in Meath with the united vicarages of Laracor and Rathbeggan, to which was added the prebend of Dunlavin in St Patrick's—the total value being about £200 a year. He was now often in Dublin at twenty miles distant, and through Lady Berkeley and her daughters he became the familiar and chartered satirist of the fashionable society there. At Laracor, near Trim, Swift rebuilt the parsonage, made a fish-pond, and planted a garden with poplars and willows, bordering a canal. His congregation consisted of about fifteen persons, "most of them gentle and all of them simple." He read prayers on Wednesdays and Fridays to himself and his clerk, beginning the exhortation "Dearly beloved Roger, the Scripture moveth you and me in sundry places. But he soon began to grow tired of Ireland again and moved about in Leinster in company with a gentleman in a small house to rebuild The Tale of a Tub, which he had had by him since 1696 or 1698. He must have felt conscious of powers capable of far more effective exercise than reading-desk or pulpit at Laracor could supply; and his resolution to exchange divinity for politics must appear fully justified by the result. The Discourse on the Dissensions in Athens and Rome (September 1701), written to repel the tactics of the Tory commons in their attack on the Partition Treaties "without humour and without satire," and intended as a dissuasive from the pending impeachment of Somers, Oxford, Halifax and Walpole, received the highest, extraordinary honours; for the sudden publication of a young politician, of being generally attributed to Somers himself or to Burnet, the latter of whom found a public disavowal necessary. In April or May 1704 appeared a more remarkable work. Clearness, cogency, masculine simplicity of diction, are conspicuous in the pamphlet, but true creative power told the Tale of a Tub. "Good God! what a genius I had when I wrote that book!" was his own exclamation in his latter years. It is, indeed, if not the most amusing of Swift's satirical works, the most strikingly original, and the one in which the compass of his powers is most fully displayed. In his kindred productions he relies mainly upon a single element of the humorous—logical sequence and unrruffled gravity bridging in an otherwise frantic absurdity, and investing it with an air of sense. In the Tale of a Tub he lashes out in all directions. The humour, if less cogent and cumulative, is richer and more varied; the invention, too,
is more daringly original and more completely out of the reach of ordinary faculties. The supernatural coat and the Quintes-

sential loaf may be paralleled but cannot be surpassed; and the

book is throughout a mine of suggestiveness, as, for example, in the anticipation of Carlyle's clothes philosophy within the

compass of a few lines. At the same time it wants unity and coherence, it attains no conclusion, and the author abuses his
digressive method of composition and his convenient fiction of

hiatuses in the original manuscript. The charges it occasioned of

profanity and irreverence were natural, but groundless. There is

nothing in the book inconsistent with Swift's professed and

real character as a sturdy Church of England parson, who accepted

the doctrines of his Church as an essential constituent of his

character, and bound himself, from the beginning, to the

attachment of a soldier defending his colours, and held it no part of his duty

to understand, interpret, or assimilate them.

In February 1701 Swift took his D.D. degree at Dublin, and

before the close of the year he had taken a step destined to

exercise a most important influence on his life, by inviting two

ladies to Laracor. Esther, daughter of a merchant named Edward

Johnson, a dependant, and legatee to a small amount, of Sir

William Temple's (born in March 1660), whose acquaintance he

had made at Moor Park in 1689, and whom he has immortalized

as "Stella," came over with her companion Rebecca Dinsley, as a

poor relative of the Temple family, and was soon permanently

domiciled in his neighbourhood. The melancholy tale of Swift's

attachment will be more conveniently narrated in another place,

and is only alluded to here for the sake of chronology. Mean-

while the sphere of his intimacies was rapidly widening. He had

been in England for three years together, 1701 to 1704, and

counted Pope, Steele and Addison among his friends. The

success of his pamphlet gained him ready access to all Whig

circles; but already his confidence in that party was shaken, and he

was beginning to meditate that change of sides which has

drawn him all through his life, but which has not been unjustifiable.

The true state of the case may easily be collected from his next

publications—The Sentiments of a Church of England Man, and

On the Reasonableness of a Test (1708). The vital differences

among the friends of the Hanover succession were not political,

but ecclesiastical. From this point of view Swift's sympathies

were entirely with the Tories. As a minister of the Church he felt

his duty and his interest equally concerned in the support of her

cause; nor could he fail to discover the inevitable tendency of Whig

methods to change the character of the clergy by transferring them

to the bestow on individual clergymen, to abuse the Establishment as a

corporation. He sincerely believed that the ultimate purpose of

freethinkers was to escape from moral restraints, and that he

had an unreasoning antipathy to Scotch Presbyterians and English

Dissenters. If Whiggism could be proved to entail Dissent, he

was prepared to abandon it. One of his pamphlets, written

about this time, contains his recipe for the promotion of religion,

and is of itself a sufficient testimony to the extreme materialism

of his views. Censorships and penalties are among the means

he recommends. His pen was exerted to better purpose in the

most consummate example of his irony, the Argument to prove

that the abolishing of Christianity in England may, as things now

stand, be attended with some inconveniences (1708). About

this time, too (November 1707), he produced his best narrative poem,

Bacis and Philomen, while the next few months witnessed one

of the most amusing hoaxes ever perpetrated against the gullibility

of astrologers. In his Almanac for 1707 a Protestant aristocrat

and plot vaticinator styled John Partridge warned customers

against rivals and impostors. This notice attracted Swift's and

Steele's attention. In January 1707 they both published, under the

ensuing year by Isaac Bickerstaff, written to prevent the people

of England being imposed upon by vulgar almanac makers.

In this brochure he predicts solemnly that on the 29th of March

1 The name "Stella" is simply a translation of Esther. Swift

may have learned that Esther means "star" from the Elementa

linguae per sacrae of John Gravae or from some Persian scholar;

but he is more likely to have seen the etymology in the form given

by Jewish sources in Buxtorf's Lexicon, where the interpretation

takes more suggestive form "Stella Veneris."
Swift, Jonathan

which it began, after Malplaquet, to think might be purchased at too heavy a cost, the nation wanted a convenient excuse for relinquishing a burdensome war, which the great military genius of the age was suspected of prolonging to fill his pockets. The Whigs had been long in office. That High Church party had derived great strength from the Sacheverell trial. Swift did not bring about the revolution with which, notwithstanding, he associated his name. There seems no reason to suppose that he was consulted respecting the great Tory strokes of the creation of the twelve new peers and the dismissal of Marlborough (December 1711), but they would hardly have been ventured upon if The Conduct of the Allies and the Examiners had not prepared the way. A scarcely less important service was rendered to the ministry by his Letter to the October Club, artfully composed to soothe the impatience of Harley's extreme followers. He had every of him to the highest preferment that ministers could give him, but his own pride and prejudice in high places stood in his way.

Generous men like Oxford and Bolingbroke cannot have been unwilling to reward so serviceable a friend, especially when their own interest lay in keeping him in England. Harley by this time was losing influence and was becoming chronically incapable of any sustained effort. Swift was naturally a little sore at seeing the see of Hereford slipping through his fingers. He had already lost Waterford owing to the prejudice against making the author of the Tale of a Tub a bishop, and still had formed designs on the archbishop of York, whom he had scandalized, and the duchess of Somerset, whom he had satirized. Anne was particularly amenable to the influence of priestly and female favourites, and it must be considered a proof of the strong interest made for Swift that she was eventually persuaded to appoint him to the deanship of St Patrick's, Dublin, vacant by the removal of Bishop Sterne to Dromore. It is to his honour that he never speaks of the queen with resentment or bitterness. In June 1713 he set out to take possession of his dignity, and encountered a very cold reception from the bishops of the provincials. His decision however, caused his party speedily recalled him to England. He found affairs in a desperate condition. The queen's demise was evidently at hand, and the same instinctive sense which had ranged the nation on the side of the Tories, when Tories alone could terminate a fatiguing war, rendered it Whig when Tories manifestly could not be trusted to maintain the Protestant succession. In any event the occupants of office could merely have had the choice of risking their heads in an attempt to exclude the elector of Hanover, or of waiting patiently till he should come and eject them from their posts; yet they might have remained formidable could they have remained united. Swift had formed designs on which he regarded Oxford's refusal to advance him in the peerage the active St John added an old disgust at the treasurer's pedantic and dilatory formalism, as well as his evident propensities, while leaving his colleague the fatigues, to engross for himself the chief credit of the administration. Their schemes of policy diverged as widely as their characters: Bolingbroke's brain teemed with the wildest plans, which Oxford might have more effectually discountenanced had he been prepared with anything in their place. Swift's endeavours after an accommodation were as fruitless as unremitting. His meditation was little compared the habitual virulence of his pen, which rarely produced anything more acrimonious than the attacks he at this period directed against Burnet and his former friend Steele. One of his pamphlets against the latter (The Public Spirit of the Whigs set forth in their Generous Encouragement of the Author of the Crisis, 1714) was near involving him in a prosecution, some invectives against the Scottish peers having proved so exasperating to Argyll and others that they repaired to the queen to demand the punishment of the author, of whose identity there could be no doubt, although, like all Swift's writings, except the Proposal for the Extension of Religion, the pamphlet had been published anonymously. The immediate withdrawal of the offensive passage, and a sham prosecution instituted against the printer, extricated Swift from his danger.

Meanwhile the crisis had arrived, and the discord of Oxford and Bolingbroke had become patent to all the nation. Foreseeing, as is probable, the impending fall of the former, Swift retired to Upper Letcombe, in Berkshire, and there spent some weeks in the strictest seclusion. This leisure was occupied in the composition of his remarkable pamphlet, Some Free Thoughts on the Present State of Affairs, which indicates his complete conversion to the bold policy of Bolingbroke. The utter exclusion of Whigs as well as Dissenters from office, the remodelling of the army, the imposition of the most rigid restraints on the heir to the throne—such were the measures which, by recommending, Swift tacitly admitted to be necessary to the triumph of his party. If he was serious, it can only be said that the desperation of his circumstances had momentarily troubled the lucidity of his understanding; if the pamphlet were merely intended as a feint after public opinion, it is surprising that he did not perceive how irretrievably he was ruining his friends in the eyes of all moderate men. Bolingbroke's daring spirit, however, recoiled from no extreme, and, fortunately for Swift, he added so much of his own to the latter's MS. that the production was first delayed and then, upon the news of Anne's death, immediately suppressed. This incident but just anticipated the revolution which, after Bolingbroke had enjoyed a three days' triumph over Oxford, drove him into exile and prostrated his party, but enabled Swift to perform the noblest action of his life. Almost the first acts of Bolingbroke's ephemeral premiership were to order with Pope and Arbuthnot to establish the exchequer and despam the most flattering invitations. The same post brought a letter from Oxford, soliciting Swift's company in his retirement; and, to the latter's immortal honour, he hesitated not an instant in preferring the solace of his friend to the offers of St John. When, a few days afterwards, Oxford was in prison and in danger of his life, Swift begged to share his captivity; and it was only on the offer being declined that he finally directed his steps towards Ireland, where he was very ill received. The draft on the exchequer was intercepted by the queen's death.

These four busy years of Swift's London life had not been entirely engrossed by politics. First as the associate of Steele, with whom he quarrelled, and of Addison, whose esteem for him survived all differences, afterwards as the intimate comrade of Pope and Arbuthnot, the friend of Congreve and Atterbury, Parnell and Gay, he entered deeply into the literary life of the period. He was treasurer and a leading member of the Brothers, a society of wits and statesmen which recalls the days of Horace and Maecenas. He promoted the subscription for Pope's Homer, contributed some numbers to the Tatler, Spectator, and Intelligencer, joined with Pope and Arbuthnot in establishing the Scriblerus Club, writing Martinus Scriblerus, his share in which can have been but small, as well as John Bull, where the chapter recommending the education of all blue-eyed children in depravity for the public good must surely be his. His miscellanies, in some of which his satire made the nearest approach perhaps ever made to the methods of physical force, such as A Meditation upon a Broomstick, and the poems Sid Hamet's Rod, The City Shower, The Windsor Prophecy, The Prediction of Merlin, and The History of Vanbrugh's House, belong to this period. A more laboured work, his Proposal for Correcting, Improving and Ascertaining the English Tongue (1712), in a letter to Harley, suggesting the regulation of the English language by an academy, is chiefly remarkable as a proof of the deference paid to French taste by the most original English writer of his day. His History of the Four Last Years of the Reign of Queen Anne is not on a level with his other political writings. To sum up the incidents of this eventful period of his life, it was during it that he lost his mother, always loved and dutifully honoured, by death; his sister had been estranged from him some years before by an improper marriage, which, though making her a liberal allowance, had never forgiven. The change from London to Dublin can seldom be an agreeable one. To Swift it meant for the time the fall from unique authority to absolute insignificance. All share in the administration of even Irish affairs was denied him; every politician
shunned him; and his society hardly included a single author or wit. He "continued in the greatest privacy" and "began to think of death." At a later period he talked of "dying of rage, like a poisoned rat in a hole"; for some time, however, he was buoyed up by feeble hopes of a restoration to England. So late as 1726 he was in England making overtures to Walpole, but he had no claim on ministerial goodwill, and as an opponent he had by that time done his worst. By an especial cruelty of fate, what should have been the comfort became the bane of his existence. We have already mentioned his invitation of Esther Johnson and Mrs Dingley to Ireland. Both before and after his elevation to the dignity of St Patrick's, the possibility that the latter might, by residing near him, and supervened his household during his absence in London. He had offered no obstacle in 1704 to a match proposed for Stella to Dr William Tisdall of Dublin, and, with his evident delight in the society of the dark-haired, bright-eyed, witty beauty—a model, if we may take his word, of all that woman should be—it seemed unaccountable that he did not secure it to himself by the expedient of matrimony. A constitutional infirmity has been suggested as the reason, and the conjecture derives support from several peculiarities in his writings. But, whatever the cause of his censure of matrimony, we may believe that his course was foredoomed. But his life and Stella's and yet another's. He had always been unlucky in his relations with the fair sex. In 1695 he had idealized "Varina." Varina was avenged by Vanessa, who pursued Swift to far other purpose. Esther Vanhomrigh (b. February 14, 1690), the daughter of a Dublin merchant of Dutch origin, who died in 1703 leaving £16,000, had become known to Swift at the height of his political influence. He lodged close to her mother, was introduced to the family by Sir A. Fountaine in 1708 and became an intimate of the house. Vanessa insensibly became his pupil, and he insensibly became the object of her insatiable admiration. Her letters reveal a spirit full of ardour and enthusiasm, and was harped by that perverse bent which leads so many women to prefer a tyrant to a companion. Swift, on the other hand, was devoid of passion. Of friendship, even of tender regard, he was fully capable, but it was not of love. The spiritual realm, whether in divine or earthy things, was a region closed to him, where he had never set foot. As a friend he must have greatly preferred Stella to Vanessa. Marriage was out of the question with him, and, judged in the light of Stella's dignity and womanliness, this ardent and unrelenting display of passion was preposterous. But whenever Vanessa assaulted him on a very weak side. The strongest of all his instincts was the thirst for imperious domination. Vanessa hugged the leters to which Stella merely submitted. Flattered to excess by her surrender, yet conscious of his binding obligations and his real preference, he could neither discard the one beauty nor desert the other. It is humiliating to human strength and consoling to human weakness to find the Titan behaving like the least resolute of mortals, seeking refuge in temporizing, in evasion, in fortuitous circumstance. He no doubt trusted that his removal to Dublin would bring relief, but here again his evil star interposed. Vanessa's mother died (1714), and she followed him to Ireland, taking up her abode at Celbridge within ten miles of Dublin. Unable to marry Stella without destroying Vanessa, or to openly welcome Vanessa without destroying Stella, he was thus involved in the most miserable embarrassment; he continued to temporize. Had the solution of marriage been open Stella would undoubtedly have been Swift's choice. Some mysterious obstacle intervened. It was rumoured at the time that Stella was the natural daughter of Temple, and Swift himself at times seems to have been doubtful as to his own paternity. There is naturally no evidence for such reports, which may have been fabrications of the anti-deanery faction in Dublin. From the same source sprang the report of Swift's marriage to Stella by Bishop Ashe in the deanery garden at Clogher in the summer of 1716. The ceremony, it is suggested, may have been extorted by the jealousy of Stella and have been accompanied by the express condition on Swift's side that the marriage was never to be avowed. The evidence is by no means complete and has never been exhaustively reviewed. John Lyon, Swift's constant attendant from 1735 onwards, disbelieved the story. It was accepted by the early biographers, Deane Swift, Orrery, Delany and Sheridan; also by Johnson, Scott, Dr Garnett, Craik, Dr Bernard and others. The arguments against the marriage were first marshalled by Monck Mason in his History of St Patrick's, and the conjecture, though plausible, has failed to convince Forster, Stephen, Aitken, Hill, Lane Poole and Churton Collins. Never more than a nominal wife at most, the unfortunate Stella commonly passed for his mistress till the day of her death (in her will she writes herself spinster), bearing her doom with uncomplaining resignation, and consoled in some degree by unquestioning preference, without ever succeeding in his immediate aim or in thereby opening her eyes to the hopelessness of her passion. In 1720, on what occasion is uncertain, he began to pay her regular visits. Sir Walter Scott found the Abbey garden at Celbridge still full of laurels, several of which she was accustomed to send in a packet with her letter to Stella; the packet at which they had been used to sit was still shown. But the catastrophe of her tragedy was at hand. Worn out with his evasions, she at last (1732) took the desperate step of writing to Stella or, according to another account, to Swift himself, demanding to know the nature of the connexion with him, and this terminated the melancholy history as with a clap of thunder. Stella sent her rival's letter to Swift, and retired to a friend's house. Swift rode down to Marley Abbey with a terrible countenance, petrified Vanessa by his frown, and departed without a word, flinging down a packet which only contained her own letter to Stella. Vanessa died within a few weeks. She left the modern her correspondence for publication. The former appeared immediately, the latter was suppressed until it was published by Sir Walter Scott.

Five years afterwards Stella followed Vanessa to the grave. The grief which the gradual decay of her health evidently occasioned Swift is sufficient proof of the sincerity of his attachment, as he understood it. It is a just remark of Thackeray's that he everywhere half-consciously recognizes her as his better angel, and dwells on her wit and her tenderness with a fondness he never exhibits for any other topic. On the 28th of January 1718, he died upon themselves and for many generations his name was the most universally popular in the country. With his fierce hatred of what he recognized as injustice, it was impossible that he should not feel exasperated at the gross misgovernment of Ireland for the supposed benefit of England, the systematic exclusion of Irishmen from places of honour and profit, the spoliation of the country by absentee landlords, the deliberate discouragement of Irish trade and manufactures. An Irish patriot in the strict sense of the term he was not; he was proud
of being an Englishman, who had been accidentally "dropped in Ireland"; he looked upon the indigenous population as conquered savages; but his pride and sense of equity alike revolted against the stay-at-home Englishmen's contemptuous treatment of their own garrison, and he delighted in finding a point in which the triumphant faction was still vulnerable. His Proposal for the Universal Use of Irish Manufactures, published anonymously in 1720, urging the Irish to disuse English goods, became the subject of a prosecution, which at length had to be dropped; Swift was raised to a height of popularity which, with the chief wants of Ireland in that day, and for many a day afterwards, was that of small currency adapted to the daily transactions of life. Questions of coinage occupy a large part of the correspondence of the prime, Archbishop Boulter, whose anxiety to deal rightly with the matter is evidently very real and conscientious. There is no reason to think that the English ministry wished otherwise; but secret influences were at work, and a patent for supplying Ireland with a coinage of copper halfpence was accorded to William Wood on such terms that the profit accruing from the difference between the intrinsic and the nominal value of the coin, about 20%, was divided between him and George I.'s favourite duke of Kendal by whose influence Wood had obtained the privilege. Swift now had his opportunity, and the famous six letters signed M. B. Drapier (April to Dec. 1724) soon set Ireland in a flame. Every effort was used to discover, or rather to obtain legal evidence against, the author, whom, Walpole was assured, it would then have taken ten thousand men to apprehend. None could be procured; the public passion swept everything before it; the patent was cancelled; Wood was compensated by a pension; Swift was raised to a height of popularity which he retained for the rest of his life; and the only real sufferers were the Irish people, who lost a convenience so badly needed that they might well have afforded to connive at Wood's illicit profits. Perhaps, however, it was worth while to teach the English ministry that not everything could be done in Ireland. Swift's pamphlets, written in a style more level with the popular intelligence than even his own ordinary manner, are models alike to the controversialist who aids a good cause and to him who is burdened with a bad one. The former may profit by the study of his marvellous lucidity and vehemence, the latter by his sublime and witty exegesis of the human mind, with which he involves the innocent halfpence in the obloquy of the nefarious patentee.

The noise of the Drapier Letters had hardly died away when Swift acquired a more durable glory by the publication of Travels Into Several Remote Nations of the World, in four parts. By Lemuel Gulliver, first a surgeon and then a captain of several ships (Benjamin Motto, October 1726). The first hint came to him at the meetings of the Scriblerus Club in 1714, and the work was well advanced, it would seem, by 1720. Allusions show that it was circulated privately for a considerable period before its actual (anonymous) publication, on the 28th of October 1726. Pope arranged that Erasmus Lewis should act as literary agent in negotiating the manuscript. Swift was afraid of the reception the book would meet with, especially in political circles. The keenness of the satire on courts, parties and statesmen certainly suggests that it was planned while Swift's disappointments as a public man were still ranking and recent. It is Swift's peculiar good fortune that his book can dispense with the interpretation of which it is nevertheless susceptible, and may be equally enjoyed whether its inner meaning is apprehended or not. It is so true, so entirely based upon the facts of human nature, that the question what particular class of persons supplied the author with his examples of folly or misdoings, however interesting to the commentator, may be neglected by the reader. It is also fortunate for him that in three parts out of the four he should have entirely missed "the chief end I propose to myself, to vex the world rather than divert it." The world, which perhaps ought to have been vexed, chose rather to be diverted; and the great satirist literally strains his power at puéris placet. Few books have added so much to the innocent mirth of mankind of the first two parts of Gulliver; the misanthropy is quite overpowered by the fun. The third part, equally masterly in composition, is less felicitous in invention; and in the fourth Swift has indeed carried out his design of vexing the world at his own cost. Human nature indignantly rejects her portrait in the Yahoo as a gross libel, and the protest is fully warranted. An intelligence from a superior sphere, bound on a voyage to the earth, might actually have obtained a fair idea of average humanity by a preliminary call at Lilliput or Brobdingnag, but not from a visit to the Yahoos. While Gulliver is infinitely the most famous and popular of Swift's works, it exhibits no greater powers of mind than many others. The secret of success, here as elsewhere, is the writer's marvelous imperturbability in paradox, his teeming imagination and his rigid logic. Grant his premises, and all the rest follows; his world may be turned topsy-turvy, but the relative situation of its contents is unchanged. The laborious attempts that have been made, particularly in Germany, to affilate the Travels only serve to bring Swift's essential originality into stronger relief. He had naturally read Lucian and Rabelais—possibly Crusoe and the Arabian Nights. He had read as a young man in the lunary adventure of Bishop Wilkins, Bishop Godwin and Cyrano de Bergerac. He had read contemporary accounts of Peter the Wild Boy, the History of Secarambes by D'Alais (1677) and Foligny's Journey of Jacques Sades to Australia (1603). He may have read Joshua Barnes's description of a race of "Pygmies" in his Gerania of 1675. He copied the account of the storm in the second voyage almost literally from Sturmy's Compleat Mariner. Travellers' tales were deliberately embalmed by Swift in the amber of his irony. Something similar was attempted by Raspe in his Munchausen sixty years later.

Swift's grave humour and power of enforcing momentous truth by ludicrous exaggeration were next displayed in his Modest Proposal for Preventing the Children of Poor People from being a Burden to their Parents or the Country, by fattening and eating them (1729), a parallel to the Argument against Abolishing Christianity, and as great a masterpiece of tragic as the latter is of comic irony. The Directions to Servants (first published in 1745) in like manner derive their overpowering comic force from the imperturbable solemnity with which all the actions and thoughts of his hero are described, and which are made the more effective by the irony with which they are put upon them as duties. The power of minute observation displayed is most remarkable, as also in Politic Conversation (written in 1731, published in 1738), a surprising assemblage of the vulgarities and trivialities current in ordinary talk. As in the Directions, the satire, though cutting, is good-natured, and the piece shows more animal spirits than usual in Swift's latter years. It was a last flash of gaiety. The attacks of giddiness and deafness to which he had always been liable increased upon him. Already in 1721 he complains that the buzzing in his ears disinconcerts and confounds him. After the Directions he writes little beyond occasional verses, not seldom indecent and comcomon trivial. He sought refuge from inferior society often in nonsense, occasionally in obscurity. An exception must be made in the case of the delightful Hamilton's Bayn, and still more of the verses on his own death (1731), one of the most powerful and also one of the saddest of his poems. In The Legion Club of 1736 he composed the finest of all his verse satires. He hated the Irish parliament for its lyncharty and the Irish bishops for their interference. He fiercely opposed Archbishop Boulter's plans for the reform of the Irish currency, but admitted that his real objection was sentimental: the coin should be struck as well as circulated in Ireland. His exertions in repressing robbery and mendicancy were strenuous and successful. His popularity remained as great as ever (he received the freedom of Dublin in 1720), and, when he was menaced by the busy Bettesworth, Dublin rose as one man to defend him. He governed his cathedral with great strictness and conscientiousness, and for years after Stella's death continued to hold a miniature court at the deanery. But his failings of mind were exacerbated by his bodily infirmities; he
grew more and more whimsical and capricious, morbidly suspicious and morbidly parsimonious; old friends were estranged or removed by death, and new friends did not come forward in their place. For many years, nevertheless, he maintained a constant and sincere friendship and correspondence with Addison, not and Gay until their deaths, with such warmth as to prove that an ill opinion of mankind had not made him a misanthrope, and that human affection and sympathy were still very necessary to him. The letters become scarcer and scarcer with the decay of his faculties; at last, in 1740, comes one to his kind niece, Mrs Whiteway, of heartrending pathos:—

"I have been very miserable all night, and to-day extremely deaf and full of pain. I am so stupid and confounded that I cannot express the mortification I am under both of body and mind. All I can say is that I am not in torture; but I daily and hourly expect it. Pray let me know how your health is and your family: I hardly understand one word I write. I am sure my days will be very few; few and miserable they must be. I am, for those few days, yours entirely—Jonathan Swift.

"If I do not blunder, it is Saturday, July 26, 1740.

"If I live till Monday I shall hope to see you, perhaps for the last time."

Account book entries continue until 1742.

In March 1742 it was necessary to appoint guardians of Swift's person and estate. In September of the same year his physical malady reached a crisis, from which he emerged a helpless wreck, with faculties paralysed rather than destroyed. He never talked with a sound voice, and by the end of the year had ceased to talk at all. The partial paralyses of his case have been investigated by Dr Bucknill and Sir William Wilde, who have proved that he suffered from something that could be called mental derangement until the "labyrinthine vertigo" from which he had suffered all his life, and which he erroneously attributed to a surfeit of fruit, produced paralysis, "a symptom of which was the not uncommon one of aphasia, or the automatic utterance of words unguarded by intention. As a consequence of that paralysis, but not before, the brain, already weakened by senile decay, at length gave way, and Swift sank into the dementia which preceded his death." In other words he retained his reason until in his 74th year he was struck down by a new disease in the form of a localized left-sided apoplexy or cerebral softening. Aphasia due to the local trouble and general decay then progressed rapidly together, and even then at 76, two more years were still to elapse before he "exchanged the sleep of idiocy for the sleep of death." The scene closed on the 19th of October 1745. With what he himself described as a satiric touch, his fortune was bequeathed to find a hospital for idiots and lunatics, now an important institution, as it was in many respects a pioneer work. He was interred in his cathedral and the first Sunday in October, in the cathedral of St. Stella, with the epitaph, written by himself, "Hic depositus est corpus Jonathan Swift, S.T.P., hujus ecclesiae cathedralis decani; ubi seaeva indignatio cor ulterius lacerare nequit. Abi, viator, et imitate, si poteris, strenuum pro virili libertatis vindicem."

The stress which Swift thus laid upon his character as an asserter of liberty has hardly been ratified by posterity, which has apparently neglected the patriot for the genius and the wit. Not unreasonably; for if half his patriotism sprang from an instinct of loathing and revulsion of all that was aristocratic and egotism. He utterly lacked the ideal aspiration which the patriot should possess: his hatred of villany was far more intense than his love of virtue. The same cramping realism clings to him everywhere beyond the domain of politics—in his religion, in his fancies, in his affections. At the same time, it is the secret of his wonderful concentration of power: he realizes everything with such intensity that he cannot fail to be impressive. Except in his unsuccessful essay in history, he never, after the mistake of his first Pindaric attempts, strays beyond his sphere, never asked what he said and a foolish thing to do, and never fails to do it. His writings have not one literary fault except their occasional looseness of grammar and their frequent indecency. Within certain limits, his imagination and invention are as active as those of the most creative poets. As a master of humour, irony and invective he has no superior; his reasoning powers are no less remarkable within their range, but he never gets beyond the range of an advocate. Few men of so much mental force have had so little genius for speculation, and he is constantly dominated by fierce instincts which he mistakes for reason. As a man the leading note of his character is the same—strength without elevation. His master passion is imperious pride—the lust of despotic dominion. He would have his superiority acknowledged, and cared little for the rest. Place and profit were comparatively indifferent to him; he declares that he never received a farthing for any of his works except Gulliver's Travels, and that only by Pope's management; and he had so little regard for literary fame that he put his name to only one of his writings. Contemptuous of the opinion of his fellows, he hid his virtues, paraded his faults, affected some failings which were the real cause of, and since his munificence and charity could not be concealed from the public, laboured to spoil it by gratuitous surliness. Judged by some passages of his life he would appear a heartless egotist, and yet he was capable of the sincerest friendship and could never dispense with human sympathy. Thus an object of pity as well as awe, he is the most tragic figure in our literature—the only man of his age who could be conceived as affording a groundwork for one of the creations of Shakespeare. "To think of him," says Thackeray, "is like thinking of the ruin of a great empire."

Nothing finer or truer has been said of Swift than the description of the Scriblerus Club with his own hatred of pedantry, cant and circumspection. His own prose is the acme of incisive force and directness. He uses the vernacular with an economy which no other English writer has rivalled. There is a masculinity about his phrases which makes him as clear to the humblest capacity as they are of being made to anyone. Ironist as he is, there is no writer that ever wrote whose meaning is more absolutely unmistakable. He is the grand master of the order of plain speech. His influence, which grew during the 18th century in spite of the depreciation of Dr Johnson, who was an enemy of Swift, and whom he regarded as the author of Gulliver he is still read all over the world, while in England discipleship to Swift is recognized as one of the surest passports to a prose style. Among those upon whom Swift's influence has been most discernible may be mentioned Chesterfield, Smollett, Cobbett, Hazlitt, Scott, Borrow, Newman, Bello.

Authorities.—Among the authorities for Swift's life the first place is still of course occupied by his own writings, especially the fragment of autobiography in the University of Dublin and the Correspondence, which still awaits an authoritative annotated edition. The most important portion is contained in the Journal to Stella, which was the result of twenty-three letters, and was written between the 1st and 28th of May 1711, and which began about the time of Jeffrey. Yet as the author of Gulliver he is still read all over the world, while in England discipleship to Swift is recognized as one of the surest passports to a prose style. Among those upon whom Swift's influence has been most discernible may be mentioned Chesterfield, Smollett, Cobbett, Hazlitt, Scott, Borrow, Newman, Bello.
SWIFT—SWIMMING

SWIFT, a bird so called from the extraordinary speed of its flight, which actually exceeds that of any other British bird except the Hirundo apus of Linnaeus and Cypselus apus or maniruri of modern ornithologists. Swifts were formerly associated with swallows (q.v.) in classification, but whilst the latter are true Passeres, it is now established that swifts are Coraciiform birds (see BIRDS) and the sub-order Cypseli has been formed to include them and their nearest allies, the humming-birds. The four toes are all directed forwards, whereas in the Passeres the hallux is directed backwards and by opposing the other three makes the foot a grasping organ. In the swifts, moreover, the middle and outer digits have only three joints and the metatarsi, and even the toes may be feathered. Swifts are divided into three sub-families: Macropteriginiæ, the true swifts, of tropical Asia, which form a nest gunned by saliva to branches of trees; Chæturiæ, building in rocks or houses, and with an almost world-wide range: it includes Chætura palagica, the "chinny-swallow" of the United States, Collocaia fusciphaga which obtained its specific name from the erroneous idea that its edible nests were formed by partly digested seaweed; Cypselinae, also world-wide and containing Cypselus apus, the common European swift. All the swifts are migratory. Well known as a summer visitor throughout the greater part of Europe, the swift is one of the latest to return from Africa, and its stay in the country of its birth is of the shortest, for it generally disappears from England very early in August, though occasionally to be seen for even two months later.

The swift commonly chooses its nesting-place in holes under the eaves of buildings, but a crevice in the face of a quarry, or even a hollow tree, will serve it with the accommodation it requires. This, indeed, is not much, since every natural function except sleep, oviposition and incubation, is performed on the wing, and the entire length of this bird in the air, where it remains for hours together, are the admiration of all who witness them. Though considerably larger than a swallow, it can be recognized at a distance by its size than by its peculiar shape. The head scarcely projects from the anterior outline of the pointed wings, which form an almost continuous curve, at right angles to which extend the body and tail, resembling the handle of the crescentic cutting-knife used in several trades, while the wings represent the blade. The mode of flight of the two birds is also unlike, that of the swift being much more steady, and, rapid as it is, ordinarily free from jerks. The whole plumage, except a greyish white patch under the chin, is a sooty black, but glossy above. Though its actual breeding-places are by no means numerous, its extraordinary speed and discursive habits make the swift widely distributed; and throughout England scarcely a summer's day passes without its being seen in most places. A larger species, C. melba or C. alpinus, with the lower parts dusky white, which has its home in many of the mountainous parts of Europe, and has twice been observed in Britain, and two examples of a species of a very distinct genus Chætura, which has its home in northern Asia, but regularly emigrates thence to Australia, have been obtained in England (Proc. Zool. Soc., 1880, p. 1).

Among other peculiarities the swifts, as long ago described (probably from John Hunter's notes) by Sir E. Home (Phil. Trans. 1817, pp. 332 et seq., pl. xvi.), are remarkable for the development of their salivary glands, the secretions of which serve in most species to glue together the materials of which the nests are composed, and in the species of the genus Collocaia form almost the whole substance of the structure. These are the "edible" nests so eagerly sought by Chinese epicures as an ingredient for soup. These remarkable nests consist essentially of mucus, secreted by the salivary glands above mentioned, which dries and looks like isinglass. They are extremely valuable for other purposes, and by the natives of Japan are often intermixed with feathers and other foreign substances. The swifts that construct these "edible" nests form a genus Collocaia, with many species; but they inhabit chiefly the islands of the Indian Archipelago and from that period to the Malay Peninsula, as well as many of the tropical islands of the Pacific so far as the Marquesas— one species occurring in the hill-country of India. They breed in caves, to which they resort in great numbers, and occupy them jointly in the form of alternate roosts—the mammals being guests at the door by the birds by night.

(A.N.)

SWIMMING (from "swim," A.S. swimman, the root being common in Teutonic languages), the action of self-support and self-propulsion on or in water; though used by analogy of inanimate objects, the term is generally connected with animal progression and specially with the art of self-propulsion on water as practised by man. Natation (the synonym derived from Lat. nātare) is one of the most useful of the physical acquirements of man. There have been cases in which beginners have demonstrated some ability in the art upon their first immersion in deep water, but generally speaking it is an art which has to be acquired. For many years Great Britain held the supremacy in this particular form of athletics, but continental, Australian and American swimmers have so much improved and have developed such speedy strokes, that the claim can no longer be maintained. English swimmers have, however, the satisfaction of knowing that in a great measure through them has come about the very great interest which is now taken in the teaching of swimming throughout the world, and more particularly on the continent of Europe, where they have made frequent tours and given instructive displays of swimming, life-saving (see DROWNING), and water polo (q.v.); the latter a water game entirely British in its origin.

The teaching of swimming has been taken up in schools, and where the work is well done it is customary to use a form of land drill so as to impress upon the pupils some idea of the motions which have to be made in order to progress through the water. This drill is the preliminary practice to the teaching of the breast stroke. This stroke is about the most useful of all the known forms of swimming, more particularly when any one is thrown overboard in clothes; and though speed swimmers look upon it as obsolete, it is undoubtedly the best for a long-distance swim, such as across the English Channel, or other similar feats. A knowledge of it, as well as of the back stroke, is essential to the effective teaching of swimming.

When learning the breast stroke, the first thing to avoid is undue haste and rapidity in the movements. It is this fault, probably born of nervousness, which causes many to aver that though eager to do so, they have never been able to learn to swim. Rapid action of the arms only exhausts the learner, whose breathing then becomes hurried and irregular, and as a consequence he fails to preserve the buoyancy necessary for carrying him along the surface. When starting for the first stroke the beginner should draw the elbows nearly to the side, at the same
time bringing up the forearm and hands to the front of the chest, with the palms of the hands downwards near to the surface of the water, the fingers being extended and closed and the forefingers and thumbs nearly touching. The hands are then pushed forward in front of the body to the full extent of the arms, the palms of the hands are turned slightly outwards, and the arms swept round until in a right angle with the shoulders, when the elbows are dropped and the hands come up in front of the chest for the next stroke. The arms should not be kept rigid, but allowed to work gracefully. As the arms are swept backwards the legs are drawn up, the knees being turned outwards to the right and left and the heels nearly touching. The legs are then kicked outward and swept round as the arms are being pushed forward to their fullest extent, a "sweep" being given with each of the feet, which must be kept loose at the ankles and in the same position as when standing. All beginners have the great fault of trying to make the limbs too rigid, thereby causing stiffness and possibly cramp. Another difficulty with them is the question of breathing, but if the learner will remember to inhale when making each backward sweep of the arms, much of the difficulty usually experienced at the start will be overcome.

Expiration should be carried out during the other portion of each stroke. The important thing is to keep the body as level along the water as possible, and at the same time maintain a natural and easy breathing. The holding of the breath for two or three strokes will exhaust the beginner more than anything else.

A knowledge of the back stroke can easily be acquired by those who are able to swim on the breast, for the leg action is very similar and the principles relating to the use of the arms are almost the same. The arms, instead of being moved through the water, are lifted in the air and carried out to beyond the head with the palms upwards. The palms are then slightly turned and the arms swept round. Just as this action is being made the legs are drawn up as in the breast stroke, the body being allowed to travel on with the force of the kick as the arms are extended beyond the head. The great difficulty that a back swimmer has to contend with in open water is that of steering, and the best way to overcome it is to take an object for a guide before starting and hold the head slightly to the side so as to steer by it.

At one time the side stroke was the great racing stroke; the body being placed on the side, the upper arm worked from the head to the upper side of the body, the lower arm taken downward through the water to the underside of the body and a scissors-like kick made with the legs; but this has now been generally given up in favour of the over-arm, trudgen and crawl strokes.

In the over-arm stroke the body is usually turned on the right side. At the start the lower arm is pulled downwards towards the hips, the fingers being kept closed and the hand flat, so as to present a large surface to the water. When the stroke is finished the hand is turned quickly palm upwards, so that together with the lower part of the arm it cuts the water sideways, the arm being almost bent double. Then, as it is shot forward, the hand is gradually turned from palm upwards to palm downwards, until, when it arrives at its position beyond the head, it is ready for the next stroke. The recovery and the pull ought to be effected as quickly as possible. The upper arm stroke is started when the downward stroke of the under or right arm is finished. It is started in front of the forehead, the arm being slightly bent and the fingers pointing downwards. The hand is pulled past the face and chest with the arm bent at right angles and swept back in front of the body, the arm gradually straightening as it leaves the water opposite the hip. When the hand is opposite the shoulder in its pull through the water the legs are kicked wide apart and closed again at the moment when the hand leaves the water. The kick is completed and the legs straightened before the left hand is replaced ready for the next stroke. As the legs are opened the upper leg is kicked forward with the knee slightly bent, and the foot kept in its ordinary position. The lower leg is bent double until the heel approaches the thigh, which is brought backwards slightly. In the actual kick the upper leg is sent forward, and as it is straightened the knee in water is swept downward and, as the lower leg comes forward to meet it with a vicious kick, the swirl of the feet and closing of the legs drives the body forward. This is what has come to be known in Great Britain as the "Northern Kick," by reason of its first being introduced by Lancashire swimmers.

The trudgen stroke, more commonly known as the trudgen stroke, and on the continent of Europe as Spanish swimming, was first made prominent in England in 1873 by a swimmer named J. Trudgen, who stated that he had acquired a knowledge of it while in South America. It was, however, a writer on swimming, who described it in 1825 as "The Thrust." Trudgen's speed was so great for his time that swimmers quickly copied his style, and it is from this stroke that the crawl stroke has been developed. When swimming Trudgen kept on the chest and lifted the upper part of his body at each stroke out of the water, and at each swing of the arms pulled himself forward, a considerable swirl of the water occurring as each movement was finished. The arms were brought forward sideways, each completing a circle on each side of the body, and the head kept constantly above the water. Trudgen's stroke was found to be less laborious and equally as fast to use a double-over-arm stroke with the head and chest well down, and thus have the body supported by the water, using the ordinary over-arm kick. At first it was considered a stroke only useful for short distances and for water polo where speed is essential, but the idea was quickly dispelled, and several men, as well as women, have swum as far as fifteen miles with this stroke.

The crawl stroke is, like the trudgen, an adaptation from native swimmers. It was not generally known in Great Britain until 1902, when Mr. Richard Cavill came from Australia to compete in the English championships, and it is believed to have been taught to natives of the South Sea Islands, and from there introduced into Australia about the year 1900. From thence it came to Europe, and there Mr. C. M. Daniels, the American amateur champion, made so excellent a study of it that he not only so greatly increased his own pace as to be able to win the English championship, and beat the world's record for a hundred yards, but also introduced various improvements upon it. This stroke is different from any other form of swimming: the legs from the knee upwards are kept in line with the body and almost completely straight when opening the legs or drawing the knee downward, as for the breast, back and side strokes. The swimmer lies flat upon his breast on the surface, the lower part of the legs from the knee downward are alternately lifted above the surface up to the middle of the calf and then they are struck down upon the water with the instep with all force possible. This striking is done from an upward to a downward direction, one leg at a time. The arms are used somewhat similarly, as in the trudgen stroke, they are bent at the elbows, dipped in just beyond the head and drawn smartly backwards till they come out of the water at the hips. The right arm is dipped in when the left foot strikes downward and vice versa. The result of this movement is that when one or the other of the limbs is pulling or propelling the body through the water at the same moment another limb is being recovered for the next stroke, most of the limbs are recovered through the air, fewer dead or retarding points are produced than in any other stroke, and less resistance is caused in the line of progress. In performing any other stroke most of the limbs are recovered through the water.

One of the most useful accomplishments for a swimmer is that of floating, but curiously enough many of them cannot acquire a knowledge of it. It is purely a matter of buoyancy, and requires constant practice before one can become perfect in it. In learning to float the beginner experiences great difficulty in overcoming the tendency of the legs to sink, and if after frequent trials they are still found to sink he should get some one to hold them up or else place them on the steps or behind the rail of the bath, and thus assisted learn to balance the body on
SWIMMING

the surface. Before doing so he should completely fill his lungs, spread his legs wide, and then lie backwards with the arms extended in a line with the body and beyond the head, with the palms upwards, care being taken to throw as much weight beyond the head as possible. Furthermore he must lie perfectly still and take care not to holler the back or raise the shoulder above water. One may sink for an instant, but, if the breath be held the lips will come above the surface, when easy breathing may be indulged in. Only the face, chest and toes should appear above the surface of the water. If the feet still have a tendency to sink after they have been gently released from the step or rail, more weight should be thrown beyond the head by turning it well back and lifting the hands out of the water, which will raise the feet. A knowledge of floating is of good service to those attempting to save life and is also essential to those desirous of making a study of the many tricks and scientific feats which are performed by swimmers.

The usual method of entering the water is by what is known as diving; some think that it should be termed "springing." The best method of learning to dive is to stand on the side of the bath or on the bank of the river, and then stoop down until the body is nearly double, stretch out the arms in front of the head, sink the head between them and gradually fall over into the water. The ability to enter the water head first will then soon be acquired. To begin, the legs should be placed together and the body kept erect, then a few short inspirations should be made and the lungs cleared and the head lowered to the water. The face should be turned forward and the head should be lowered for a moment to the bottom of the stroke, then brought up before the nose is wholly lost from sight. The body faces the water, the head bends down and the body remains in the same position. A little practice and the body is made to enter the water in a graceful manner. A useful accomplishment is that known as surface diving, because it enables you to find and bring an object to the surface. The correct method of performing it is to first swim a few yards on the surface with the breast stroke, take a breath, then suddenly depress the head, look downwards, elevate the body at the hips, and at the same time make a powerful stroke with the legs and an upward stroke with the hands. The impetus thus obtained will suffice to take the swimmer to the bottom in 10 ft. of water. The surface it is necessary to keep the body straightened and the breath by means of the breast stroke in order to find the object of search. When about to rise to the surface, the head should be turned backwards with the eyes upwards, and a vigorous stroke made with arms and legs. Plunging is not very generally practised, though there is a championship for it. A plunge is a standing dive made head first from a firm take off, free from spring. The body must be kept motionless face downwards, no progressive movement must be imparted other than the action of the dive. The plunge terminates when the plunger raises his face above the surface of the water. With the idea of preventing long tests without breathing, it was deemed in 1893 advisable by the swimming association to impose a time limit of one minute in all competitions. Yet even with this time limit, over 80 ft. has been plunged. In Sweden and Germany skilled forms of acrobatic and gymnastic diving have been more largely practised than in England, and as a consequence diving in those countries is in a much higher state of perfection than in England, though even in England great improvement has been made owing to a large influx of Swedish teachers.

In the matter of the principal races as decided in baths, but there has been a tendency of late years to revert to open water in the summer and also to encourage long-distance swimming. The first public baths in Great Britain were opened by the corporation of Liverpool in 1828 and the Baths and Washhouses Act was passed in 1846, the first of the London parishes to adopt the act being St Martin's in the Fields, who opened baths in Green Street, Leicester Square in 1846. Since then public baths have been erected all over Great Britain and Ireland, and open water swimming has become, by reason of the lack of reasonable open water accommodation, the principal means of the teaching of the young. But open water swimming, and more particularly swimming in the sea, is the best training and practice for those who really love the art, because they are able to swim under normal climatic conditions, instead of in tepid water. Many persons in England bathe in the open all the year round, notably in the Serpentine in London, on the sea-coast and in various inland waters.

In the matter of bathing there has been and is continued to be taken to avoid weeds or undercurrents. In the event of accidentally getting hold of a bed of weeds, the swimmer should cease kicking and work with the arms, and the current will then take him through. If he tries to swim the weeds will entangle his legs and put him in an awkward plight. If he be carried away by a current in a river, he should select a spot on either bank and swim diagonally towards it, never minding where he has left his clothes. When in the sea, the conditions are not always the same, though the general rule of swimming diagonally for shore also applies. For sea bathing, however, it is far better, no matter how good a swimmer one may be, to have a boat in attendance. The hundred yards record has been for some years by a diver who has been bathing in any strange place, the swimmer should make himself acquainted with the currents and the direction of the tide. When the tide is going out the course should be made along the coast, close in shore. In a rough sea the swimmer should not attempt to breast the waves, but as each wave rises he should swim through, thereby saving himself from buffeting, which, if long continued would cause insensibility or else great waste of physical power. When using a boat for bathing the best way is to dive from the stem, to which some steps or a rope ladder should be fixed, in order to aid the swimmer when getting in again. Failing these being at hand, the best way is to lay hold of the stern with both hands and then, making a hard rising kick, raise the body till it rests on the edge of the hips. Then softly slip the hands a little forward, turn to a sitting position and enter the boat.

Speed swimming records are so frequently altered, that students had best obtain the Amateur Swimming Association's Annual Handbook, in which are detailed the accepted records up to date. The improvement in speed has been most remarkable. In 1871 the mile amateur record was 29 m. 245 secs.; and that stood until 1892. The record in 1907 was 24 m. 425 secs. made by Mr. D. Billington. In 1897 Webb's 662 yards record was similarly reduced. In 1878 it was 1 m. 161 secs.; in 1888 it had been lowered by Mr J. Nuttall to 1 m. 61 secs.; and in 1907 Mr C. M. Daniels, of America, created a world's record of 55! 1/2 secs. The records over intermediate distances have also been considerably lowered and many long-distance swimming records have from time to time been created. One of the most remarkable of these long-distance swims is the race which is known as the "Swim through London," from Richmond lock and weir to Blackfriars, which was instituted in 1907 and won by Mr J. A. Jarvis of Leicester, in 3 hours 24 minutes 68 secs. In this event 34 started, and 21 finished the distance, which goes to show that much attention is being devoted to long-distance trials; in this event Miss Lilian M. Smith finished fourteenth. Much interest has centred in attempts to swim across the English Channel; Captain Webb, D. Dalton and F. Cavill, all claim to have done it, but only the swim of Captain Webb has been accepted as genuine. The first recorded attempt was made on the 24th of August 1872 by J. B. Johnson, who started from Dover, but remained in the water only 65 minutes. It was on the 12th of August 1875 that Captain Matthew Webb made his first attempt. He started from Dover and remained in the water 6 hours 49 m., when the weather became too rough for him to continue. It is estimated he was about 134 m.
across when he had to give up. On the 24th-25th of August 1875, he swam across the English Channel, diving from the Admiralty Pier, Dover, and touching Calais sands, France, after swimming for 21 hours 45 m. It is the greatest swim ever recorded, and at the time of the accomplishment created a great sensation in England. Since this great achievement, numerous unsuccessful attempts have been made, the best being those of Montague Holbein, Jabez Wolff and T. W. Burgess, and their efforts created an interest in long-distance swimming in all parts of the world, which has resulted in the accomplishment of trials and tests once thought impossible.

BIBLIOGRAPHY.—The literature of the subject of swimming is considerable, and modern works of general reference is Swimming, by Ralph Thomas (London, 1904), with bibliography. Other chief works on the technique of swimming that may be mentioned are: Thevenot, The Art of Swimming (London, 1789); Steedman, Manual of Swimming (Melbourne, 1867); W. Wilson, The Swimming Instructor (London, 1883); A. Sinclair and W. Henry, Swimming (Badminton Library, London, 1883); C. M. Daniels, How to Swim and Save Life (Spalding's Library, London, 1897). (W. H.)

SWINBURNE, ALGERNON CHARLES (1837-1909), English poet and critic, was born on 14th March 1837. He was the son of Admiral Charles Henry Swinburne (of an old Northumbrian family) and of Lady Jane Henrietta, a daughter of George, 3rd earl of Ashburnham. It may almost be said to have been by accident that Swinburne owned London for his birthplace, since he was removed from it immediately, and always felt a cordial dislike for the surroundings and influences of life in the heart of a great city. His own childhood was spent in a very different environment. His grandfather, Sir John Edward Swinburne, bart., owned an estate in Northumberland, and his father, the admiral, bought a beautiful spot near Norden, and Niton, on the Isle of Wight, called East Dene, together with a strip of undercliff known as the Landslip. The two homes were in a sense amalgamated. Sir Edward used to spend half the year in the Isle of Wight, and the admiral's family shared his northern home for the other half; so that the poet's earliest recollections took the form of strangely contrasted emotions, inspired on the one hand by the bleak north, and on the other by the luxuriant and tepid south. Of the two, the influences of the island are, perhaps naturally, the stronger in his poetry; and many of his most beautiful pieces were actually written at the Orchard, an exquisite spot between Norden and Niton, and are imbued with the spirit of the Dene, or the spirit of the sea, and the spirit of the Elysian south.

After some years of private tuition, Swinburne was sent to Eton, where he remained for five years, proceeding to Balliol College, Oxford, in 1857. He was three years at the University, but left without taking a degree. Clearly he must have cultivated while there his passionate and altogether unacademic love for the literature of Greece; but his undergraduate career was unattended by university successes, beyond the Taylorian prize for French and Italian, which he gained in 1858. He contributed to the "Undergraduate Papers," published during his first year, under the editorship of John Nichol, and he wrote a good deal of poetry from time to time, but his name was probably regarded without much favour by the college authorities. He took a second class in classical moderations in 1858, but his name does not occur in any of the "Final" honour schools. He left Oxford in 1860, and in the same year published those remarkable dramas, The Queen Mother and Rosamond, which, despite a certain rigidity of style, must be considered a wonderful performance for so young a poet, being fuller of dramatic energy than most of his later plays, and rich in really magnificent blank verse. The volume was scarcely noticed at the time, but it attracted the attention of one or two literary judges, and was by them regarded as a first appearance of uncommon promise.

It is a mistake to say, as most biographers do, that Swinburne, after leaving Oxford, spent some time in Italy with Walter Savage Landor. The facts are quite otherwise. The Swinburne family went for a few weeks to Italy, where the poet's mother, Lady Jane, had been educated, and among other places they visited Fiesole, where Landor was then living in the house that had been arranged for him by the kindness of the Brownings. Swinburne was a great admirer of Landor, and, knowing that he was likely to be in the same town with him, had provided himself with an introduction from his friend, Richard Monckton Milnes. Landor and Swinburne met and conversed, with great interest and mutual esteem; but the meetings were not for more than an hour at a time, nor did they exceed four or five in number. Swinburne never lived in Italy for any length of time. In 1865 appeared the lyrical tragedy of Atalanta in Calydon, followed in the next year by the famous Poems and Ballads, and with them the poet took his seat, within sound of the London literary world, that may almost be likened to the vogue of Byron. His sudden and imperative attraction did not, it is true, extend, like Byron's, to the unliturgical; but among lovers of poetry it was sweeping, permeating and sincere. The Poems and Ballads were vehemently attacked, but Dolores and Fousine were on everyone's lips: as a poet of the time has said, "We all went about chanting to one another these new, astonishing melodies." Chastelard, which appeared between Atalanta and Poems and Ballads, enjoyed perhaps less unstinted attention; but it is not too much to say that by the close of his thirtieth year, in spite of detraction, Swinburne had placed himself in the highest rank of contemporary poets, but had even established himself as leader of a choir of singers to whom he was at once master and prophet.

Meanwhile, his private life was disturbed by troublesome influences. A favourite sister died at East Dene, and was buried in the little shady churchyard of Bonchurch. Her loss overwhelmed the poet's father with grief, and he could no longer tolerate the house that was so full of tender memories. So the family moved to Holmwood, in the Thames Valley, near Reading, and the poet, who had been placed in the highest rank of contemporary poets, but had even established himself as leader of a choir of singers to whom he was at once master and prophet.

The Pre-Raphaelite movement was in full swing, and for the next few years he was involved in a rush of fresh emotions and rapidly changing loyalties. It is indeed necessary to any appreciation of Swinburne's genius that one should understand that his inspiration was almost invariably derivative. His first book is deliberately Shake-spearian in design and expression; the Atalanta, of course, is Virgilian, and the Faustine and the Hellenic spirit. With a wider swing of the pendulum, he recedes, in Poems and Ballads, to the example of Baudelaire and of the Pre-Raphaelites themselves; with the Song of Italy (1867) he is drawing towards the revolt of Mazzini; by the time Songs before Sunrise are completed (in 1871) he is altogether under the influence of Victor Hugo, while Rome has become to him "first name of the world's names." But, if Swinburne's inspiration was derivative, his manner was in no sense imitative; he brought to poetry a spirit entirely his own, and a method even more individual than his spirit. In summing up his work we shall seek to indicate wherein his originality and his service to poetry has lain; meanwhile, it is well to distinguish clearly between the influences which touched him and the original, personal fashion in which he assumed those influences, and made them his own. The spirit of Swinburne's muse was always a spirit of revolution. In Poems and Ballads the revolt is against moral conventions and restraints; in Songs before Sunrise the arena of the contest is no longer the sensual sphere, but the political and the ecclesiastical. The detestation of kings and priests, which marked so much of the work of his maturity, is now in full swing, and Swinburne's language is tinged with extravagance and an almost virulent animosity. With Backwell (1874) he returned to drama and the story of Mary Stuart. The play has fine scenes and is burning with poetry, but its length not only precludes patient enjoyment, but transcends all possibilities of harmonious unity. Erechtheus (1876) was a return to the Greek inspiration of Atalanta; and then in the second series of Poems and Ballads (1878) the French influence is seen to be at work, and Victor Hugo begins to hold alone the place possessed, at different times, by Baudelaire and Mazzini. At
this time Swinburne's energy was at fever height; in 1879 he published his eloquent Study of Shakespeare, and in 1880 no fewer than three volumes, The Modern Heptalogy, a brilliant anonymous essay in parody, Songs of the Springtides, and Studies in Song. It was shortly after this date that Swinburne's friendship for Theodore Watts-Dunton (then Theodore Watts) grew into one of almost more than brotherly intimacy. After 1880 Swinburne's life remained without disturbing event, devoted entirely to the pursuit of literature in peace and leisure. The conclusion of the Elizabethan trilogy, Mary Stuart, was published in 1881, and in the following year Tristram of Lyonesse, a wonderfully individual contribution to the art of poetic fiction; in which the heroic couplet is made to assume opulent, romantic cadences of which it had hitherto seemed incapable. Among the publications of the next few years must be mentioned A Century of Roundels, 1883; A Midsummer Holiday, 1884; and Miscellanies, 1886. The current of his poetry, indeed, continued unchecked; and though it would be vain to pretend that he added greatly either to the range of his subjects or to the fecundity of his versification, it is at least true that his melody was unbroken, and his magnificently tormented prose inexhaustible. His Marino (1881) and Locrine (1887) have passages of power and intensity unsurpassed in any of his earlier work, and the rich metrical effects of Astrophel (1894) and The Tale of Balin (1896) are inferior in music and range to none but his own masterpieces. In 1899 appeared his Rosamund, Queen of the Lombards; in 1908 his Duke of G Gäste; and in 1904 was begun the publication of a collected edition of his Poems and Dramas in eleven volumes.

Besides this wealth of poetry, Swinburne was active as a critic, and several volumes of fine impassioned prose testify to the variety and fluctuation of his literary allegiances. His Note on Charlotte Brenton (1897) must be read by every student of her subject; the Study of Shakespeare (1880)—followed in 1900 by The Age of Shakespeare—is full of vigorous and arresting thought, and many of his scattered essays are rich in suggestion and appreciation. His studies of Elizabethan literature are, indeed, full of "the noble tribute of praise," and no contemporary critic did so much to revivify an interest in that wonderful period of dramatic recrudescence, the side-issues of which have been generally somewhat obscured by the pervading and dominating genius of Shakespeare. Where his enthusiasm was heart-whole, Swinburne's appreciation was stimulating and infectious, but the very qualities which give his poetry its unique charm and character were antithetic to his success as a critic. He had very little capacity for cool and reasoned judgment, and his criticism is often a tangled thicket of prejudices and predilections. He was, of course, a master of the phrase; and it never happened that he touched a subject without illuminating it with some lightning-flash of genius, some vivid penetrating suggestion that outflames its shadowy and confused environment. But no one of his studies is satisfactory as a whole; the faculty for sustained exercise of the judgment was denied him, and even his best appreciations are disfigured by error in taste and proportion. On the other hand, when he is aroused to literary indignation the avalanche of his invective sweeps before it judgment, taste and dignity. His dislikes have all the superlative violence of his affections, and while both alike present points of great interest to the analyst, revealing as they do a rich, varied and fearless individuality, the criticism which his hatreds evoke is seldom a safe guide. His prose work also includes an early novel of some interest, Love's Cross-currents, disinterred from a defunct weekly, the Taller, and revised for publication in 1905.

Whatever may be said in criticism of Swinburne's prose, there is at least no question of the quality of his poetry, or of its important position in the evolution of English literary form. To treat first of its technique, it may safely be said to have revolutionized the whole system of metrical expression. It found English poetry bound in the bondage of the iambic; it left it revelling in the freedom of the choriambus, the dactyl and the anapaest. Entirely new effects; a richness of orchestration resembling the harmony of a band of many instruments; the thunder of the waves, and the lip of leaves in the wind; these, and a score other astonishing poetic developments were allied in his poetry to a mastery of language and an overwhelming impulse towards beauty of form and exquisiteness of imagination. In Tristram of Lyonesse the heroic couplet underwent a complete metamorphosis. No longer wedded to antithesis and a sharp caesura, it grew into a rich melodious measure, capable of an infinite variety of notes and harmonies, palpitating, intense. The service which Swinburne rendered to the English language is as a whole for lyrical effect is simply incalculable. He revolutionized the entire scheme of English prosody. Nor was his singular vogue due only to this extraordinary metrical ingenuity. The effect of his artistic personality was in itself intoxicating, even delicious. He was the poet of youth insurgent against all the restraints of conventionalism and custom. The young lover of poetry, when first he encounters Swinburne's influence, is almost bound to be swept away by it; the wild, extravagant licence, the apparent sincerity, the vigour and the verve, cry directly to the aspirations of youth like a clarion in the wilderness. But, while this is inevitable, it is also lamentable to see that the young poet is often led into resting allegiance to the Swinburnian mood more quickly than any other of the diverse emotions aroused by the study of the great poets. It is not that what has been called his "pananthropism"—his universal worship of the holy spirit of man—is in itself an unsound philosophy; there have been many creeds founded on such a basis which have impartially withstood the attacks of criticism. But the unsoundness of Swinburne's philosophy lies in the fact that it celebrates the spirit of man engaged in a defiant rebellion that leads nowhere; and that as a "criticism of life" it has neither finality nor a sufficiently high seriousness of purpose. Walt Whitman preaches very much the same gospel of the "body electric" and the glory of human nature; but Whitman's attitude is far saner, far more satisfying than Swinburne's, for it is concerned with the human spirit realizing itself in accordance with the unchangeable laws of nature; while Swinburne's enthusiasm is, more often than not, directed to a spiritual revolution which sets the laws of nature at defiance. It is impossible to acquit his poetry entirely of the charge of an animalism which wars against the higher issues of the spirit—an animalism sometimes of love, sometimes of hatred, but, in both extremes, out of centre and harmony.

Yet, when everything has been said that can be said against the unesthetic violence of the poet's excesses, his service to contemporary poetry outweighed all disadvantages. No one did more to free English literature from the shackles of formalism; no one, among his contemporaries, pursued the poetic calling with so sincere and resplendent an allegiance to the claims of absolute and unadulterated poetry. Some English poets have turned preachers; others have been seduced by the attractions of philosophy; but Swinburne always remained an artist absorbed in a lyrical ecstasy, a singer and not a seer. When the history of Victorian poetry comes to be written, it will be found that his personality was, in its due perspective, among the most potent of his time; and as an artistic influence it will be pronounced both inspiring and beneficent. The topics that he touched were often ephemeral; the causes that he celebrated will, many of them, wither and desiccate; but the magnificent freedom and lyrical resource which he introduced into the language will enlarge its borders and extend its sway so long as English poetry survives.

On the 10th of April 1909, after a short attack of influenza followed by pneumonia, the great poet died at the house on Putney Hill, "The Pines," where with Mr Watts-Dunton he had lived for many years. He was buried at Bonchurch, Isle of Wight. (E. G.)

SWINDON, a market town and municipal borough in the Cricklade parliamentary division of Wiltshire, England, 77½ m. W. of London by the Great Western railway. Pop. (1891), 33,001; (1901), 45,006. It has two parts, New and Old. The
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new town grew up around the vast locomotive and wagon works of the Great Western railway, and is an important junction on that system with a separate station on the Midland and South-Western Junction railway. It arose rapidly on a strip of waste land, and churches and chapels were built for the workmen, whose numbers soon exceeded 10,000. Each man contributes to a medical fund which maintains the fever, accident and general hospitals, providing also laundries and baths. There are a mechanics' institute, containing a large library, theatre, reading-rooms and lecture-hall. The company owns a park with football and cricket grounds. An aisle of St Saviour's Church, dedicated in 1905, was built by the priest and congregation with their own hands. The picturesque old town stands on a hill overlooking the Gloucestershire borders, the White Horse Vale and Lambourn Down in Berkshire, and the great chalk uplands of Marlborough; while the camps of Blunsdon, Kingsbury, Barbury and Badbury are all visible. Here the chief buildings are the church, town-hall, market-hall and corn exchange. Old Swindon received the right of holding a fair from Charles I. Coate Reservoir, less than 2 m. south-east, is a broad lake which supplies a branch of the Berks and Wilts Canal. Its shores are beautifully wooded, and it abound with fish. Swindon is governed by a mayor, 12 aldermen and 36 councillors. Area, 4,265 acres.

SWINE, a name properly applicable to the domesticated pig (Sus scrofa), but also including its wild relatives. As stated in the article ARTIODACTyla, these animals typify the family Suidae, which, with the Hipposopomatidae, constitute the section Suina, a group of equal rank with the Pecora. The Suine animals are divisible into the true Old World swine (Suinae) and the American peccaries (Dicotylinae). Of the former the leading characteristics are as follows: an elongated mobile snout, with an expanded, truncated, nearly naked, flat, oval terminal surface in which the nostrils are placed. Feet narrow, with four completely developed toes on each. Hoofs of the two middle toes with their contiguous surfaces flattened. The outer toes not reaching to the ground in the ordinary walking position. Teeth variable in number, owing to the suppression in some forms of an upper incisor and one or more premolars.

In the typical genus Sus, as exemplified by domesticated pigs (see Pig) and the wild boar (see Boar), the dentition is i, j, c, p, i; m, j; total 44; the upper incisors diminishing rapidly in size from the first to the third, and the lower incisors long, narrow, closely approximated, and almost horizontal in position, their tips inclining towards the middle line, the second slightly larger than the first, the third much smaller. The tusks or canines are strongly developed, with persistent roots and a partial enamel covering, those of the upper jaw not having the usual downward direction, but curving outwards, upwards and finally inwards, while those of the lower jaw are directed upwards and outwards with a gentle backward curve, their hinder edges working and wearing against the front edges of the upper pair. The tusks appear externally to the mouth, the form of the upper lip being modified to allow of their protrusion, but are much less developed in females than in males. The teeth of the molar series gradually increase in size and complexity from first to last, and are arranged in contiguous series, except that the first lower premolar is separated by an interval from the second. First and second upper premolars with compressed crowns and two roots; and the third and fourth with an inner lobe of the crown, and an additional pair of roots. The first and second molars have quadrate crowns, with four principal obtuse conical cusps, around which numerous accessory cusps are clustered. The crown of the third molar is nearly as long as those of the first and second together, having, in addition to the four principal lobes, a large posterior heel, composed of clustered conical cusps, and supported by additional roots. The lower molars resemble generally those of the upper jaw, but are narrower. Milk dentition: i, j, c, p, m, j; total 28—the first permanent premolar having no predecessor. The third incisor in both upper and lower jaws is large, developed before the others, with much the size, form and direction of the canine. Vertebrae: C, 7, D, 13-14, L, 6, S, 4, Ca, 20-24. The hairy covering of the body varies under different conditions of climate, but when best developed, as in the European wild boar, consists of long stiff bristles, abundant on the back and sides, and of a close softer curling undercoat.

All the typical swine are further characterized by the fact that the young are longitudinally striped with bands of dark brown and some paler tint; this striped coat disappearing in the course of a few months. On the other hand, this peculiar marking is rarely seen in domestic pigs in any part of the world, although it has been occasionally observed. It is stated by Darwin that the pigs which have run wild in Jamaica and New Granada have assumed this aboriginal character, and produce longitudinally striped young; these being the descendants of domestic animals introduced from Europe since the Spanish conquest, as before that time there were no true pigs in the New World. Another character by which the European domesticated pig differs from any of the wild species is the concave outline of the frontal region of the skull.

In the wild boar (Sus scrofa) the upper or hinder surface of the lower tusk, which has no enamel, inclines obliquely outwards and is broader than the outer surface. The distributional area of this species includes northern Africa, Europe and central and northern Asia as far as Amurland. Whether the Nubian S. senaresi is really distinct, seems doubtful. To the same group belongs the Indian S. cristatus, distinguished by the more pronounced development of the crest of long hairs on the nape of the neck, and closely related to the next species. The third species is the banded pig S. vitatus, of Sumatra, characterized by having a broad reddish or whitish band running from the middle of the snout along the upper lip to disappear on the side of the neck; the skull being short and high, with the facial portion of the lachrymal bone small. Races of this type are also met with in Java, Cochinchina and Formosa; the pig from the latter island having been named S. tibonius. Near akin is the Japanese S. leucomystax and the small Andamanese S. andamanensis. Whether the New Guinea S. populensis and S. niger are really indigenous members of this group or modified descendants of European tame pigs is doubtful; although the general character of the Papuan fauna supports the idea that they are introduced.
A second group is typified by the wary pig, S. verrucosus, of Java, in which the hinder or upper unenamelled surface of the lower tusk is narrower than the outer, concave, and set nearly in the long axis of the skull. The skull itself is elongated, with comparatively simple and primitive molars, the latter being relatively short. There are also three small warts on each side of the face, the largest of which is just below the eye and carries long bristles. The small S. celebensis of Celebes and S. philippinus are probably only varieties of this species. The bearded pig (Sus barbatus, L.) is distinguished from the preceding by the great elongation of the skull, and the presence of a tuft of long hair near the muzzle. In Sumatra it is represented by the subspecies S. b. di, and in south-west Borneo by S. b. gorgonius. Some doubt exists whether the pygmy hog of the Nepal Terai, which is not much larger than a hare, is best regarded as a member of the typical genus, under the name of Sus salaminus or as representing a genus by itself, with the title Porcula salaminia.

Similar doubts have also been entertained with regard to the African bush-pigs or river-hogs, but from geographical considerations alone these are but regarded as representing a separate genus, Potamochoerus, although they are nearly allied to the verrucosus group of Sus. They are specially distinguished by the great development of the anterior half of the zygomatic arch of the skull, and by the presence in the boars of a horny protuberance of the skin in front of each eye, which overlies a tuberosity on the nasal bone; the molars are also small and simple, and the anterior premolars are generally shed at an early stage of life. The group is represented in Madagascar, as well as in Africa south of the Sahara.

The recently discovered Hylochoerus of the equatorial forest districts of Africa comes nearest to the under-mentioned wart-hogs, but the skull is of a much less specialized type, while the upper tusks are much smaller although they have the same general curvature and direction, and the cheek-teeth lack the peculiar characteristics of those of Potamochoerus, although they present a certain approximation thereto. On the other hand, resemblance to that genus is shown by the reduction of the upper incisors to a single pair. The skin is clothed with a thick coat of coarse black hair of a bristly nature, but there are a few whitish hairs on the face and in the groin.

In the African wart-hogs (Potamochoerus), which take their name from the large wart-labs projecting from each side of the face, the teeth are remarkably modified. The molar-dentine, and even the early condition of the permanent dentition, is formed on the same general type as that of Sus, except that the cheek teeth are much smaller. The formula being 3, 3, 3, 3, 3, 3, total 34; but as age advances all the teeth have a tendency to disappear, except the canines and the posterior premolars, which are the teeth that are retained. In the lower jaw, there are only two incisors on each side, which, owing to the position of the upper incisors, are always in contact with the lower ones, and there is a continuous superficial leaf-like enamel, which is very thick, and is preserved throughout the body.

Extinct Swine.—Species of Sus are met with in Pliocene strata of Europe and Asia, the Lower Pliocene S. ermyanthus of Greece and S. giganteus and S. titan of India being enormous animals; the last with comparatively simple molars. The European S. palaeocherus and the Indian S. khyudrucus are smaller forms; the first exhibiting signs of relationship with Potamochoerus. In India also occurs Hylochoerus, a distinct species, that bears none of the characters of its molars. In the European Miocene we have Hypotherium and Palaeocherus, and in the Upper Oligocene Propalaeocherus, which have square molars without any tendency to a solenodont structure in their cusps. Curiously enough a solenodont type is, however, apparent in those of the imperfectly known Egyptian Genyictis of the Upper Eocene, the earliest species which can be included in the family. Even in the same stratum and section of some of the lower incisors is noticeable. Choeroderma is a European Oligocene genus which bears bunodont molars which show a conspicuous basal cingulum in the lower dentition; the first premolar is absent. In the European Miocene Lophodon not infrequently occurs in the Indian Tertiaries, the molars have a pair of transverse ridges, like those of the proboscidean Dinootherium (q.v.); but the genus is believed to be related to the Oligocene Dolichorhino and Choerotherium, in which these teeth show a more normal type of structure.

For the genus Eotherium, of the Lower Miocene and Upper Oligocene of both hemispheres, which is often placed next the Susidae, see Arvactyta. The American Dicotyline are noticed under Peccary.

SWINEMÜNDE—SWING, D.

SWINEMÜNDE, a port and seaside resort of Germany, is situated at the east extremity of the island of Usedom, and on the left bank of the river Swine which connects the Stettiner Haff with the Baltic. Pop. (1905), 13,272. It serves as a port of Stettin (q.v.), 42 m. distant by water, with which, as with Heringsdorf, it has direct railway connection. Its broad unpaved streets and one-storey houses built in the Dutch style give it an almost rustic appearance. although its industries, beyond some fishing, are entirely connected with its shipping. The entrance to the harbour, the best on the Prussian Baltic coast, is protected by two long breakwaters, and is strongly fortified. The grand lighthouse, 216 ft. high, rises beside the new dock on the island which, on the other side of the narrow Swine, in 1897 the river continued of the Kaiserfahrt was opened to navigation, and, further, the waterway between the Haff and the Baltic was deepened to 24 ft. in 1900-1901 and in other ways improved. The connexion between Swinemünde and Stettin is kept open in winter by ice breakers. Formerly ships of heavy burden bound for Stettin discharged or lightened their cargo at Swinemünde, but since the recent deepening of the river Oder they can proceed direct to the larger port.

The Swine, the central and shortest passage between the Stettiner Haff and the Baltic Sea, was formerly flanked by the fishing villages of West and East Swine. Towards the beginning of last century it was made navigable for large ships, and Swinemünde, which was founded on the site of West Swine in 1748, was fortiﬁed and raised to the dignity of a town by Frederick the Great in 1755.

See Wittenberg, Swinemünde, Ahlbech and Heringsdorf (Linz, 1893).

SWING, DAVID (1830-1894), American clergyman, was born of Alsatian stock in Cincinnati, Ohio, on the 23rd of August 1830. He spent most of his boyhood on a farm and earned his schooling; graduated at Miami University in 1852; studied theology at Lane Seminary; and was principal of the preparatory school at Miami in 1853-1866. He became pastor in 1866 of the Westminster Presbyterian Church (after 1868 the Fourth Church) in Chicago, which was destroyed in the fire of 1871; he then preached in McVicker's theatre until 1874, when a new building was completed. In April 1874 he was tried before the presbytery of Chicago on charges of heresy preferred by Dr Francis Landey Patton, who argued that Professor Swing preached that men were saved by works, that he held a "mod ald" Trinity, that he did not believe in the necessity of any saving religion or order of worship (see Unitarianism, &c.), and that he countenanced Unitarianism, &c. The presbytery acquitted Dr Swing, who resigned from the presbytery when he learned that the case was to be appealed to the synod. As an action was taken against the church, of which he had remained pastor, he resigned the pastorate, again leased McVicker's theatre (and after 1880 leased Central Music Hall, which was built for the purpose), and in 1875 founded the Central Church, to which many of his former parishioners followed him, in which he

See Wittenberg, Swinemünde, Ahlbech and Heringsdorf (Linz, 1893).
SWINTON—SWITZERLAND

built up a large Sunday school, and established a kindergarten, industrial schools, and other important charities. He died in Chicago on the 3rd of October 1894. He was an excellent preacher, but no theologian. He published Sermons (1874), including most of his “heretical” utterances, Truths for To-day (2 vols., 1874-1876), Motives of Life (1875), and Club Essays (1881).

SWINTON, Joseph F. Newton, David Swing, Poet-Preacher (Chicago, 1909).

SWINTON AND PENDLEBURY, an urban district in the Eccles parliamentary division of Lancashire, England, 5 m. N.W. of Manchester, with stations on the Lancashire & Yorkshire railway. Pop. (1901), 27,695. The church of St Peter, a fine building of stone with a lofty western tower, was erected from the designs of Sir Gilbert Scott in 1865. The Swinton industrial schools, opened in February 1846, are a fine range of tidings of the West, the kitchen ranges), and earthenware manufactures. The town was formerly renowned for its Rockingham ware. A free warren was granted to Swinton by Henry II.

SWITCHBACK, a form of pleasure railway, built over alternate descents and ascents, the train or car first gathering momentum by running down a incline, and surmounting by means of this a lesser ascent. Switchbacks were originally merely an imitation, using cars upon wheels, of the sledge-coasting courses of Russia, and were indeed named by the French montagnes russes. They were introduced in Paris in 1816, but soon disappeared in consequence of several serious accidents. About 1880 they again became popular both in Europe and America. A variation of the switchback, though lacking its essential principle of climbing by means of momentum, is the water-chute, an imitation of the Canadian toboggan-slide, in which cars built in the shape of boats glide down steep inclines into artificial lakes at their bases. This is popularly called “shooting the chutes.” A further variation is “looping the loop,” in which a heavy car on wheels, or a bicycle, starting at a considerable altitude, descends an incline so steep that sufficient momentum is accumulated to carry it completely round a track in the form of a perpendicular loop, in the course of which journey the occupants or rider, while crossing the top of the loop, are actually head downwards. Later it was made even more dangerous by taking out part of the top of the loop, so that the car or bicycle actually passes through the air across the gap.

SWITCH PLANTS, a botanical term for plants, such as broom, with leaves very small or absent, and slender green shoots.

SWITHIN (or Swithin), ST (d. 862), bishop of Winchester and also the saint of Winchester Cathedral from the 10th to the 16th century. He is scarcely mentioned in any document of his own time. His death is entered in the Anglo-Saxon Chronicle under the year 862; and his signature is appended to several charters in Elmore’s Codex diplomaticus. Of these charters three belong to 833, 838, 860-862. In the first the saint signs as “Swithinus presbyter regis Egberti,” in the second as “Swithinus diaconus,” and in the third as “Swithinus episcopus.” Hence if the second charter be genuine the first must be spurious, and is so marked in Elmore. More than a hundred years later, when Dunstan and Ethelwold of Winchester were inaugurating their church reform, St Swithun was adopted as patron of the restored church at Winchester, formerly dedicated to St Peter and St Paul. His body was transferred from its almost forgotten grave to Ethelwold’s new basilica on the 15th of July 971, and according to contemporary writers, numerous miracles preceded and followed the translation.

The revival of St Swithun’s fame gave rise to a mass of legendary literature. The so-called Vita Swithuni of Lanfranc and Wulstan, written A.D. 1080, contains a fragment of the Life; and all that has in later years passed for authentic detail of St Swithun’s life is extracted from a biography ascribed to Gotzelin, a monk whose name occurs amongst the disciples of the bishop of Swithun from 1058 to 1078. From this writer, who has perhaps preserved some fragments of genuine tradition, we learn that St Swithun was born in the reign of Egbert, and was ordained priest by Ethelbert, bishop of Winchester, and became a hermit in the king’s woods, which he afterwards enclosed in a garden, and finally became the abbot and founder of the monastic houses which subsequently took its name. He seems to have been a learned and holy man, and was one of the first monks to be consecrated by Archbishop Ceolnoth. In his new office he was remarkable for his piety and zeal in building new churches or restoring old ones. At his request Ethelwulf gave the tenth of his royal lands to the Church. His humility was such that he made his diocesan journeys on foot; and when he gave a banquet he invited the poor and not the rich. He built near the eastern gateway of his cathedral city a bridge whose stone arches were so strongly connected together that, according to Ethelwulf, bishop of Swithun, they are a fine range of cataracts; and he marked the stone facing of the bridge with his name. He was buried in his cathedral, and his tomb was visited by multitudes 287; and Ethelwulf commemorated him as the patron of Winchester, appointing a bishop of that see. He retired to the hermitage in the grounds of his cathedral, and was the first Englishman who built himself a monastery.

SWITZERLAND, a republic of central Europe, comprising the Swiss Confederation, and bounded N. by the
German Empire, E. by Austria (except where the principality of Liechtenstein intervenes), S. by Italy, and W. by France.

Physical Description.—Switzerland extends between the parallels 43° 49' 2" and 47° 48' 32" lat. (Greenwich) and the meridians 5° 57' 26" and 10° 29' 40" long. (Greenwich). It forms an irregular quadrilateral, of which the greatest length from east to west is 226 m., and the greatest breadth from north to south is nearly 137 m. (136°). It has, however, no proper physical unity, as it consists of a number of small districts, differing from each other widely in language, religion, ethnology, customs, &c., but bound together in a political alliance, made originally for common defence against a common foe. It is therefore an artificial land, just as its inhabitants form an artificial nation, though nowadays it is becoming more homogeneous in both respects. Its political boundaries thus do not coincide with those of nature. The entire canton of Ticino is south of the Alps, as are the valleys of Simplon (Valais), Mesocco, Bregaglia, Poschiavo and Münster (all in the Grisons); the whole canton of Schaffhausen and part of that of Basel are north of the Rhine, while a large part of the Grisons lies to the east of the Rhine basin, and Porrentruy is far down on the western slope of the Jura. But it is to be noted that all these exceptional cases were outside the limits of the Swiss Confederation up to 1798. Putting them aside, the physical geography of Switzerland may thus be described—

1. On the south runs the main chain of the Alps (q.v.), which is joined, at the Mont Dolent (12,553 ft.) in the chain of Mont Blanc, by the lower ranges that rise south of the Lake of Geneva, and which continues partly Swiss till close to the Stelvio Pass on the east.
2. To the north of this main chain there is another great range of mountains (wholly Swiss) only slightly inferior in extent and height, which starts from the hills known as the Jorat range above Lausanne, and culminates in the great snowy summits of the Bernese Oberland and of the Tödi group, before trending to the north near Coire, and, after rising once more in the Säntis group, dies away on the southern shore of the Lake of Constance.

3. The Swiss portion of the main chain of the Alps and this great northern outlier run parallel to each other from the Mont Dolent to near Coire, while for a short distance they actually unite near the Pizzo Rotondo (west of the St Gotthard Pass), parting again near the Oberalp Pass (east of the St Gotthard). Between these two great snowclad ranges flow two of the mightiest European rivers, the Rhine towards the west and the Rhone towards the east, their headwaters being only separated by the tangled mountain mass between the Pizzo Rotondo and the Oberalp Pass, which sends the Reuss towards the north and the Ticino towards the south.
4. To the north of this great northern outlier rises the Jura range (q.v.), really a huge spur of the Alps (with which it is connected by the Jorat range), while between the northern outlier and the Jura extends what may be called the plains or "plateaux" of Switzerland, consisting all but wholly of the undulating valley of the Aar (below Thun) with its numerous affluents. To that river valley we must add the valley of the Thur (a direct affluent of the Rhine), that lies between the Aar basin and the Rhine basin (the Lake of Constance).

We may thus roughly describe Switzerland (as it exists at the present time) as consisting of three great river valleys (Rhône, Rhine and Aar) with the smaller one of the Thur, which all lie to the north of the main chain of the Alps and include the region between the Alps and the Jura. If we examine matters more carefully we note that the Rhône and Rhine valleys are shut off from that of the Aar (and, of course, of the Thur) by the great northern outlier of the Alps, which consists of the Bernese Oberland and Tödi Alps. Two wide and undulating valleys (Aar and Thur) and two deep cut trenches (Rhône and Rhine) thus lie on the northern slope of the Alps, to the north and south respectively of the great northern outlier of the Alps. The main chain of the Alps rises in Swiss territory to the height of 15,217 ft. in the loftiest summit or DuFourspitze (wholly Swiss) of Monte Rosa, though the Dom (14,942 ft.), in the Mischabel range, between Zermatt and Saas, is the highest mountain mass which is entirely Swiss. The great northern outlier attains a height of 14,026 ft. in the Finsteraarhorn (Bernese Oberland), while the lowest level (58 ft.) within the Confederation is on the Lago Maggiore. The highest
permanently inhabited village in Switzerland is Jul (699 ft.), at the head of the Avers valley (a tributary of the Hinter Rhine, Grisons), while the lowest is Ascona (666 ft.), on the Lago Maggiore and just southwest of Locarno.

According to the most recent calculations, the total area of Switzerland is 55,551 sq. m. (some 2,500 sq. m. less than that of Sweden). Of this 11,027-5 sq. m. (20.4%) are reckoned as "productive," forests occupying 3,990-9 sq. m. and vineyards 108.7 sq. m., the remainder, or 8,427.7 sq. m., consisting of arable and pasture land. Of the "unproductive" area of 4023.5 sq. m. (25.2%) much consists of lakes and rivers, while glaciers cover 709.7 sq. m. Approximately the Alps occupy one-sixth of this area, the Jura about one-tenth, and the "platen" the rest. Of the entire area the great cantons of the Grisons, Bern and the Valais take up 7411.8 sq. m., or nearly one-half, while if to them be added Vaud, Ticino and St Gall the extent of these six out of twenty-two cantons is 10,537.6 sq. m., or almost two-thirds of the area of the Confederation.

Not included in the total area of Switzerland are three small "enclaves" (4 sq. m. in all), Büsingen and Verenahof (both in Schaffhausen) belonging to Baden, while Campione (opposite Lugano) is Italian. Switzerland borders on many countries—France west and south-west, Italy south, Austria east (Tirol and Vorarlberg), and Germany north (Bavaria, Württemberg, Baden and Alsace). Switzerland sends its waters to four great river basins (which drain to three different seas). In the following proportions: Rhine basin, 11,159 sq. m.; Rhone basin, 2768.8 sq.; Po basin, 1561.5 sq.; and Inn basin, 663 sq. m.

The thirteen cantons which till 1798 formed the Confederation are all comprised in the Rhine basin, the ten oldest (i.e. before 1490) having still that character, while the three youngest (the Treviso, the Milanese and the Ticino) include each other, as it were, at the southwest and north-east corners of the land. But neither of these is wholly Swiss, this distinction being claimed by the next in size, that of Neuchâtel (924 sq. m.). In the Swiss Cantons of the west, the mountains are being followed by the wholly Swiss lakes of Lucerne and of Zürich. Then come Lugano, Thou, Bienne, Zug, Brienz, Morat, the Walensee, and Glarus (316 sq. m.). The Cheran basin (218 sq. m.) is in extent. Eleven of them are in the Rhine basin (also in that of the Aar), two (Maggiore and Lugano) in that of the Po, and one (Geneva) in that of the Rhone. There are no large lakes in the Swiss portion of the Inn basin, the most extensive being that of Siles (41 sq. m.). Of the smaller lakes those best known to travellers are the Daubensee (near the summit of the Gümmer), the Oeschinensee (at the foot of the Bünland Alp range) and the Mänerlence, formed by the damming up of the waters of the Great Aletsch glacier by a huge lateral moraine. Alpine tarns are innumerable.

Of the countless waterfalls in Switzerland those of the Rhine (most northern outlier) are the only really remarkable, where the case is in varying degrees with those of the Aar at the Handegg, of the Reichenbach, of Pisseevache, and particularly of the Staubbach, a mere thread of water falling clear of a cliff of great height.

The snow-clad Alps of Switzerland are really impossible to estimate the number accurately, as practically all are now in retreat, and it is not easy to say whether an isolated fragment of ice is or is not entitled to rank as an independent glacier. "Proper" glaciers are considered as such when they have a lateral extent of eighty yards, or more, and a height of fifty feet, or more, above the bed of the valley. Yet their distribution is very unequal, for eleven cantons (just one-half of the Confederation) have none. The Valais heads the list with 77-3, while the Grisons has 25, and the Uri (44.3), Glarus (15.9) and Ticino (13.1). The five others (Unterwalden, Vaud, St Gall, Schwyz and Appenzell) boast of 13-3 all together. The three longest glaciers in the Alps are all in the greatest canton (Bern): the Glarus (164 m.), the Fiescher and the Unteraar (each 10 m.). In the main chain the Gorner (91 m.) is the longest. Of glaciers covering an area of over 6 sq. m. no fewer than 17 are in Switzerland, as against two each in the French portion of the chain of Mont Blanc and in the Eastern Alps.

Covering 21.2% (3390-99 sq. m.) of the total area of Switzerland. Of the six most extensive cantons five are also at the head in the matter of forests: Bern (594 sq. m.), the Grisons (503), Vaud (320), the Valais (297.4) and Ticino (267.2). St Gall (157) cut a like respectable figure. The only other cantons with over 100 sq. m. are Lucerne (120.4), Fribourg (119) and Soleure (111.3), the lowest place being taken by Basle (4.9). The timber growing area belongs to the communities or private corporations, while 28.3% is in the hands of private individuals (much of this having become private property in the time of Napoleon I.), but only 4.5% is included in the property of the forest corporations of many monasteries. The cantons own 94.3% of the forest area in the Valais, private individuals 78.8% in Lucerne, and the state 9.7% in the Schaffhausen. The great cantons and the Jura cantons are the most wooded in proportion to their area, while at the other end of the scale are the towns of Geneva and Basel, and the barren canton of Uri. The great floods of 1832, 1852 and 1868 drew attention to the negligent administration of the forests, considered specially as a protection against damage due to the forces of nature. A forestry department was created in the polytechnic school in Zürich when it was opened in 1855. The Federal Constitution of 1841 (art. 24) handed over to the Confederation the oversight of the forests "in the high mountains," this being interpreted to mean the Alps with their spurs, but not to include the Jura, and a law of 1874 has regulated the action of the cantons in respect of the woods. During this period the efforts of the cantons, to reforest districts where the trees had been recklessly cut down, and to ensure the proper administration of forests generally.

The greater part of Switzerland is occupied by the belts of folded rock which constitute the Alps and the Jura (q.v.). The central plain, however, is covered by nearly undisturbed deposits (pleistocene and glossose), which have been laid down, so to speak, by the glaciers and have been the subject of further deposition by glacial, alluvial and other accumulations of later date. Both the Oligocene and the Miocene beds are, for the most part, of fresh-water or brackish-water origin, but the middle of the Miocene series (between marls and sandstones) is believed to have included, when the Alps were covered by the sea. When these formations were worn down the glaciers of the Mediterranean spread up the valley of the Rhone. It reached its maximum extension during the middle portion of theertiary period, when it appears to have stretched continuously along the outer Alps from the Adriatic to the Swiss territory, while in Italian Switzerland winter lasts only three months, at Glarus (1578 ft.) it lasts four, in the Engadine (9945 to 4360 ft.) six, on the St Gotthard (6956 ft.) eight, on the Great St Bernard (8111 ft.) nine, while on the St Beatus (6966 ft.) it lasts eleven months. The highest mean annual temperature (53°F.) in Switzerland is naturally that at Lugano (900 ft.), while at Bevers (6510 ft.), Upper Engadine 55°F., or 13°F. and at Zermatt 50°F. While the highest in summer is 77°F., an immense difference. At Montreux the annual mean is 50°F., at Sion, Basel, Geneva and Coire about 49°F., at Zürich 48°F., at Bern and Lucerne 47.5°F., at St Gall 45°F., at Davos 37-5°F., at Sils Maria 34.5°F. and on the Great St Bernard 29°F. Of course many factors, such as the shape of the ground, the sheltered position of the place, the degree of exposure to sunshine, counterbalance the mere height at which the town is situated.

The snow-clad Alps of course have the heaviest rain or snow-fall in Switzerland, this being estimated at 89-7 in. per annum. The greatest fall is at Davos Pass (6765 ft.), while the lowest (21-7 in.) was at Sierre (1767 ft.). At Lugano the average annual rainfall is 65-4 in., on the Great St Bernard 48-7 in., at Lucerne 45-6 in., at Montreux 42-6 in., at St Gall 37 in., at Davos 37-5 in., at Sils Maria 34-5 in., and on the Great St Bernard 29-7 in. Of course many factors, such as the shape of the ground, the sheltered position of the place, the degree of exposure to sunshine, counterbalance the mere height at which the town is situated.
Aar valleys are very fertile, the two great trenches between the main chain and its north outlier, though warm, are less productive, as the water comes from the rivers and not from the skies.

People.—The first estimate of the population of Switzerland with any pretence to accuracy was that of 1817, which put the number at 1,687,900. The first regular census took place in 1836 to 1838, but was therefore not synchronous, while it was also not very systematic—the number was put at 2,190,926. That of 1850 was better organized, while in 1860 the census was really conducted and had the result that of 1888 for practical reasons. The following was the number of the population usually resident (the number of those actually present was also taken, but all detailed subdivisions refer only to the residents): in 1850, 2,302,740; in 1860, 2,510,404; in 1870, 2,655,001; in 1880, 2,831,787; in 1888, 2,917,754; and in 1900, 3,315,443. The density per square mile was as follows: 150 in 1850; 157 in 1860; 150 in 1870; 177 in 1850; 152 in 1888; and 207 in 1900. The increase in the whole of the country from 1850 to 1900 was 39%. Thirteen cantons showed an increase greater than this average, the rest being moderate. In Bern the increase of the towns did not counterbalance the diminution in the country districts. The nine counties which increased above the average rate did so either owing to special circumstances (e.g. the construction of the Simplon railway in the Valais), or because their industries were very flourishing (e.g. St Gall), or because they contain great towns (e.g. Zürich). The highest rates of increase were shown by Geneva (107% increase) and the half canton of Urban Basel (278% increase). As to the actual distribution of the population, the Alpine regions are the sparest generally (with the exception of the Outer Rhone valley, that of the Jura is a vast region in which a high ratio, while the densest region of all is the Swiss plateau. The strong attraction of the towns is shown by the facts that between 1850 and 1900 the population of the nineteenth nearly tripled, while in 1900, of the 187 "political districts" in Switzerland 41 showed a decrease, and they were all exclusively rural.

The shifting of the population within the country is also proved when we note that in 1850 but 36.5% of the Swiss citizens inhabited their commune of birth, though the proportion was 64% in 1850. If we consider the different cantons, we find that in 1850, 59.7% in 1850 but 26.4% lived in another commune within their canton of birth, while 18.4% (as against 6.6% in 1850) dwelt in a canton other than their canton of birth. To sum up, in 1850, out of the 25 cantons, 12 remained republican and 18 had a majority of citizens living in their commune of birth, while in 1900 the number was but 11, and those all rural cantons. Of the 3164 communes (or civil parish) in the Basel, 1827 had a majority of citizens, while 3862,000, while 20 had under 50 inhabitants. If we look at the height of the communes above the sea-level, we find that there were but 3 (with a population of 465 souls) above 1900 metres (2986 ft) and 132 below 200 metres (656 ft). The communes enclosed by a perimeter of 1000 metres (3280 ft) and 300 metres (984 ft). The number of inhabited houses rose from 347,327 in 1850 (the number was not taken in 1850) to 434,084 in 1900, while that of separate households mounted from 485,087 in 1850 (328,105 in 1860) to 572,920 in 1900. The non-Swiss element of the population increased from 3% in 1850 to 11% in 1900, and its number from 71,570 in 1850 to 383,424 in 1900. The first two are the most numerous, next in order are Italians, French, and Austrians. In 1900 there were 3,535 British resident in Switzerland, and 1,595 citizens of the United States. Of course most of the non-Swiss are found in the cantons or in rural districts where any great railway line is being constructed.

The emigration of Swiss beyond seas was but 1691 in 1877, though it rose in 1883 to 15,802 (the maximum as yet attained). Then the number retired still to 1,303, and 1,305 respectively, but the Jews increased from 3% in 1850 to 4% in 1900—the remainder (other religions or none) being 2% in 1860 (not reckoned separately in 1850) and in 1900. Ten and a half cantons had a majority of Protestants, whereas the "Catholics" have the upper hand. The same proportion prevailed in 1850, save that then Geneva had a Protestant majority, whereas in 1870 already the balance had shifted, owing to the number of immigrants from France and Italy.

As to languages habitually spoken, Switzerland presents a very varied picture. The Federal Constitution of 1848 (art. 106) and 1874 (art. 116), German, French and Italian are recognized as "national languages," so that debates in the Federal parliament are held almost equally in all three. The use of French is, of course, limited to the departments founded for the "French" population, and are not even in the majority (which is German) in the Grisons. Of the other 21 cantons, all have a German-speaking majority except Fribourg, Vaud, the Valais, Neuchâtel and Geneva, and Italian in Ticino. Since the census of 1860, when detailed inquiries as to language were made for the first time, there has been a certain amount of shifting, as is shown by the following figures (as in 1875 and 1893, while 55.7 for 1906): 71.4 in 1888 and by 69 8-9 in 1900; the figures for French are respectively 21.4, 21.8 and 22, and for Italian 5.7, 5.3 and 6.7; while Romonch fell from 1.4 to 1.2 and 1.2%. Other languages were 2, 2 and 3%. Thus in 1900 there were nearly 70% of German-speaking persons, as against nearly 30% who spoke one or other of the Romance tongues. The most interesting cases are the cantons of Fribourg (g.) and the Valais (g.), in which French is advancing at the expense of German.

Chief Political Divisions and Towns.—When considering Switzerland it must never be forgotten that, strictly speaking, the only political "divisions" are the 187 "districts" into which the cantons are divided (Bern has 30, Vaud 19 and St Gall 15, no others having over 15) These are administrative districts, created for political purposes. The cantons themselves are not "divisions" but sovereign states, which have formed an alliance for certain purposes, while they are built up out of the 3164 "communes," which are really the political units. Of these, the 310 canton-wise divided—130 from Bern into Obwalden and Nidwalden, and Appenzell (since 1597) into the Outer Rhones and the Inner Rhones, while Basel (since 1853) forms urban Basel (the city) and rural Basel (the country districts). The Swiss political capital is Bern (by virtue of a Federal law of 1848), while the Federal Supreme Tribunal is (since its foundation in 1874) at Lausanne, and the Federal Polytechnic School (since it was opened in 1855) at Zürich.

In 1900 there were 19 towns in Switzerland which had a population exceeding 10,000 souls, all having increased very much within the 50 previous years. The following are the six largest, the figures for 1850 being enclosed within brackets: Zürich, 150,703 (35,483); Basel, 109,161 (27,844); Geneva, 104,795 (23,127); Bern, 64,227 and 18,902; Lausanne, 49,903 (17,103), and La Chaux de Fonds, 35,965 (15,650). Thus Geneva was first in 1850, but only third in 1900. Thirteen of these nineteen towns are cantonal capitals, though La Chaux de Fonds, Winterthur, Biennar, Tubus (practically a city within the canton of Zurich), Derno-Gall, and the two states of Vaud, have the same status. Twelve cantonal capitals (Sion, Bellinzona, Aarau, Altford, Schwyz, Frauenfeld, Glarus, Lertal, Sarnen, Stans, Appenzell and Zug) are also towns of 10,000 souls. Some of these, though over 10,000 inhabitants had in 1850 a population of 355,722, that number had swollen in 1900 to 747,205.

Communications.—The carriage roads of Switzerland were much improved and increased in number after a strong Federal government was set up in 1848, for it largely subsidized cantonal undertakings. In the course of the 19th century many splendid roads were carried over the Alpine passes, whether within or leading from Swiss territory; in the latter case within the canton of Glarus and from the Austrian State ( chiefly the Milanese). The earliest in date was that over the Simplon (1800-1857), while others were opened respectively over the Furka (7992 ft.) in 1867, to the top of the Great St Bernard (8111 ft.) in 1853, over the Grimsel (7100 ft.) in 1853, and over the Klausen Pass (6404 ft.) in 1900. The highest carriage road entirely within Switzerland is that over the Umbrail Pass (8242 ft.), opened in 1901, and leading from the Swiss upper Münter valley to close to the Stelvio.

The first Swiss lake over which a steamer plied regularly was that of Geneva (1823), followed by Constance (1824), Lago Maggiore (1826), Neuchâtel (1827), Thun (1835), Lucerne (1835), and

The cantons are—Aargau, Appenzell, Basel, Bern, Fribourg, Geneva, Glarus, Graubunden, Lucerne, Obwalden, Payerne, Schaffhausen, Schwyz, Solucore, Thurgau, Ticino, Unterwalden, Uri, Vaud, Zürich (see separate articles).
SWITZERLAND

Industries.—a. Of the Land. If we look at the annual turnover through the near-by railway, the pleasant and seductive entertainment of foreign visitors, for its gross receipts are larger than those of any other branch. It appears from the official statistics that in 1905 its gross receipts amounted to rather over £7,500,000 (as against about £5,000,000 in 1890 and rather over £2,000,000 in 1880), the net profit being nearly £1,500,000 (as against £659,000 and nearly £300,000 respectively), while in 1905 the capital invested in railways was nearly £12,000,000 (as against £7,000,000, £12,750,000 respectively). In 1905 there were in Switzerland 1924 hotels (of which 402 were in Bern and 358 in the Grisons) specially built for the accommodation of foreign visitors, containing 12,000 bedrooms and 35,000 beds. In 1894 and 1890 are 1905 and 1906 occupied in the tourist houses for 68,534 and 58,137, and 23,997 and 16,022 respectively). Part of this increase is due to the fashion of going to a better location for their holidays, tourism, skiing and camping. Of the actual productive soil about two-thirds is devoted to arable or pasture purposes, but the latter branch is by far the more important, occupying about 83% of this two-thirds, for Switzerland is much more a pastoral than an agricultural country. In 1906 the number of cattle was officially put at 1,497,904 (as against 1,349,375 in 1901 and 993,291 in 1866). In summer they are supported on the numerous mountain pastures or pastures, which are mostly level and capable of being estimated capital value of rather over £3,000,000, while in winter they are fed on the hay mow on the lower meadows or purchased from the lord of the manor. Meat and dairy foods are sold in Switzerland, the dun race (best represented by the cattle of Schwyz) and the dappled race (of which the Simme valley beasts are the red and white kind, and those of the Gruyère the black and white varietal), but to this breed is added the East Frisian of the Gruyère, while the two principal condensed milk factories (Nestlé at Vevey and that at Cham) are now united. It should be noted that the proportion of the land devoted to pastoral purposes increases, like the rainfall, from the west and north-west to the east and north-east, so that it is highest (near 90%) in Appenzell and St Gall. As regards other domestic animals, the number of swine increased from 304,428 in 1886 to 556,474 in 1896 (the maximum recorded), but in 1906 fell to 548,355. The number of goats has remained pretty steady (350,913 in 1906 to 375,482 in 1886, the maximum, 416,323, being attained in 1886), but that of sheep has decreased, falling from 2,001,443 in 1886 to 1,965,787 in 1906. It is stated that but 14% of the productive area of Switzerland is corn-growing, this proportion being rather doubled in Vaud. Hence for its food the country is largely dependent on its imports, the home supply sufficing for 153,761,231 of which 20%, mainly sugar from Brazil, are procured from abroad. Corn is grown to a certain extent, especially near Payenre in the Broye valley (Vaud) and in Ticino, while more recently beetroot has been cultivated, for the manufacture of molasses and sugar. The district of the vineyards and vineyard wines, vegetables are made into jams and concentrated foods at Lenzburg and Kemptthal, while hirschenstücker (cherry brandy) is made in Zug. Vineyards cover about 28% of the productive area of Switzerland. There are more than 2,063 vineyards and 110,000,000 bottles manufactured. Vineyards in Switzerland now cover 108,741 m. sq., though the area is steadily decreasing owing to the competition of foreign cheap wines. The total production, which has been rather constant for a long time, was valued at £21,370,000 in 1906, 9,750,000 in 1905. Among the best Swiss wines are those of La Côte, Lavaux and Yvorne (all in Vaud), and Muscat, Fenand and Vin du Glacier (all in the Valais). Those grown near Neuchâtel, at the northern end of the lake of Zürich, near Baden (Aargau), and along the Swiss bank of the Rhine, are much esteemed. The value of raw mineral products of Switzerland the most important is asphalt, which is worked by an English company in the Val de Travers (Neuchâtel). Various minerals (even including gold and copper) are worked in Switzerland, the best known are Lenzburg (Delémont), copper (Val d'Anniviers) and argentiferous lead (Lötschberg). True coal is wholly absent, but lignites occur here and there, and are sometimes worked (e.g. at Käppach, Zürich). An early industry on the limestone deposits in the Neuchâtel Salt in first found at Bex (Vaud) in 1544, and the mines are still worked. But far more important are the saline deposits along the shores of Lake Geneva and near Bischofszell, the one being the famous Aar, which were discovered at Schweizerhalle in the year 1836, at Kaiseraugut in 1844, at Rheinfelden in 1845 and at Ryburg in 1848. Marble, sandstone and granite are worked in various spots and are mainly used for the ornamentation of churches and public buildings, and are much used for the manufacture of various kinds of cement. There are said to be 620 mineral springs in Switzerland, the best known being those at Baden (Aargau) and at Schinzach (both sulphur), Schutz-Tann and St Moritz. Laugh-bath, Reussberg, Pfäfers, Leukerbad and Weissenburg. The most important slate quarries are those in the canton of Glarus. The relative importance of the different industries concerned with the land, is derived from the census taken in 1900 as to the occupations of the inhabitants. No fewer than 1,035,010 (about one-third of the total population) were engaged in pastoral or agricultural pursuits, as against 19,334 engaged in the carving of stone. The most important markets are those of the forests, 12,735 in the vineyards and 12,323 in extracting minerals (of these 8004 were employed in stone or marble quarries). b. Manufactures.—The same census also shows the relative importance of the various manufactures. This is calculated from the number of registered persons employed in each line of business. In the textile industries 270,114 (of which 88,457 were in the silk branch and 63,853 in that of cotton), watchmaking 115,617, embroidery 89,558, besides 74,148 engaged in the manufacture of machinery. The most important industries are the spinning, weaving and spinning of cotton, watchmaking and some minor industries are carried on in the textile industries. The textile industries are by far the most important in Switzerland, almost 20% of the population being engaged in them. This branch (this branch was revived by the Protestants exiles from Italy in the 16th century) and cotton, while St Gall, Appenzell and Thurgau are mainly devoted to embroidery, and the silk branch and the embroidery industry were extensively engaged and cutaneous and machine tools. The industry was first established in Geneva since the end of the 16th century, and spread in the early 18th century to the Neuchâtel portion of the Jura (centre La Chaux-de-Fonds and Le Locle), which were chiefly made at St Croix in the Vaud section of the Jura, while Geneva was, for its jewelry and goldsmiths' work. The growth of the manufacture of machines is much more recent, having originally been a mere adjunct of the textile industry, and the development is due to the increasing demand of England. Its centres are in and around Zürich, Winterthur, St Gall and Basel. Among other products and industries are chocolate (Suchard, Cailler, Sprüngli, etc.), soap, rubber goods, milk products, harness and saddles, machine tools, watches and other watchmaker's industry, and chemical industry. There are some 132,000 persons engaged in commerce. The general increase of the trade is from 1848, customs duties within the land were abolished, while moderate duties only were levied on imports, the sum increasing as the articles came more or less within the category of luxuries, but being lowest on necessaries of life. Down to 1870 Switzerland was all but entirely on the side of free trade. Since that time it has been becoming more and more protectionist. This change was due in part to the increased tariffs levied in Germany and France, and in part to the strong pressure exerted by certain branches of the Swiss manufacturing industries, while treaties of commercial preference have been made with divers countries. Hence in 1903 the number of people engaged in commerce fell to 57,850,000—other words, the unfavourable balance of trade had increased from 10,000,000 in 1895 to 16,250,000 in 1905. The increase during the same period in the case of the four great articles of export (cotton, wool, silk and iron) was from £2,530,000 to £8,500,000 to rather over £10,000,000, embrodiery from nearly £3,000,000 to £5,000,000, watches from £1,500,000 to £5,250,000, and machinery from rather £1,000,000 to £2,500,000.
Abbreviations:

Aig. Auguillle, Aors, Aurer; B. Berg, Burg, b.jpg
bo, bro, brunnen; C, Col, Ceu, Canal, C. Cine, Chap,
Chapel; D, Pont, St, Haute, Col, Grund, Ge, Greze;
H, Alpe, b. harn, Meier, Messieurs, Mon, hovel, ham, belin;
Bl, Bitter; M, Monde, J. Jord, b. horf, b. horf, M. hren,
M. Mt. Mont, Montc, M. Mlneisen, A. Nieder, ob, Over, j.
Sp, Spiter, et, stock, Sout, Stadlen, St. Margreth, St. Margre-
then, th, thl, tol; E. Unt, Unten; Humble m. n. sometimes
written thus. M. n.
Government.—The Swiss Confederation must be carefully distinguished from the 22 cantons of which it is composed, and which are sovereign states, save in so far as they have given up their rights to the Federal government. These cantons themselves are built up of many political communes, or Gemeinden, or civil parishes, which are the real political units of the country (and not merely local subdivisions); for any one desiring to become naturalized a Swiss must first become (by purchase or grant) a member of a commune, and then, if his burgershript of the commune is confirmed by the cantonal authorities, he obtains also, simultaneously, both cantonal and Federal citizenship.

a. Now in Switzerland there are 3164 political communes (municipalités ou Einwohnergemeinden). These are composed of the areas situated over which the canton recognizes a peculiar character and resident in the commune for at least three months. The meeting of these persons is called the assemblée générale or Gemeindeversammlung, while the executive council chosen by it is the conseil municipal or Gemeinderat, the chief person in the commune (elected by the larger meeting) being termed the syndic or maire, the Gemeindepräsident or the Gemeindeammann. This kind of commune includes all Swiss residents (hence the German name) within its territorial limits, and has practically all powers of management of local affairs, including the carrying out of cantonal and Federal laws or decrees, save and except matters concerning the jurisdiction devolved on the Federal government.

This class of commune dates only from the time of the Helvetic republic (1798–1802), and its duties were largely increased after the liberal movement of 1830; the care of the highways, the police, the schools, the administration of the poor law being successively handed over to it, so that it became a political body. As regards Swiss citizens belonging to cantons other than that in which they reside, the Federal Constitution of 1848 (art. 41) gave them rights of voting there in cantonal and Federal matters, but not in those relating exclusively to the commune itself. This provision was revoked by the people in 1874, and cantons have to choose one of three solutions to enforce this principle; as those named above (établis ou Niedergelasenen—that is, permanent settlers) all voting rights, cantonal and communal (save as below), the two last named after a stay of three months. Temporary residents being Swiss citizens (e.g. labourers, servants, students, officials not being communal officials) are called résidents or Aufenthalter, and are in most cantons considered to be as such incapable of voting in communal matters until after a residence of three months, though some cantons require a longer sojourn. Foreign residents are included under this class of Aufenthalter.

Communes bourgeoises or Bürgergemeinden, now principally of historical interest, having for the most part gradually merged with the other class of communes, were originally simply the communities that dealt with the management of the "fiefs" or the "manor," perhaps usus agrorum (the old Burgergemeinden (the burghers of which only have rights of user over the common lands) was very delicate, and has been settled (if settled at all) in various fashions. In some cases the older communes simply merged with the newer, the ownership of the common lands thus passing from one to the other class. In other cases the Bürgergemeinden still exist as distinct from the "political communes," but solely for purposes (enjoyment, management, &c.) relating to the common lands, and thus form a sort of privileged community inside the larger and now more generally important community. In some cases the common lands have been divided in varying proportions between the two classes of communes, the Bürgergemeinden thus continuing to exist solely as regards that part of the common lands which they have retained. In other cases the common lands, whether before or after the reforms of 1802, passed to the possession of the burghers, who form a close corporation, the revenues of which are enjoyed by the members as such, and not as citizens—in short are subject to no public obligations or burdens save rates and taxes.

b. The twenty-two cantons (three are subdivided—Unterwalden, Appenzell and Basel—into two halves) are divided into "administrative districts" (18 in number), which are ruled by prefects, in the French fashion, appointed by the cantonal authorities. These are the true local divisions in the country. Each canton has its own legislature, executive and judiciary. The older cantons have in some cases (Uri, Unterwalden, Appenzell and Glarus) preserved their ancient democratic assemblies (or Landesgemeinden), in which each burgher appears in person, and which usually meet once a year, on the last Sunday in April or the first Sunday in May, always (weather permitting) in the open air. These annual assemblies elect annually a sort of standing committee, and also the chief magistrate or Landammann, as well as the judiciary. In the other eighteen cantons the legislative body (Grande or general council) is composed of representatives chosen by the canton, voting by population, varying in each canton, to the population. They are thus local parliaments rather than mere county councils. The executive (Regierungsrat or conseil d'état) is elected everywhere (save Fribourg, the Valais and Vaud) by a popular vote, this plan having gradually superseded election by the cantonal legislature. All the cantons (save Fribourg) have the referendum and initiative, by which the electors can exercise control over their elected representatives. The cantonal judiciary is chosen by the people.

In 1848 the Federal government was reorganized according to the plan adopted in the United States, at any rate so far as regards the legislature (Bundesversammlung or assemblee fédérale). This is composed of two houses: (1) the Ständerat or conseil des états, to which each canton, great or small, sends two representatives (generally chosen for varying terms by the people, but, in 1907, still by the cantonal legislature in Bern, Fribourg, Neuchâtel, St Gall, the Valais and Vaud), this house being like the American Senate; (2) the Nationalrat or conseil national, composed of representatives (at present 167 in number) elected within the cantons in the proportion of 1 to every 20,000 (or 10,000 persons) of the population, and holding office for three years, before the expiration of which it cannot be dissolved. The two houses are on an absolutely equal footing, and bills are introduced into one or the other simply because of reasons of practical convenience. The Federal parliament meets, at least, once a year, in Bern, the Federal capital. The Federal executive (Bundesrat or conseil fédéral) was set up in 1848 and is composed of seven members, who are elected for three years by the two houses of the Federal legislature, sitting together as a congress, but no two members may belong to the same canton. The Federal president (the chairman of the Federal council), and the vice-president, are not elected for more than one term, and in the case where the president dies or is removed from office, the vice-president succeeds to the presidency. But, in 1907, the Swiss people adopted the "circle system," by which, if the Federal president should die or be removed from office, his place is filled by a member of the Federal council, not elected for the purpose. To avoid some of these inconveniences "political communes" were set up, consisting practically of all Swiss permanent residents. By the constitution of 1848, those between these and the old Bürgergemeinden (the burghers of which only have rights of user over the common lands) were very delicate, and has been settled (if settled at all) in various fashions. In some cases the older communes simply merged with the newer, the ownership of the common lands thus passing from one to the other class. In other cases the Bürgergemeinden still
and vice-president of the Federal tribunal. Its seat is at Lausanne. Its jurisdiction extends to disputes between the Confederation, the cantons, and private individuals, so far as these differences refer to Federal matters. An appeal lies in some cases (not too clearly distinguished) to the Federal council, and in some to the two houses of the Federal legislature sitting together. As to the referendum and initiative (whether as to the revision of the constitution or as to bills) see REFERENDUM.

It was natural that, as the interests of the Christian cantons and those of the French-speaking district grew closer together, there should arise the idea of a Federal code as distinguished from the manifold cantonal legal systems. The Federal Constitution of 1874 conferred on the Federal authorities the power to legislate on certain defined legal subjects, and advantage was taken of this to revise and codify the Law of Obligations (1881) and the Law of Bankruptcy (1886). The success of these attempts led to the adoption by the Swiss people (1898) of new constitutional articles, extending the powers of the Federal authorities to the other departments of civil law and also to criminal law. Drafts prepared by commissions of specialists were slowly considered during nearly two years by the two houses of the Federal parliament, which finally adopted the civil code on the 10th of December 1907, and it was expected that by 1912 both a complete Federal civil code and a complete Federal criminal code would come into operation.

Before 1848 there was scarcely such a thing as Federal finances for there was no strong central Federal authority. As the power of those authorities increased, so naturally did their expenditure and receipts. In 1849 the receipts were nearly £130,000, as against an expenditure of £260,000, and each canton had raised rather over £1,250,000, while in 1883 they just overtopped £2,000,000 sterling each, and in 1900 the receipts were just over £8,000,000, with an expenditure of nearly £4,000,000. For the two years 1906 and 1907 the receipts were £5,750,000 as against just over £5,500,000, and are the highest yet recorded. The funded Federal debt rose from a modest £150,000 in 1849 to over £2,000,000 in 1864, and rather over £4,000,000 in 1905.

By the Federal Constitution of 1848 the post office was made a Federal authority, and the first Federal law on the subject was passed in 1849 (postage stamps were introduced in the country in 1845 for an expenditure of £1,500,000 in 1877), and in 1892 the prices were taken up by public subscription in June 1906. The remaining fifth was reserved to the existing thirty-six banks in Switzerland (all founded between 1834 and 1900), which have hitherto enjoyed the right of issuing notes. It was stipulated that within three years of the opening of the National Bank all notes issued by these thirty-six banks must be withdrawn, and many had by 1907 taken this course in anticipation of it.

There is no "established Swiss Church" recognized by the Federal Constitution, but there may be one or more "established churches" in any canton. The Federal Constitution of 1874 guarantees full religious freedom, but contrary to morals and the public peace, as well as exemption from any compulsory church rates (arts. 49 and 50). But it repeats, with fresh pricks (art. 51), the provision of the Constitution of 1851, that the public authorities are forbidden to settle in Switzerland, extending this prohibition to any other orders that may endanger the safety of the state or the public peace. It also introduces a new article (art. 188) providing that if any new dioceses are formed or new monasteries or the re-establishment of old ones, and also a new clause (last part of art. 50) by which the erection of new bishoprics on Swiss soil is subject to the approval of the Federal authorities. This last article is inconsistent with the principles of the Constitution of 1874 and the rest of the exceptional legislation to the "Kulturrampf" which raged in Switzerland in 1872-1874. The Protostats form rather over three-fifths of the population, but have the majority in only 22 cantons only. In the German-speaking districts they are Zwinglians, and in the French-speaking cantons Calvinists, though in neither case of the original and orthodox shade. The Protostats alone are "established" in the Outer Rhones of Appenzell; while the Romanists alone are "established" in 71 cantons (Lucerne, St Gall, Unterwald, and the Inner Rhones of Appenzell), but only jointly in the 3 other cantons (Fribourg, St Gall and Solouere) in which they are in a majority. In June 1907 Geneva decided on the complete separation of church and State, and now 27 cantons, including the Old Romanists, are "established church" at all (previously it had two—Protestants and Catholic Churches). In the other 21 cantons, the Protostats and Romanists are jointly "established" in 113, as are the Prot-
religious instruction in the school, this being compulsory on the children professing the religion that is in the majority in that particular commune—consequently a Protestant teacher would never be appointed to a Catholic school. The teacher occupies an hour (always at the beginning of the school hours) three a week, while special dogmatic instruction is imparted by the pastor, outside the school-house as a rule, or in a room especially set apart for this purpose. The teacher is elected by the cantonal school commission, while the religious teaching in school is based on a special "school Bible," containing short versions of the chief events in Bible history. The exact curriculum (which is the same for all schools) is fixed by the respective canton, and during which the school must be open annually, but the precise reparation of these is left to the local Schulkommission. The attendance registers kept by the teachers are subjected to audit by the Schulkommission, and the measures against truant children or negligent parents by means of a written warning, followed (if need be) by a summons before a court. The treasurer of the Schulkommission receives and distributes the money provided by the canton, including the idea of making the primary schools wholly dependent financially on the Confederation and also of the communes, or of benevolent private individuals. The school hours are as a rule four hours (from 7 a.m. in summer and 8 a.m. winter) in the morning (in the winter) three hours in the afternoon, but on two afternoons in the week there is a sewing school for the girls, the boys being free. There are no regular half-holidays. Private schools are permitted, where the teacher must hold a certificate of efficiency as in the state schools, must adopt the same curriculum, and is subject to the by-laws made by the Schulkommission. On the other hand he is not bound by any rules, may open and close his school at will, and examines each school (of either class) annually and reports to the cantonal educational authorities, who point out any deficiencies to the local Schulkommission, and cause the school to be examined by paid inspectors, but do not the money contributions (from any source) depend on the number of attendances made, though of course they are more or less in proportion to the number of scholars attending. The idea of making the primary schools wholly dependent financially on the Confederation has obvious consequences, but a first attempt was defeated in 1882, and the scheme is still opposed, mainly on the ground that it would seriously impair the principle of cantonal sovereignty, and immensely strengthen the power of the Federal educational authorities. By the law of 1903 the quota of the Federal subvention was limited at the expense of the canton of the poorer ones—an extra twopence was added.

b. The secondary schools are meant on the one side to help those scholarcs of the primary schools who desire to increase their knowledge though without any idea of going on to higher studies, and on the other to prepare certain students for entrance into the middle schools. The attendance everywhere is optional, save in the city of Basel, where it is compulsory. These schools vary very much from canton to canton. The course of studies extends over two to four years, and students are admitted at ages from ten upwards. The curriculum includes the elements of the classical and modern languages, of mathematics, and of the natural sciences. They receive no Federal subvention, but are supported by the cantons and the communes. In 1905 the cantons contributed £20,000 less than the expenditure of the total amount of £84,000.

c. Under the general name of middle schools (Mittelschulen or écoles moyennes) the Swiss include a variety of educational establishments, which fall roughly under two heads.

1. Technical schools (like those at Bienna and Winterthur) and schools for instruction in various professions (commerce, agriculture, forestry, and the training colleges for teachers).

2. Grammar schools, colleges and cantonal schools, which in some cases prepare for the universities and in some do not.

The expenses of both classes fall mainly on the cantons (in 1905 about £524,000), school fees from the parents (who pay an income tax (including certain departments of the second) receive a grant in aid from the Confederation—in 1905 about £84,000.

d. As regards the higher education the Federal Constitution of 1848 provides that the cantons are to erect schools of science, besides the existing Federal Polytechnic School (opened at Zürich in 1855, having been founded by virtue of art. 22 of the Federal Constitution of 1848), a Federal university (this has not been done) and other establishments for the higher education (see above). This clause would seem to authorize the Confederation to make grants in aid of the cantonal universities, but as yet this has not been done. The University at Berne (1835), which is supported by the cantons and Neuchâtel (established 1840–1848, re-founded in 1866, and raised from the rank of an académie to that of a university in 1909), is being called a university, and others are being established. In general they each (save Sion, of course) have four faculties—theology, medicine, law and philosophy. Fribourg and Neuchâtel both lack a medical faculty, while Zürich and Bern have distinct faculties for veterinary medicine, and Zürich a special one for dentistry (in Geneva there is a school of dentistry), while Geneva and Lausanne have schools of pharmacy. 

Army.—The Swiss army is a purely military force, receiving only periodical training (so far as regards men between 20 and 48 years of age), based upon the principle of universal compulsory personal military service. Till 1848 the cantons alone raised, armed, equipped and trained all military units and nominated the officers. By the Federal Constitution of 1848 (art. 20) the Confederation was entrusted with the training of the engineers, artillery and the cavalry, with the education of instructors for all other arms, and with the higher training of all army and navy officers; it was also empowered to found military schools, to organize general military manoeuvres, and to supply a part of the war matériel. The Confederation, too, was given the supervision of the training of the infantry, as well as the furnishing, the construction and the maintenance of all war matériel, which the cantons were bound to supply to the Confederation. The Federal Constitution of 1874 marked an advance on that of 1848 as to the following points. The principle of universal military service and the organization of the Federal army were developed according to the proportion of the population capable of bearing arms (in contradistinction to the 1848 system, art. 19, of fixed contingents in the proportion of 3 to every 100 men of the population of each canton); the entire military training and arming of these men and the cost of their uniform and equipment were taken over by the Confederation, which, too, supervised the military administration of the cantons. The uniform, equipment and weapons of the men were to be free of cost to them, while compensation was due from the Confederation to the families of those killed or permanently injured in the course of their military service, as well as to the invalids themselves. Thus remained to the cantons the raising of all the infantry units and of most of the cavalry and artillery units as well as the nomination of the officers of all arms; all these acts were subject to the supervision of the Confederation and had to be in accordance with Federal laws and regulations. An attempt made in 1895 to extend still further the sphere of action of the Confederation in military matters was rejected by a vote of the Swiss people. Thus the present system rests partly on the 1874 Constitution, and partly on the new military law, passed by the Federal parliament on the 12th of April 1907.
SWITZERLAND

[HISTORY]

The Confederation has control of the Federal army and of the war matériel, the cantons being only allowed certain defined rights within their respective territories. By art. 20 the limits of the Federal army are defined. After the treaty of 1877 the cantons are exempted from the provisions of art. 21. The Confederation has the sole right of legislation in military matters, but the execution of these laws is in the hands of the cantons, though under Federal supervision, while all branches of the public service, both civil and military, are in the hands of the cantons. On the other hand, the cantons supply and keep up the equipment and the uniforms of the soldiers, though these expenses are reimbursed by the Confederation and are reckoned as part of the general nomination and the promotion of the officers, belong to the cantons, subject to certain general principles to be laid down by the Confederation. Finally, the Confederation has (art. 22) the right of using or confiscating property which is needed for the protection of a canton, by which more uniformity was introduced into administrative matters and the whole system remodelled, of course according to the general principles formulated in the Federal Constitution of 1874.

The following is a bird's-eye view of the actual organization of the Swiss army. Every Swiss male citizen is bound to render personal military service between the ages of twenty and forty-eight. Certain classes are exempt, such as high Federal officials, clergy (not being military chaplains), officials of hospitals and prisons, as well as custom-house and police officials and officers of public means of communication, but in the last case only those whose services would be indispensable in time of war, e.g., post office, telegraph, telephone, railway and steamer employés (all exempted before 1897)—custom-house men, policemen and the like, as well as rural postmen, before they are exempted. Those who are totally disqualified for any reason must, till the age of forty, pay an extra tax of 6 francs a head, plus 1½ francs on every 1000 francs of their net property, and 1 franc on every 100 francs of their net income, the maximum tax that can be levied in any particular case being 3000 francs a year (property under 1000 francs and the first 600 francs of income are free from this tax, which is only levied as to its half in case of the men in the Landwehr); this tax is equally divided between the Confederation and the cantons, its total yield in 1905 being about £171,000. The cantonal authorities must in certain fixed centres their officers (chief, gunners, surgeons, etc.), who are bound, in order to submit themselves at the hands of the Federal officials to a medical examination, a literary examination (reading, arithmetic, elementary Swiss geography and history, and the composition of a short essay), and, if required, to undergo gymnastic tests (a long jump of at least 8 ft., lifting at least four times a weight of about 37 lb in both hands at once, and running about 25 yds in 26 seconds) in order to be accepted for military service, whether by stimulating bodily training or the practice of rifle shooting, in which case rifles, ammunition and equipment are supplied free—in all these cases the attendance of the lad is partially or wholly remunerated. In the next age (ages of eighteen and twenty), are required to attend a night school (in order to rub up their school knowledge) for sixty hours a winter for three years, and the last age of twenty and twenty-two, for their soldier service, but in all cases the service is paid for. The Swiss army is divided into the Landwehr (men between thirty-three and forty) and the Landsturm (men between forty-one and forty-eight). The recruits serve for different periods, the engagements varying from one to twenty years. In the Landwehr they are incorporated—infantry and engineers sixty-five days, artillery and garrison troops seventy-five days and cavalry ninety days (forty-five days in the case of Switzerland. The Swiss army is made up (according to the new law of 1907) of a staff, composed of all the commanding officers on active service from the rank of major upwards (in this as in all the following laws), the general staff, the army service corps (post office, telegraph, railways, motor cars, chaplains, police, courts of justice, secretaries, &c., and the auxiliary services), while the soldiers proper are divided into a number of classes—infantry (including sharpshooters and cyclists), cavalry, artillery (including the mountain batteries), engineers (including sappers and railway labourers), garrison troops, the medical, veterinary, (veterinary surgeons and surgeons), the commissariat and transport services (drivers and leaders of laden horses and mules). On the first of January 1907 (still under the old system) the numbers of the Swiss army were as follows: the Landwehr, 18,544 artillery and 556 engineers, and the Landsturm 93,163 (including 67,955 infantry, 4378 cavalry, 13,332 artillery and 4313 engineers)—making thus a total of 282,577 men between the ages of twenty and forty-eight years of age (17,221 infantry, 981 cavalry, 31,866 artillery and 9880 engineers). To this total must be added 44,294 men in the armed Landsturm (forty-five to fifty years of age) and 26,2038 auxiliary troops (pioneers, workmen in military camps, medical, commissariat and transport departments, police, firemen, clerks, and men at a military dépôt). The total of the Landsturm and the auxiliary services is 306,432, so that a maximum of 489,000 men is available, of which 226,648 (in the Landwehr forty-eight, and in the Landsturm fifty-five). The total expenses of the Swiss army rose from £28,000 in 1896 to £4,900,001 in 1906. Rifles are manufactured in Berne, ammunition at Lucerne, and the depot is at Schaffhausen. The remount dépôt is at Thun, which is also the chief artillerie centre of Switzerland. There is a department for military education at the Federal Polytechnic School at Zürich, and there is a special training of mechanics in general, and the other specially for officers. (W. A. B. C.)

HISTORY

The Swiss Confederation is made up of twenty-two small states, differing from each other in nearly every point—religious, political, social, industrial, physical and linguistic; yet it forms a nation the patriotism of whose members is universally acknowledged. History alone can supply us with the key to this puzzle; but Swiss history, while thus essential if we could thoroughly grasp the nature of the Confederation, is very intricate and very local. A firm hold on a few guiding principles is therefore most desirable, and of these there are three which we must always bear in mind. (1) The first is the growth of a confederation of small provinces or cantons. Swiss history is largely the history of the drawing together of bits of each of the imperial kingdoms (Germany, Italy and Burgundy) for common defence against a common foe—the Habsburgs; and, when this family have secured to themselves the permanent possession of the Empire, the Swiss League little by little wins its independence of the Empire, practically in 1499, formally in 1648. Originally a member of the Empire, the Confederation becomes first an ally, then merely a friend. (2) The second is the German origin and nature of the Confederation. Round
a German nucleus (the three Forest districts) there gradually gather other German districts; the Confederation is exclusively German (save partially in the case of Fribourg, in which after its admission in 1481 Teutonic influences gradually supplanted the Romance speech); and it is not till 1803 and 1815 that its French- and Italian-speaking "subjects" are raised to political equality with their former masters, and that the Romonosh-speaking Leagues of Raetia (Graubünden) pass from the status of an ally to that of a member of the Confederation. (3) Swiss history is a study in federalism. Based on the defensive alliances of 1291 and 1315 between the three Forest districts, the Confederation is formed by the admission of other districts and towns, all leagues with the original three members, but not necessarily with each other. Hence great difficulties are encountered in looking after common interests, in maintaining any real union; the Diet was merely an assembly of ambassadors with powers very strictly limited by their instructions, and there was no central executive authority. The Confederation is a Staatenbund, or permanent alliance of several small states. After the break-up of the old system in 1798 we see the idea of a Bundesstaat, or an organized state with a central legislative, executive, and judicial work, in Switzerland. (4) Political liberty is gradually realized in the Constitutions of 1848 and 1874. The whole constitutional history of the Confederation is summed up in this transition to a federal state, which, while a single state in its foreign relations, in home matters maintains the more or less absolute independence of its several members.

Swiss history falls naturally into five great divisions: (1) the origins of the Confederation—up to 1291 (for the legendary origin see Tell, William); (2) the shaking off dependence on the Habsburgs—up to 1394 (1474); (3) the shaking off dependence on the Empire—up to 1499 (1648); (4) the period of religious divisions and French influence—up to 1814; (5) the construction of an independent state as embodied in the Constitutions of 1848 and 1874.

1. On the 1st of August 1291 the men of the valley of Uri (homines vallis Uraniæ), the free community of the valley of Schwyz (universitas vallis de Switz), and the association of the men of the lower valley or Nidwalden (communitas hominum intramontanorum vallis inferioris)—Obwalden or the upper valley is not mentioned in the text, though it is named on the seal appended—formed an Everlasting League for the purpose of self-defence against all who should make an attack or trouble them, a league which is expressly stated to be a confirmation of a former one (antiquum confederationes formam juramento vallatam presentibus innovando). This league was the foundation of the Swiss Federation.

What were these districts? and why at this particular moment was it necessary for them to form a defensive league? The legal and political conditions of each were very different. (a) In 853 Louis the German granted (inter alia) all his lands (and the rights annexed to them) situated in the pagiis Uraniæ to the convent of Sts Felix and Regula in Zürich (the present Frauenmünster), of which his daughter Hildegarde was the first abbess, and gave to this district the privilege of exemption from all the jurisdiction save that of the king (Reichsfreiheit), so that though locally within the Zürichgau it was not subject to its county, the king's deputy. The abbey thus became possessed of the greater part of the valley of the Reuss between the present Devil's Bridge and the Lake of Lucerne, for the upper valley (Urseren) belonged at that time to the abbey of Disentis in the Rhine valley, and did not become permanently allied with Uri till 1410. The privileged position of the abbey tenants gradually led the other men of the valley to "commend" themselves to the abbey, whether they were tenants of other lords or free men as in the Schächental. The meeting of all the inhabitants of the valley, for purposes connected with the customary cultivation of the soil according to fixed rules and methods, served to prepare them for the enjoyment of full political liberty in later days. The important post of "protector" (advocatus or Vogt) of the abbey was given to one family after another by the emperor as a sign of trust; but when, on the extinction of the house of Zähringen in 1218, the office was granted to the Habsburgs, the protests of the abbey tenants, who feared the rapidly rising power of that family, and perhaps also the desire of the German king to obtain command of the St Gotthard Pass (of which the first authentic mention occurs about 1326, when of course it could only be traversed on foot), led to the recall of the grant in 1231, the valley being thus restored to its original privileged position, and depending immediately on the king. (b) In Schwyz (first mentioned in 972) we must distinguish between the districts west and east of Steinen. In the former the land was in the hands of many nobles, amongst whom were the Habsburgs; in the latter there was, at the foot of the Mythen, a free community of townsmen, of the latter as soon as it could maintain on their land in common; both, however, were politically subject to the king's delegates, the counts of the Zürichgau, who after 1173 were the ever-advancing Habsburgs. But in 1240 the free community of Schwyz obtained from the emperor Frederick II. a charter which removed them from the jurisdiction of the counts, placing them in immediate dependence on the king, like the abbey men of Uri. In a few years, however, the Habsburgs contrived to dispense with this charter in practice. (c) In Unterwalden things were very different. The upper valley of Schwyz, with its former abbey of Grossmünster, was formed part of the Zürichgau, while in both the soil was owned by many ecclesiastical and lay lords, among them being the Habsburgs and the Alsatian abbey of Murbach. Hence in this district there were privileged tenants, but no free community, and no centre of unity, and this explains why Obwalden and Nidwalden won their way upwards so much more slowly than their neighbours in Uri and Schwyz. Thus the early history and legal position of these three districts was very far from being the same. In Uri the Habsburgs, save for a brief space, had absolutely no rights; while in Schwyz, Obwalden and Nidwalden they were also, as counts of the Zürichgau, the representatives of the king, and thus could enforce their will as they chose.

The Habsburgs had been steadily rising for many years from the position of an unimportant family in the Aargau to that of a powerful clan of large landed proprietors in Swabia and Alsace, and had attained a certain political importance as counts of the Zürichgau and Aargau. In one or both qualities the cadet or Laufenburg line, to which the family estates in the Forest districts round the Lake of Lucerne had fallen on the division of the inheritance in 1232, seem to have exercised their legal rights in a harsh manner. In 1240 the free men of Schwyz obtained protection from the emperor, and in 1244 we hear of the castle of New Habsburg, built by the Habsburgs on a promontory jutting out into the lake not far below Lucerne, with the object of enforcing their real or pretended rights. It is therefore not a matter for surprise that when, after the excommunication and deposition of Frederick II. by Innocent IV. at the Council of Lyons in 1245, the head of the cadet line of Habsburg sided with the pope, some of the men of the Forest districts should rally round the emperor. Schwyz joined Sarnen and Lucerne (though Uri and Obwalden supported the pope); the castle of New Habsburg was reduced to its present ruined state; and in 1247 the men of Schwyz, Sarnen and Lucerne were threatened by the pope with excommunication if they persisted in upholding the emperor and defying their hereditary lords the counts of Habsburg. The rapid decline of Frederick's cause soon enabled the Habsburgs to regain their authority in these districts. Yet these obscure risings have an historical interest, for they are the foundation in fact (so far as they have any) of the legendary stories of Habsburg oppression told of and by a later age. After this temporary check the power of the Habsburgs continued to increase rapidly. In 1273 the head of the cadet line sold all his lands and rights in the Forest districts to the head of the elder or Alsatian line, Rudolph, who a few months later was elected to the imperial throne, in virtue of which he acquired for his family in 1282 the duchy of Austria, which now for the first time became connected with the Habsburgs. Rudolph recognized the privileges of Uri but not those of Schwyz; and, as he now united in his own person the characters of emperor, count of the Zürichgau, and landowner in the Forest districts (a name occurring first in the 14th century), such a union of offices might

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be expected to result in a confusion of rights. On the 16th of April 1291 Rudolph bought from the abbey of Murbach in Alsace (of which he was "advocate") all its rights over the town of Lucerne and the abbey estates in Unterwalden. It thus seemed probable that the other Forest districts would be shut off from their natural means of communication with the outer world by way of the lake. Rudolph's death, on the 15th of July of the same year, cleared the way, and a fortnight later (August 1) the Everlasting League was made between the men of Uri, Schwyz and Nidwalden (the words et vallis superioris, i.e. Obwalden, were inserted, perhaps between the time of the drawing up of the document, the text of which does not mention Obwalden, and the moment of its sealing on the original seal of Nidwalden) for the purpose of self-defence against a common foe. We do not know the names of the delegates of each valley who concluded the treaty, nor the place where it was made, nor have we any account of the deliberations of which it was the result. The common seal—that great outward sign of the right of a corporate body to act in its own name—appears first in Uri in 1243, in Schwyz in 1281, in Unterwalden not till this very document of 1291; yet, despite the great differences in their political status, they all joined in concluding this League, and confirmed it by their separate seals, thereby laying claim, on behalf of their union to an independent existence. Besides promises of aid and assistance in the case of attack, they agreed to punish great criminals by their own authority, but advise that, in minor cases and in all civil cases, each man should make his complaint to a "judex" (i.e. a judge) whom the League had appointed. All this the Confederates will, in case of need, enforce the decision of the "judex." At the same time they unanimously refuse to recognize any "judex" who has bought his charge or is a stranger to the valleys. All disputes between the parties to the treaty are, as far as possible, to be settled by a reference to arbiters, a principle which remained in force for over six hundred years. "Judex" is a general term for any local official, especially the chief of the community, whether named by the lord or by the community; and, as earlier in the same year Rudolph had promised the men of Schwyz not to force upon them a "judex" belonging to the class of serfs, we may conjecture from this very decided protest that the chief source of disagreement was in the matter of the jurisdictions of the lord and the free community, and that some recent event in Schwyz led it to insist on the insertion of this provision. It is stipulated also that every man shall be bound to obey his own lord "convenienter," or so far as is fitting and right. The antiqua confederatio mentioned in this document was probably merely an ordinary agreement to preserve the peace in that particular district, made probably during the interregnum (1254-1273) in the Empire.

Margarten and the League of 1218.

On the 24th of July 1291 the 20,000 men moved forward along the shore of the Lake of Lucerne, and met the Austrians and Hussars of Schwyz by defeating the advance of Margarten above the south-eastern end of the lake. There they were awaited by the valiant band of the Confederates from 1300 to 1500 strong. The march up the rugged and slippery slope threw the Austrian army into disarray, which became a rout and mad flight when huge boulders and trunks of trees were hurled from above by their foes, who charged down and drove them into the lake. Leopold fled in hot haste to Winterthur, and the attack by the Brünig was driven back by the men of Unterwalden. On the 9th of December 1315 representatives of the victorious highlanders met at Brunnen, on the Lake of Lucerne, not far from Schwyz, and renewed the Everlasting League of 1291. In their main lines the two documents are very similar, the later being chiefly an expansion of the earlier. That of 1315 is in German (in contrast to the 1291 League, which is in Latin), and has one or two striking clauses largely indebted to a decree issued by Zürich on the 24th of July 1291.

None of the three districts or their dependents is to recognize a new lord without the consent and counsel of the rest. (This is probably meant to provide for an interregnum in disputed election to the Empire, possibly for the chance of the election of a Habsburg or, if the law of the lawfulness of the 1291 League is to be rendered to the rightful lord in each case, unless he attacks or wrongs any of the Confederates, in which case they are to be
free from all obligations. No negotiations, so long as the "Länder" have no lord, are to be entered on with outside powers, save by common agreement of all. Louis solemnly recognized and confirmed the new league in 1316, and in 1318 a truce was concluded between the Confederates and the Habsburgs, who treat with them on equal terms. The lands and rights annexed belonging to the Habsburgs in the Forest districts are fully recognized as they existed in the days of Henry of Luxemburg, and freedom of commerce is granted. But there is not one word about the political rights of the Habsburgs as count of the Zürichgau and Aarau. This distinction gives the key to the whole history of the relations between the Confederates and Habsburgs; the rights of the latter as landowners are fully allowed, and till 1801 they possessed estates within the Confederacy; it is their political rights which were always contested by the Swiss, who desired to rule themselves.

As early as 1320 we find the name "Switzerland" (Sweitz) (derived from Schwyz, which had always been the leader in the struggle) applied to the three Forest cantons, and in 1352 extended to the Confederation as a whole. But it was not till after Sempach (1386) that it came into popular use, the historian J. von Müller (1783) fixing the distinction between "Schweiz" (for the country) and "Schweiz" (for the canton), and it did not form the official name of the Confederation till 1803. (Officially in the middle ages and later the Confederation was named "les Liques de la Haute Allemagne," or, as Commynes, late in the 15th century, puts it, "les vieilles Liques d'Allemagne qu'on appelle Suisses," while from c. 1450 onwards the people were called "Swiss"). This is in itself a proof of the great renown which the League won by its victory at Morgarten. Another is that as years go by we find other members admitted to the privileges of the original alliance of the three Forest districts. First to join the League (1332) was the neighbouring town of Lucerne, which had grown up round the monastery of St Leodegar or Leger (whence the place took its name), perhaps a colony, certainly a cell of the great house of Murbach in Alsace, under the rule of which the town remained till its sale in 1291 to the Habsburgs. This act of Lucerne was opposed by the house of Austria, but, despite the decision of certain chosen arbiters in favour of the Habsburg claims, the town clung to the League with which it was connected by its natural position, and thus brought a new element into the pastoral associations of the Forest districts. For a long time later the entire Lake of Lucerne, and in 1351, the ancient town of Zürich, which in 1218, on the extinction of the house of Züiringen, had become a free imperial city in which the abbess of the Fraumünster (the lady of Uri) had great influence, while in 1336 there had been a great civic revolution, headed by Rudolph Brun, who had raised the members of the craft guilds to a position in the municipal government of equal power with that of the patricians, who, however, did not cease intriguing to regain their lost privileges, so that Brun, after long hesitation, decided to throw in the lot of the town with the League rather than with Austria. In this way the League now advanced from the hilly country to the plains, though the terms of the treaty with Zürich did not bind it so closely to the Confederates as in the other cases (the right of making alliances apart from the League being reserved though the League was to rank before these), and hence rendered it possible for Zürich now and again to incline towards Austria in a fashion which did great hurt to its allies. In 1352 the League was enlarged by the admission of Glarus and Zug. Glarus belonged to the monastery of Säckingen on the Rhine (founded by the Irish monk Fridolin), of which the Habsburgs were "allsaints," claiming therefore many rights over the valley, which refused to admit them, and joyfully received the Confederates who came to its aid; but it was placed on a lower footing than the other members of the League, being bound to obey their orders. Three weeks later the town and district of Zug, attacked by the League and abandoned by their Habsburg masters, joined the Confederation, forming a transition link between the civic and rural members of the League. The immediate occasion of the union of these two districts was the war begun by the Austrian duke against Zürich, which was ended by the Brandenburg peace of 1352, by which Glarus and Zug were to be restored to the Habsburgs, who also regained their rights over Lucerne. Zug was won for good by a bold stroke of the men of Schwyz in 1364, but it was not till the day of Náefels (1388) that Glarus recovered its lost freedom. These temporary losses and the treaty made by Brun of Zürich with Austria in 1356 were, however, far outweighed by the entrance into the League in 1353 of the famous town of Bern, which, founded in 1191 by Berthold V. of Züiringen, and endowed with great privileges, had become a free imperial city in 1358 on the extinction of the Züiringen dynasty. Founded for the purpose of bridling the turbulent feudal nobles around, many of whom had become citizens, Bern beat them back at Dornbühl (1298), and made a treaty with the Forest districts as early as 1373. In 1339, at the bloody fight of Laupen, she had broken the power of the nobles for ever, and in 1352 had been forced by a treaty with Austria to take part in the war against Zürich, but soon after the conclusion of peace entered the League as the ally of the three Forest districts, being thus only indirectly joined to Lucerne and Zürich. The special importance of the accession of Bern was that the League now began to spread to the west, and was thus brought into connexion for the first time with the French-speaking land of Savoy. The League thus numbered eight members, the fruits of Morgarten, and no further members were admitted till 1481, after the Burgundian War. But, in order thoroughly to understand the nature of the League, it must be remembered that, while each of the five new members was allied with the original nucleus—the three Forest districts—these five were not directly allied to one another: Lucerne was allied with Zürich and Zug; Zürich with Lucerne, Zug and Glarus; Glarus with Zürich; Zug with Lucerne and Zürich; Bern with no one except the three original members. The circumstances under which each entered the League can alone explain these very intricate relations. After a short interval of peace the quarrels with Austria broke out afresh; all the members of the League, save the three Forest districts and Glarus, joined (1385) the great union of the south German cities; but their attention was soon called to events nearer home. Lucerne fretted much under the Austrian rule, received many Austrian subjects among her citizens, and refused to pay custom duties to the Austrian bailiff at Rothenburg, on the ground that she had the right of free commerce with her neighbours in the west. The king of Germany threatened her with the loss of the privileges of burghership to the discontented inhabitants of the little town of Sempach a short way off, so irritated Leopold III. (who then held all the possessions of his house outside Austria) that he collected an army, with the intention of crushing his rebellious town. Lucerne meanwhile had summoned the other members of the League to her aid, and, though Leopold's feat of attacking Zürich caused the troops of the League to march at first in that direction, they discovered their mistake in time to turn back and check his advance on Lucerne. From 1500 to 1560 men of Uri, Schwyz, Unterwalden, and Lucerne opposed the 6000 which made up the Austrian army. The decisive fight took place on the 4th of July 1386, near Sempach, on a bit of sloping meadow-land, cut up by streams and hedges, which forced the Austrian knights to dismount. The great heat of the day, which rendered it impossible to fight in armour, and the furious attacks of the Confederates, finally broke the Austrian line after more than one repulse and turned the day (see Winkelried). Leopold, with a large number of his followers, was slain, and the Habsburg power within the borders of the Confederation finally broken. Glarus at once rose in arms against Austria, but it was not till the expiration of the truce made after Sempach that Leopold's brother, Albert of Austria, brought an army against Glarus, and was defeated at Náefels (not far from Glarus) on the 9th of April 1388, by a handful of Glarus and Schwyz men.

In 1389 a peace for seven years was made, the Confederates being secured in all their conquests; an attempt made in 1393 by Austria by means of Schöno, the chief magistrate of Zürich and leader of the patrician party, to stir up a fresh attack
failed owing to a rising of the burghers, who sympathized with the Confederates, and on the 16th of July 1394 the peace was prolonged for twenty years (and again in 1412 for fifty years), various stipulations being made by which the long struggle of the League against the Habsburgs was finally crowned with success.

By the peace of 1394 Olarz was freed on payment of £200 annually; (in 1395 it bought up all the rights of Stübingen). Zug too was released from Austrian rule. Schwyz was given the advocatia of the great abbey of Einsiedeln; Lucerne got the Entlebuch (finally in 1405), Sempach and Rothenburg, Bern and Soleure were confirmed in their conquests. Above all, the Confederation as a whole was released from the overlordship of the Habsburgs, to whom, however, all their rights and dues as landed proprietors were expressly reserved; Bern, Zürich and Soleure guaranteeing the maintenance of these rights and dues, with power in case of need to call on the other Confederates to support them by arms. Though the house of Habsburg entertained hopes of recovering its former rights, so that technically the treaties of 1380, 1394 and 1412 were but truces, it finally and for ever renounced all its feudal rights and privileges within the Confederation by the "Everlasting Compact" of 1474.

It is probable that Bern did not take any active shire in the Sempach War because she was bound by the treaty of peace made with the Austrians in 1368; and Soleure, allied with Bern, was doubtless a party to the treaty of 1394 (though not yet in the League), because of its sufferings in 1382 at the hands of the Kyburg line of the Habsburgs, whose possessions (Thun, Briegdorf, etc.) were ceded to the League by the Aargau. The treaty of 1394 also gave the Confederacy considerable lands (known as the Freie Aemter) were joined together and governed as bailiwicks held in common by all the members of the League (save Uri, busied in the south, and Bern, who had already secured the lion's share of the spoil for herself). This is the first case in which the League as a whole took up the position of rulers over districts which, though guaranteed in the enjoyment of their old rights, were nevertheless politically unfree. As an encouragement and a reward, Sigismund had granted in advance to the League the right of criminal jurisdiction (haute justice or Bläbans), which points to the fact that they were soon to appear as the representative of the great districts.

As the natural policy of Bern was to seek to enlarge its borders at the expense of Austria, and later of Savoy, so we find that Uri, shut off by physical causes from extension in other directions, as steadily turned its eyes towards the south. In 1410 the valley of Urseren was finally joined to Uri; though communications were difficult, and carried on only by means of the "Steilende Brücke," a wooden bridge suspended by chains over the Reuss, along the side of a great rocky buttress (pierced in 1797 by the tunnel known as the Urnerloch). By this to recover the Val d'Ossola caused the Confederates to send a force to rescue these adventurers; but

permanently the Val d'Ossola on the south side of the Simplon Pass. Bern, however, supported its burgler, the lord of Raron, and peace was made in 1420. Such were the first links which bound these lands with the League; but they did not become full members for a long time—Appenzell in 1513, St Gall in 1803, the Valais in 1515.

Space will not allow us to enumerate all the small conquests made by the League in the first half of the 15th century by every member of the League; suffice it to say that each increased and defended off its territory, but did not give the conquered lands any political rights, governing them as "subject lands," often very harshly. The same phenomenon of lands which had won their own freedom playing the part of tyrant over other lands which joined them more or less by their voluntary action is seen on a larger scale in the case of the conquest of the Aargau, and in the first attempts to secure a footing south of the Alps.

In 1412 the treaty of 1394 between the League and the Habsburgs had been renewed for fifty years; but when in 1415 Duke Leopold of Austria helped Pope John XXII. to war against Constance, where the great ecclesiastical council was then sitting, and the emperor Sigismund placed the duke under the ban of the Empire, summoning all members of the Empire to arm against him, the League hesitated, because of their treaty of 1412, till the emperor declared that all the rights and lands of Austria in the League were forfeited, and that their compact did not release them from their obligations to the Empire. In the name, therefore, of the emperor, and by his special command, the different members of the League overran the extensive Habsburg possessions in the Aargau. The terrible case of the Aargau, and the other districts (known as the Freie Aemter) were joined together and governed as bailiwicks held in common by all the members of the League (save Uri, busied in the south, and Bern, who had already secured the lion's share of the spoil for herself). This is the first case in which the League as a whole took up the position of rulers over districts which, though guaranteed in the enjoyment of their old rights, were nevertheless politically unfree. As an encouragement and a reward, Sigismund had granted in advance to the League the right of criminal jurisdiction (haute justice or Bläbans), which points to the fact that they were soon to appear as the representative of the great districts.

As the natural policy of Bern was to seek to enlarge its borders at the expense of Austria, and later of Savoy, so we find that Uri, shut off by physical causes from extension in other directions, as steadily turned its eyes towards the south. In 1410 the valley of Urseren was finally joined to Uri; though communications were difficult, and carried on only by means of the "Steilende Brücke," a wooden bridge suspended by chains over the Reuss, along the side of a great rocky buttress (pierced in 1797 by the tunnel known as the Urnerloch) and the road of the Confederacy.

The titles of the heroic defence of Uri Rotach of Appenzell, and of the appearance of a company of Appenzell women disguised as warriors which turned the battle, are told in connexion with this fight, but do not appear till the 17th and 18th centuries, being thus quite unhistorical, so far as our genuine evidence goes. Schwyz had given them, some help, and in 1415 Appenzell was placed under the protection of the League (save Bern), with which in the next year the city of St Gall made a similar treaty to last ten years. So too in 1416-1417 several of the "tithings" of the Upper Valais (i.e. the upper stretch of the Rhone valley), which in 1388 had beaten the bishop and the nobles in a great fight at Visp, became closely associated with Lucerne, Uri and Unterwalden. It required aid in its final struggle (1418-19) against the great house of Raron, the count-bishop of Sitten (or Sion), and the house of Savoy, which held the Lower Valais—the Forest districts on the other hand, wishing to secure themselves against Raron and Savoy in their attempt to conquer

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the duke of Milan ingratiated with the divided Confederates, and finally in 1446, by a payment of a large sum of money and the grant of certain commercial privileges, the Val Leventina, the Val d’Ossola and Bellinzona were formally restored to him. Thus the first attempt of Uri to acquire a footing south of the Alps failed; but a later attempt was successful, leading to the inclusion in the Confederation of what has been called “Italian Switzerland”.

The original contrasts between the social condition of the different members of the League became more marked when the period of conquest began, and led to quarrels and ill-feeling in the matter of the Aargau and the Italian conquests which a few years later ripened into a civil war, brought about by the dispute as to the succession to the lands of Frederick, count of Toggenburg, the last male representative of his house. Count Frederick’s predecessors had greatly extended their domains, so that they took in not only the Toggenburg or upper valley of the Thur, but Uznach, Sargans, the Rhine valley of Feldkirch and Sargans, the Prättigau or Davos valley. He himself, the last great feudal lord on the left bank of the Rhine, had managed to secure his vast possessions by making treaties with several members of the League, particularly Zürich (1400) and Schwyz (1417)—from 1428 inclining more and more to Schwyz (then ruled by Ital Riding), as he was disgusted with the arrogant behaviour of Stüssi, the burgomaster of Zürich. His death (April 30, 1436) was the signal for the breaking out of strife. The Prättigau and Davos valley formed the League of the Ten Jurisdictions in Raetia (see below), while Frederick’s wishes concurred with Zürich against Schwyz for different portions of the great Italian possessions held in common in the valley of the Rhine. After being twice defeated, Zürich was forced in 1440 to buy peace by certain cessions (the “Höfe”) to Schwyz, the general feeling of the Confederates being opposed to Zürich, so that several of them went so far as to send men and arms to Schwyz. Zürich, however, was bitterly disappointed at these defeats, and had recourse to the policy which she had adopted in 1356 and 1393—an alliance with Austria (concluded in 1442), which now held the imperial throne in the person of Frederick III. Though technically within her rights according to the terms on which she had joined the League in 1435, this act of Zürich caused the greatest irritation in the Confederation, and civil war at once broke out, especially when the Habsburg emperor had been solemnly received and acknowledged in Zürich. In 1443 the Zürich troops were completely defeated at St Jakob on the Sihl, close under the walls of the city, Stüssi himself being slain. Next year the city itself was long besieged. Frederick, unable to get help elsewhere, procured from Charles VII of France the despatch of a body of Armagnac free lances (the Écorcheurs), who came, 30,000 strong, under the dauphin Louis, plundering and harrying the land, till at the very gates of the free imperial city of Basel (which had made a twenty years’ alliance with Bern), by the leper house of St Jakob on the Birs (Aug. 26, 1444), the desperate resistance of a small body of Confederates (1200 to 1500), till cut to pieces, checked the advance of the freebooters, who sustained such tremendous losses that, though the victors, they hastily made peace, and returned whence they had come. Several small engagements ensued, Zürich long declining to make peace because the Confederates required, as the result of a solemn arbitration, the abandonment of the Austrian alliance. At length it was concluded in 1450, the Confederates restoring almost all the lands they had won from Zürich. Thus ended the third attempt of Austria to conquer the League by means of Zürich, which used its position as an imperial free city to the harm of the League, and caused the first civil war by which it was distracted.

These fresh proofs of the valour of the Confederates, and of the growing importance of the League, did not fail to produce important results. In 1452 the “Confederates of the Old League of Upper Germany” (as they styled themselves) made their first treaty of alliance with France, a connexion which was destined to exercise so much influence on their history. Round the League there began to gather a new class of allies (known as “Zugswandte Orte,” or associated districts), more closely joined to it, or to certain members of it, than by a mere treaty of friendship, yet not being admitted to the rank of a full member of the League. Of these associates three, the abbot (1451) and town of St Gall (1454), and the town of Bienna (Biel), through its alliance (1352) with Bern, were given seats and votes in the Diet, being called socii; while others, known as confessorati, were not so closely bound to the League, such as the Valais (1416–1417), Schaffhausen (1450–1473), and the cities of the class of confessorati belonged in later times Neuchâtel 1406–1501, the Three Leagues of Raetia (1497–1498), Geneva (1510–1536), and the bishop of Basel (1570). Appenzell, too, in 1452, rose from the rank of a “protected district” into the class of associates, outside which were certain places “protected” by several members of the League, such as Gersau (1359), the abbey of Engelberg (c. 1421), and the town of Rapperswil (1464). The relation of the “associates” to the League may be compared with the ancient practice of “commendation”: they were bound to certain orders in declaring war, making alliances, &c.

In 1439 Sigismund succeeded his father Frédéric Arichon as the Habsburg lands in Alsace, the Thurgau, and Tirol and, being much irritated by the constant encroachments of the Confederates, in particular by the loss of Rapperswil (1458), declared war against them, but fared very badly. In 1460 the Confederates overran the Thurgau and occupied Sargans. Winterthur was only saved by an heroic defence. Hence in 1461 Sigismund had to give up his claim on those lands and renew the peace for fifteen years, while in 1467 he sold Winterthur to Zürich. Thus the whole line of the Rhine was lost to the Habsburgs, who claimed (1454) the territories of the Confederates in the Frickthal only. The Thurgovian bailiwicks were governed in common as “subject” lands by all the Confederates except Bern. The touchiness of the now rapidly advancing League was shown by the eagerness with which in 1468 its members took up arms against certain small feudal nobles who were carrying on a harassing guerrilla warfare with their allies Schaffhausen and Mühlhausen. They laid siege to Waldshut, and to buy them off Sigismund in August 1468 engaged to pay 10,000 guilden as damages by the 24th of June 1469; in default of payment the Confederates were to keep for twelve years the Black Forest, and Waldshut, one of the Black Forest towns on the Rhine. A short time before (1467) the League had made treaties of friendship with Philip the Good, duke of Burgundy, and with the duke of Milan. All was now prepared for the intricate series of intrigues which led up to the Burgundian War—a great epoch in the history of the League, as it created a common national feeling, enormously raised its military reputation, and brought about the close connexion with certain parts of Savoy, which finally (1803–1815) were admitted into the League.

Sigismund did not know where to obtain the sum he had promised to pay. In this strait he turned to Charles the Bold (properly the Rash), Duke of Burgundy, who was then beginning his wonderful career, and aiming at Burgundian restoration of the kingdom of Burgundy. For this purpose Charles wished to marry his daughter and heiress to Maximilian, son of the emperor, and first cousin of Sigismund, in order that the emperor might be induced to give him the Burgundian crown. Hence he was ready to meet Sigismund’s advances. On the 9th of May 1469 Charles promised to give Sigismund 50,000 florins, receiving as security for repayment Upper Alsace, the Breisgau, the Sundgau, the Black Forest, and the four Black Forest towns on the Rhine (Rheinfelden, Stäckingen, Lauternburg, and Waldshut), and agreed to give Sigismund aid against the Swiss, if he was attacked by them. It was not unnatural for Sigismund to think of attacking the League, but Charles’s engagement to him is quite inconsistent with the friendly agreement made between Burgundy and the League as late as 1467. The emperor then on his side annulled Sigismund’s treaty of 1468 with the Swiss, and placed them under the ban of the Empire. Charles committed the mortgaged lands to Peter von Hagenbach, who proceeded to try to establish his master’s power there by such harsh measures as to cause the people to rise against him.
The Swiss in these circumstances began to look towards Louis XI. of France, who had confirmed the treaty of friendship made with them by his father in 1452. Sigismund had applied to him early in 1469 to help him in his many troubles, and to give him aid against the Swiss, but Louis had point-blank refused. Anxious to secure their neutrality in case of his war with Charles, he made a treaty with them on the 13th of August 1470 to this effect. All the evidence goes to show that Sigismund was not a tool in the hands of Louis, and that Louis, at least at that time, had no definite intention of involving Charles and the Swiss in a war, but wished only to secure his own flank.

Sigismund in the next few years tried hard to get from Charles the promised aid against the Swiss (the money was paid punctually enough by Charles on his behalf), who put him off with various excuses. Charles on his side, in 1471–1472, tried to make an alliance with the Swiss, his efforts being supported by a party in Bern headed by Adrian von Bubenberg. Probably Charles wished to use both Sigismund and the Swiss to further his own interests, but his shifty policy had the effect of alienating both from him. Sigismund, disgusted with Charles, now inclined towards Louis, whose ally he formally became in the summer of 1475—a change which was the real cause of the emperor’s flight from Treves in November 1473, when he had come there expressly to crown Charles. The Confederates on their side were greatly moved by the oppression of their friends and allies in Alsace by Hagenbach, and tried in vain (January 1474) to obtain some redress from his master. Charles’s too astute policy had thus lost him both Sigismund and the Swiss. They now looked upon Louis, who, throughout, promised Charles support, as the latter to be the least disappointing at Treves would soon lead to open war, aimed at a master stroke—no less than the reconciliation of Sigismund and the Swiss. This on the face of it seemed impracticable, but common need and Louis’s dexterous management brought it to pass, so that on the 9th of March 1474 the Everlasting Compact was signed at Constance, by which Sigismund finally renounced all Austrian claims on the lands of the Confederates, and guaranteed them in quiet enjoyment to them; they, on the other hand, agreed to support him if Charles did not give up the mortgaged lands within a week. The next day the Swiss joined the league of the Alsatian and Rhine cities, as also did Sigismund. Charles was called on to receive the money contributed by the Alsatian cities, and to restore his lands to Sigismund. He, however, took no steps. Within a week the oppressive bailiff Hagenbach was captured, and a month later (May 9, 1474) he was put to death, Bern alone of the Confederates being represented. On the 9th of October the emperor, acting of course at the instance of Sigismund, ordered them to declare war against Charles, which took place on the 25th of October. Next day Louis formally ratified his alliance with the Confederates, promising money and troops to them if Sigismund’s defeat produced the result of which he did not send men. Throughout these negotiations and later Bern directs Swiss policy, though all the Confederates are not quite agreed. She was specially exposed to attack from Charles and Charles’s ally (since 1468) Savoy, and her best chance of extending her territory lay towards the west and south. A forward policy was thus distinctly the best for Bern, and this was the line supported by the French party under Nicholas von Diesbach, Adrian von Bubenberg opposing it, though not with any idea of handing over Bern to Charles. The Forest districts, however, were very suspicious of this movement to the west, by which Bern alone could profit, though the League as a whole might lose; then, too, Uri had in 1440 finally won the Val Leventina, and she and her neighbours favoured a southerly policy—a policy which was crowned with success after the gallant victory won at Giornico in 1478 by a handful of men from Zürich, Lucerne, Uri and Schwyz over 12,000 Milanese troops. Thus Uri first gained a permanent footing south of the Alps, not long before Bern won its first conquests from Savoy.

The war in the west was begun by Bern and her allies (Fribourg, Solothurn, etc.) by marauding expeditions across the Jura, in which Héricourt (November 1474) and Blamont (August 1475) were taken, both towns being held of Charles by the “sires” de Neuchâtel, a cadet line of the counts of Montbéliard. It is said that in the former expedition the white cross was borne (for the first time) as the ensign of the Confederates, but not in the other. Meanwhile Yolande, the duchess of Savoy, had, through fear of her brother Louis XI. and hatred of Bern, finally joined Charles and Milan (January 1475), the immediate result of which was the capture, by the Bernese and friends (on the way back from a foray on Pontzailier in the free county of Burgundy or Franche-Comté), of several places in Vaud, notably Grandson and Échallens, both held of Savoy by a member of the house of Chalon, princes of Orange (April 1475), as well as of Orbe and Jougne, held by the same, but under the count of Burgundy. In the summer Bern seized on the Savoyard district of Aigle. Soon after (October–November 1475) the same energetic policy won for her the Savoyard towns of Morat, Avenches, Estavayer and Yverdon; while (September) the Upper Valais, which had conquered all Lower or Savoyard Valais, entered into alliance with Bern for the purpose of opposing Savoy by preventing the arrival of Milanese troops. Alarmed at their success, the emperor and Louis deserted (June–September) the Confederates, who thus, by the influence of Louis and Bernese ambition, saw themselves led on and then abandoned to the wrath of Charles, and very likely to lose their new conquests. They had entered on the war as “helpers” of the emperor, and now became principals in the war against Charles, who raised the siege of Neuss, made an alliance with Edward IV. of England, received the surrender of Lorrach and Kempten (June 1476), and Jura (February 1476) in the north of his ally Yolande. On the 21st July he laid siege to the castle of Grandson, and after a week’s siege the garrison of Bernese and Fribourgers had to surrender (Oct. 28), while, by way of retaliation for the massacre of the garrison of Estavayer in 1475, of the 412 men two only were spared in order to act as executioners of their comrades. This hideous news met a large body of the Confederates gathered together in great haste to relieve the garrison, and going to their rendezvous at Neuchâtel, where both the count and town had become allies of Bern in 1466. An advance body of Bernese, Fribourgers and Schwyzers, in order to avoid the castle of Vauxmarx (seized by Charles), on the shore of the Lake of Neuchâtel, and on the direct road from Neuchâtel to Grandson, climbed over a wooded spur to the north, and attacked (March 2) the Burgundian outposts. Charles drew back his force in order to bring down the Swiss to the more level ground where his cavalry could act, but his rear misinterpreted the order, and when the main Swiss force appeared over the spur the Burgundian army was seized with a panic and fled in disorder. The Swiss had gained a glorious victory, and regained their conquest of Grandson, besides capturing very rich spoil in Charles’s camp, parts of which are preserved to the present day in various Swiss armouries. Such was the famous battle of Grandson. Charles at once retired to Lausanne, and set about reorganizing his army. He resolved to advance on Bern by way of Morat (or Murten), which was occupied by a Bernese garrison under Adrian von Bubenberg, and laid siege to it on the 9th of June. The Confederates had now put away all jealousy of Bern, and collected a large army. The decisive battle took place on the afternoon of the 22nd of June, after the arrival of the Zürich contingent under Hans Waldmann. English archers were in Charles’s army, while with the Swiss was René, the despoissèd duke of Lorraine. After facing each other many hours in the driving rain, a body of Swiss, by outflanking Charles’s van, stormed his palisaded camp, and the Burgundians were soon hopelessly beaten, the losses on both sides (a contrast to Grandson) being exceedingly heavy. Vaud was recaptured by the Swiss (Savoy having overrun it on Charles’s advance); but Louis now stepped in and procured the restoration of that region to Savoy, save Grandson, Morat, Orbe and Échallens, which were to be held by the Bernese jointly with the Fribourgers, Aigle by Bern alone—Savoy the same time renouncing all its claims over Fribourg. Thus French-speaking districts first became permanently...
connected with the Confederation, hitherto purely German, and the war had been one for the maintenance of recent conquests, rather than purely in defence of Swiss freedom. Charles tried in vain to raise a third army; René recovered Lorraine, and on the 5th of January 1477, under the walls of Nancy, Charles's wide-reaching plans were ended by his defeat and death, many Swiss being with René's troops. The wish of the Bernese to overturned French claims on territory, and the conflict of the members of the Confederation, and finally, in 1479, Louis, by very large payments, secured the abandonment of all claims on that province, which was annexed to the French crown.

These glorious victories really laid the foundation of Swiss nationality; but soon after them the long-standing jealousy between the civic and rural elements in the Confederation nearly broke it up. This had always hindered common action save in the case of certain pressing questions. In 1370, by the "Tarsons' ordinance" (Pfaffenberg), agreed on by all the Confederates except Bern and Glarus, all residents whether clerics or laymen in the Confederation who were bound by oath to the duke of Austria were to swear faith to the Confederation, and this oath was to rank before any other; no appeal was to lie to any court spiritual or lay (except in matrimonial and purely spiritual questions) outside the limits of the Confederation, and many regulations were laid down as to the suppression of private wars and keeping of the peace on the high roads. Further, in 1393, the "Sempach ordinance" was accepted by all the Confederates and Soleure; this was an attempt to bring the two upper Swiss Confederations and the old canton of Zürich into line with the Swiss Confederation, minute regulations being made against plundering—women, monasteries and churches being in particular protected and secured. But save these two documents common action was limited to the meeting of two envoys from each member of the Confederation and one from each of the "socii" in the Diet, the powers of which were greatly limited by the instructions brought by each envoy, thus entailing frequent reference to his government, and included foreign relations, war and peace, and common arrangements as to police, pestilence, customs duties, coinage, &c. The decisions of the majority did not bind the minority save in the case of the affairs of the bailiwicks ruled in common. Thus everything depended on common agreement and good will. But disputes as to the divisions of the lands conquered in the Burgundian War, and the proposal to admit into the League the towns of Fribourg and Soleure, which had rendered such good help in the war, caused the two parties to form separate unions, for by the latter proposal the number of towns would have been made the same as that of the "Länder," which did not at all approve. Suspended a moment by the campaign in the Val Leventina, these quarrels broke out again, in 1478, when Fribourg, whose influence was greatly increased at the Diet of Stans (December 1487), when it seemed probable that the failure of all attempts to come to an understanding would result in the disruption of the League, the mediation of Nicholas von der Flüe (or Bruder Klaus), a holy hermit of Sachseln in Obwalden, though he did not appear at the Diet in person, succeeded in bringing both sides to reason, and the third great ordinance of the League—the "compact of Stans"—was agreed on. By this the promise of mutual aid and assistance was renewed, especially when one member attacked another, and stress was laid on the duty of the several governments to maintain the peace, and not to help the subjects of any other member in case of a rising. The treasure and movable captors in the war were to be equally divided amongst the combatants, but the territories and towns amongst the members of the League. As a practical proof of the reconciliation, on the same day the towns of Fribourg and Soleure were received as full members of the Confederation, united with all the other members, though on less favourable terms than usual, for they were forbidden to make alliances, save with the consent of all or of the greater part of the other members. Both towns had long been allied with Bern, whose influence was greatly increased by their admission. Fribourg, founded in 1178 by Berthold IV. of Züringen, had on the extinction of that great dynasty (1218) passed successively by inheritance to Kyburg (1218), by purchase to Austria (1277), and by commendation to Savoy (1452); when Savoy gave up its claims in 1477 Fribourg once more became a free imperial city. It had become allied with Bern as early as 1243, but in the 14th and 15th centuries became Romance-speaking, though from 1483 onwards German gained in strength and was the official language in 1578. Soleure (or Solothurn) had been associated with Bern from 1252, but was not admitted to the League in 1411. Both the new members had done much for Bern in the Burgundian War, and it was for their good service that she now procured them this splendid reward, in hopes perhaps of aid on other important and critical occasions.

The compact of Stans strengthened the bonds which joined the members of the Confederation; and the same centralizing tendency is well seen in the attempt (1483-1489) of Hans Waldmann, the burgomaster of Zürich, to assert the rule of his city over the neighbouring country districts, to place all power in the hands of the guilds (whereas by Brun's constitution the patricians had an equal share), to suppress all minor jurisdictions, and to raise a uniform tax. But this idea of concentrating all powers in the hands of the government aroused great resistance, and led to his overthrow and execution. Peter Kistler succeeded (1470) better at Bern in a reform on the same lines, but less sweeping.

The early history of each member of the Confederation, and of the Confederation itself, shows that they always professed to belong to the Empire, trying to become immediately dependent on the emperor in order to prevent oppression by middle lords, and to enjoy practical liberty. The Empire itself had now become very much a shadow; titles and honours were gradually asserting their own independence, sometimes breaking away from it altogether. Now, by the time of the Burgundian War, the Confederation stood in a position analogous to that of a powerful free imperial city. As long as the emperor's nominal rights were not enforced, all went well; but, when Maximilian, in his attempt to reorganize the Empire, erected in 1495 at Worms an imperial chamber which had jurisdiction in all disputes between members of the Empire, the Confederates were not bound to obey it—partly because they could maintain peace at home by their own authority, and partly because it interfered with their practical independence. Again, their refusal to join the "Swabian League," formed in 1488 by the lords and cities of South Germany to keep the public peace, gave further offence, as well as their fresh alliances with France. Hence a struggle was inevitable, and the occasion by reason of which it broke out was the seizure by the Tyrolese authorities in 1499 of the Münsterthal, which belonged to the "Gotteshausbund," one of the three leagues which had gradually arisen in Raetia. These were the "Gotteshausbund" in 1367 (taking in all the dependents of the cathedral church at Chur living in the Oberhalbstin and Engadine); the "Oberr" or "Grauer Bund" in 1395 and 1424 (taking in the abbey of Disentis and many counts and lords in the Vorder Rhein valley, though its name is not derived, as often stated, from the "grey coats" of the first members, but from "graven" or "grafein," as so many counts formed part of it); and the "League of the Ten Jurisdictions" (Zehngerichtenbund), which arose in the Iettiengau and Davos valley (1436) on the death of Count Frederick of Taggenburg, but which, owing to certain Austrian claims in it, was not quite so free as its neighbours. The first and third of these became allied in 1450, but the formal union of the three language districts only from 1524. As documentary proof is wanting, the alleged meeting at Vazeral in 1471, though practically before 1524 they had very much in common. In 1497 the Ober Bund, in 1498 the Gotteshausbund, made a treaty of alliance with the Everlasting League or Swiss Confederation, the Ten Jurisdictions being unable to do more than show sympathy, owing to Austrian claims, which were not bought up till 1649 and 1652. Hence this attack on the Münsterthal was an attack on an "associate" member of the Swiss Confederation, Maximilian being supported by the Swabian League; but its real historical importance is the influence it had on the relations of the Swiss
to the Empire. The struggle lasted several months, the chief fight being that in the Calven gorges (above Mals; May 22, 1499), in which Benedict Fontana, a leader of the Gotteshaushund men, performed many heroic deeds before his death. But, both sides having given up the幻想 of Tirol in the latter half of September 1499. By this the matters in dispute were referred to arbitration, and the emperor annulled all the decisions of the imperial chamber against the Confederation; but nothing was laid down as to its future relations with the Empire. No further real attempt, however, was made to enforce the rights of the emperor, and the Confederation became a state allied with the Empire, enjoying practical independence, though not formally freed till 1648. Thus, 208 years after the origin of the Confederation in 1338, it had got rid of all Austrian claims (1304 and 1474), as well as all practical subjection to the emperor. But its further advance towards the position of an independent state was long checked by religious divisions within, and by the enormous influence of the French king on its foreign relations.

With the object of strengthening the northern border of the Confederation, two more full members were admitted in 1501—Basel and Schaffhausen—on the same terms as Fribourg and Soleure. The city of Basel had originally been ruled by its bishop, but early in the 14th century it became a free imperial city; before 1501 it had made no permanent alliance with the Confederation, though it had been in constant relations with it. Schaffhausen, on the other hand, was an imperial city.

The League expanded to Thirteen Members.

Round the three original members had gathered first five others, united with the three, but not necessarily with each other; and then gradually there grew up an outer circle, consisting of five more, allied with all the eight old members, but tied down by certain stringent conditions. Constance, which seemed called by nature to enter the League, kept aloof, owing to a quarrel as to criminal jurisdiction in the Thurgau, pledged to it before the district was conquered by the Confederates.

The system of giving pensions, in order to secure the right of enlisting men within the Confederation, and of capitulations, by which the different members supplied troops, was originated by Louis XI. in 1474, and later followed by many other princes. Though a tribute to Swiss valour and courage, this practice had very evil results, of which the first fruits were seen in the Milanese troubles (1500-1516), of which the following is a summary. Both Charles VIII. (1484) and Louis XII. (1499 for ten years) renewed Louis XI.'s treaty. The French attempted to win Milan as the largest city on the north side of the Alps mercenaries, some of whom were on the opposite side; and, as brotherly feeling was still too strong to make it possible for them to fight against one another, Lodovico Sforza's Swiss troops shamefully betrayed him to the French at Novara (1500). In 1500, too, the three Forest districts occupied Bellinzona with the Val Benio at the request of its inhabitants, and if 1503 Louis XII. was forced to cede it to them. He, however, often held back the pay of his Swiss troops, and treated them as mere hirelings, so that when the ten years' treaty came to an end, Matthew Schinard, bishop of Sitten (or Sion), induced them to join (1510) the pope, Julius II., then engaged in forming the Holy League to expel the French from Italy. But when, after the battle of Ravenna, Louis XII. became all-powerful in Lombardy, 20,000 Swiss poured down into the Milanese and occupied it, Felix Schmid, the burgomaster of Zürich, naming Maximilian (Lodovico's son) duke of Milan, in return for which he ceded to the Confederates Locarno, Val Maggia, Mendrisio and Lugano (1512), while the Raetian Leagues seized Chavenna, Bormio and the Valtellina. (The former districts, with Bellinzona, the Val Benio and the Val Venentia, were in 1863 made given them two-thirds of the "common has, the latter were held by the French till 1797.) In 1513 the Swiss completely defeated the French at Novara, and in 1515 Peace was sent by Henry VIII. of England to give pensions and get soldiers. Francis I. at once on his accession (1515) began to prepare to win back the Milanese, and, successfully evading the Swiss awaiting his descent from the Alps, beat them in a pitched battle at Marignano near Milan (Sept. 13, 1515), which broke the Swiss power in north Italy, so that in 1516 a peace was made with France—the Valais, the Three Raetian Leagues and both the abbot and town of St. Gall being included on the side of the Confederates. Provision was made for the neutrality of either party in case the other became involved in war, and large pensions were promised. This treaty was extended by another in 1521 (to which Zürich, then under Zwingli's influence, would not agree, holding aloof from the French alliance till 1614), by which the French king might, with the consent of the Confederation, enlist any number of men between 6000 and 16,000, paying them fit wages, and the pensions were raised to 3000 francs annually to each member of the Confederation. These two treaties were the starting point for the Swiss leagues and the old city states.

The Reformation.

In 1499 the Swiss had practically renounced their allegiance to the emperor, the temporal chief of the world according to medieval theory; and in the 16th century a great number of them did the same by the world's spiritual chief, the pope. The scene of the revolt was Zürich, and the leader Ulrich Zwingli (who settled in Zürich at the very end of 1518). But we cannot understand Zwingli's career unless we remember that he was almost more a political reformer than a religious one. In his former character his policy was threefold. He bitterly opposed the French alliance and the pension and other favours of St. Gall being included on the side of the Confederates. These were the starting point for the Swiss leagues and the old city states.

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League. Zürich was greatly moved by this, and, as Zwingli held that for the honour of God war was as necessary as iconoclasm, hostilities seemed imminent; but Bern held back, and the first peace of Kappel was concluded (June 1529), by which the Hungarian alliance was annulled and the principle of “religious parity” (or freedom) was admitted in the case of each member of the League, while in the “common bailiwicks” the majority in each parish was to decide the religion of that parish. This was at once a victory and a check for Zwingli. He tried to form an alliance with Paris, but failed at meeting at Marburg (October 1529) to come to an agreement, with Luther on the subject of the Eucharist, and the division between the Swiss and the German Reformation was stereotyped. Zwingli now developed his views as to the greater weight which Zürich and Bern ought to have in the League. Quarrels, too, went on in the “common bailiwicks,” for the members of the League who clung to the old faith had a majority of votes in matters relating to these districts. Zürich tried to cut off supplies of food from reaching the Romanist members (who were in the wishes of Zwingli), and, on the abbot of St Gall, disregarding the rights of Lucerne, Schwyz and Glarus, who shared with her since 1451 the office of protectors of the abbey, suppressed the monastery, giving the rule of the land and the people to her own officers. Bern in vain tried to moderate this aggressive policy, and the Romanist members of the League indignantly advanced from Zug towards Zürich. Near Kappel, on the 11th of October 1531, the Zürich vanguard under Gúldi was (perhaps owing to his treachery) surprised, and despite reinforcements the men of Zürich were beaten, among the slain being Zwingli himself. Another defeat completed the discomfiture of Zürich, and both the second and third battles of Kappel (November 1531) the principle of “parity” was recognized, not merely in the case of each member of the League and of the “common bailiwicks,” but in the latter Romanist minorities in every parish were to have a right to celebrate their own worship. Thus everywhere the rights of a minority were protected from the encroachments of the majority. The “Christliches Burgrecht” was abolished, and Zürich was condemned to pay heavy damages. Bullinger succeeded Zwingli, but this treaty meant that neither side could now try to convert the other wholly, the League was permanently split into two religious camps: the Romanists, who met at Lucerne, number, besides the five already mentioned, Fribourg, Soleure, Appenzell (Inner Rhoden) and the abbot of St Gall (with the Valais and the bishop of Basel), thus commanding sixteen votes (out of twenty-nine) in the Diet; the Evangelicals were Zürich, Bern, Schaffhausen, Appenzell (Außer Rhoden), Glarus and the towns of St Gall, Basel and Bienna (with Graubünden), who met at Aarau.

Bern had her eyes always fixed upon the Savoyard lands to the southwest, in which she had got a footing in 1475, and now Conquest of thole zeal for religious reforms the excuse for resuming her advance policy. In 1526 Guillaume Farel, a preacher from Dauphiné, had been sent to reform Aigle, Morat and Neuchâtel. In 1532 he came to Geneva, an ancient city of which the rule had long been disputed by the prince-bishop, the burgesses and the house of the nobles, the latter holding the neighbouring districts. She had become in 1519 the ally of Fribourg, in 1526 that of Bern also; and in 1530, by their influence, a peace was made between the contending parties. The religious changes introduced by Farel greatly displeased Fribourg, which abandoned the alliance (1534), tried in 1535 the Reformation was firmly planted in the city. The Duke of Savoy, however, took up arms against Bern (1536), who overran Geneva, captured and the independent bishopric of Lausanne, as well as the Chablais to the south of the lake. Geneva was only saved by the unwillingness of the citizens. Bern thus ruled north and south of the lake, and carried matters with a high hand. Shortly after this John Calvin, a refugee from Picardy, was, when passing through Geneva, detained by Farel to aid him, and, after an exile from 1535-1541, owing to opposition of the papal party and of the burghers, who objected to Bernese rule, he was recalled (1541) and set up his wonderful theocratic government in the city, in 1553 burning Servetus, the Unitarian (see Calvin and Servetus), and in 1555 expelling many who upheld municipal liberty, replacing them by French, English, Italians and Spaniards as new burghers, whose names are still frequent in Geneva (e.g. Candolle, Mallet, Diodati). His theological views led to disputes with the Zürich Reformers, which were partly settled by the Consensus Tigurinus of 1540, and more completely by the Helvetic Confession of 1562-1566, which formed the basis of union between the two parties.

In the Thirty Years’ War the League was still subject to frequent changes. The old faith had begun to take the offensive; the reforms made by the Council of Trent urged on the Romanists to make an attempt to recover lost ground. Emmanuel Philibert, duke of Savoy, the hero of St Quentin (1557), and one of the greatest generals of the day, with the support of the Romanist members of the League, demanded the restoration of the districts seized by Bern in 1536, and on the 30th of October 1564 the Treaty of Lausanne confirmed the decision of the other Confederates sitting as arbitrators (according to the old constitutional custom). By this treaty Gex, the City of Savoy, the Chablais were to be given back, while Lucerne, Vevey, Chillon, Villeneuve, Nyon, Avenches and Yverdon were to be kept by Bern, who engaged to maintain the old rights and liberties of Vaud. Thus Bern lost the lands south of the lake, in which St Francis of Sales, the exiled prince-bishop of Geneva (1602-1622), at once proceeded to carry out the restoration of the old faith, at 1555 Bern and Fribourg, as creditors of the debt-laden count, divided the county of Gruyère, thus getting French-speaking subjects. In 1558 Geneva renewed her alliance with Bern, and in 1584 she made one with Zürich. The duke of Savoy made several vain attempts to get hold of Geneva, the last (1630) being known as the “escalade.”

The decrees of the Council of Trent had been accepted fully by the Romanist members of the League, so far as relates to dogma, but not as regards discipline or the relations of the Counter-Reformation, however, or reaction in favour of the old faith, was making rapid progress in the Confederation, mainly through the indefatigable exertions of Charles Borromeo, from 1560 to 1584 archbishop of Milan (in which diocese the Italian Italians were included), and nephew of Pius IV, supported at Lucerne by Ludwig Pfiffer, who, having been (1562-1570) the chief of the Swiss mercenaries in the French wars of religion, did so much till his death (1594) to further the religious reaction at home that he was popularly known as the “Swiss king.” In 1574 the Jesuits, the great order of the reaction, were established at Lucerne; in 1579 a papal nuncio came to Lucerne; Charles Borromeo founded the “Collegium Helveticum” at Milan for the education of forty-two young Swiss, and the Catholic members of the League made an alliance with the bishop of Basel; in 1581 the Capuchins were introduced to influence the more ignorant classes. Most important of all was the Golden or Borromean League, concluded (Oct. 5, 1586) between the seven Romanist members of the Confederation (Uri, Schwyz, Unterwalden, Lucerne, Zug, Fribourg and Soleure) for the maintenance of the true faith in their territories, each engaging to punish backsliding members and to help each other if attacked by external enemies, notwithstanding any other leagues, old or new. This league marks the final breaking up of the Confederation into two great parties, which greatly hindered its progress. The Romanist members had a majority in the Diet, and were therefore able to refuse the Diet—“Inner Rhoden” remaining Romanist, “Außer Rhoden” adopting the new views. We may compare with this the action of Zürich in 1555, when she received the Protestant exiles (bringing with them the silk-weaving industry) from Locarno and the Italian bailiwicks into her burghership, and Italian names are found there to this day (e.g. Orelli, Murali).

In the Thirty Years’ War the Confederation remained neutral, being bound both to Austria (1643) and to France (1576), and
neither religious party wishing to give the other an excuse for calling in foreign armies. But the troubles in Raetia threatened entanglements. Austria wished to secure the Münsterthal (conquered by the leagues of Raetia in 1512), the object being to connect the Habsburg lands of Tirol and Milan. In the Valtellina the rule of the Three Raetian Leagues was very harsh, and Spanish intrigues easily brought about the massacre of 1620, by which the valley was won, the Romanist members of the Confederation stopping the troops of Zürich and Bern. In 1622 the Austrians conquered the Prättigau, over which they still had certain feudal rights. French troops regained the Valtellina in 1624, but it was occupied once more in 1629 by the imperial troops, and it was not till 1667 that the French, under Rohan, finally succeeded in holding it. The French, however, wished to keep it permanently; hence new troubles arose, and in 1637 the natives, under George Jenatsch, with Spanish aid drove them out, the Spaniards themselves being forced to resign it in 1639. It was only in 1649 and 1652 that the Austrian rights in the Prättigau were finally bought up by the League of the Ten Jurisdictions, which thus gained its freedom.

In consequence of Ferdinand II.'s edict of restitution (1620), by which the status quo of 1552 was re-established—the high-water mark of the curzer-Reformation—the abbot of St Gall tried to make some religious changes in his territories, but the protest of Zürich led to the Baden compromise of 1632, by which, in the case of disputes on religious matters arising in the "common bailiwicks," the decision was to be, not by a majority of the cantons, but by means of friendly discussion—a logical application of the doctrine of religious parity—or by arbitration. But by far the most important event in Swiss history in this age is the formal freeing of the Confederation from the empire. Basel had been admitted a member of the League in 1501, two years after the Confederation had been formed, and the Basel zugspitz, or council, though the city was included in the new division of the empire into "circles" (1524), which did not take in the older members of the Confederation. Basel, however, refused to admit this jurisdiction; the question was taken up by France and Sweden at the congress of Münster, and formed the subject of a special clause in both the treaties of Westphalia, by which the city of Basel and the other "Helvetiorum cantones" were declared to be "in the possession, or almost in the possession, of entire liberty and exemption from the empire, and in all cases they are to be subject only to the laws of their respective states, and in no case to be driven to mean formal exemption from all obligations to the empire (with which the Confederation was connected hereafter simply as a friend), and to be a definitive settlement of the question. Thus by the events of 1499 and 1648 the Confederation had become an independent European state, which, by the treaty of 1516, stood as regards France in a relation of neutrality.

In 1668, in consequence of Louis XIV.'s temporary occupation of the Franche Comté, an old scheme for settling the number of men to be sent by each member of the Confederation to the joint army, and the appointment of a council of war in war time, that "Garde de guerre," where the vote of Bern was counted as two votes, was revived to mean formal exemption from all obligations to the empire (with which the Confederation was connected hereafter simply as a friend), and to be a definitive settlement of the question. Thus by the events of 1499 and 1648 the Confederation had become an independent European state, which, by the treaty of 1516, stood as regards France in a relation of neutrality.

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The Diet had few powers; the Romanists had the majority there, the foreign rights of each member of the League and the limited mandate of the electors not being sufficiently effective to impress Zürich, as the leader of the League, managed matters when the Diet was not sitting, but could not enforce her orders. The Confederation was little more than a collection of separate atoms, and it is really marvellous that it did not break up through its own weakness.

In these same two centuries, the chief feature in domestic Swiss politics is the growth of an aristocracy—the power of voting and the power of ruling are placed in the hands of a small class. This is chiefly seen in Bern, Lucerne, Fribourg and Solothurn, where the aristocracy is strong, or in the smaller local units of the "communes" in the rural districts) with the question of poor relief after the suppression of the monasteries. Outsiders (Hinterasse or niedergelässene) had no political rights, however long they might have resided, while the privileges of burghership were strictly hereditary. Further, within the burghers, a small class succeeded in securing the monopoly of all public offices, which was kept up by the practice of co-opting, and was known as the "patriciate." So in Bern, out of 360 burgher families 69 only towards the close of the 18th century formed the ruling oligarchy—and, though to foreigners the government seemed
 admirably managed, yet the last thing that could be said of it was that it was democratic. In 1749 Samuel Henzi (dis-
gusted at being refused the post of town librarian) made a
fruitless attempt to overthrow this oligarchy, like the lawyer,
Pierre Fatio at Geneva in 1707. The harsh character of Bernese
rule (and the same holds good with reference to Uri and the
Val Leventina) was shown in the great strictness with which its
subject land Vaud was kept in hand: it was ruled as a
conquered land by a benevolent despot, and we can feel no
surprise that Major J. D. A. Davel in 1723 tried to free his
native land, or that it was in Vaud that the principles of
liberalism were first enunciated in the eighteenth century.
Another result of this aristocratic tendency was the way in which
the cities despised the neighbouring country districts, and managed
gradually to deprive them of their equal political rights and to
levy heavy taxes upon them. These and other grievances (the fall in the price of food after the close of the Thirty Years' War, the lowering of the value of the coin, &c.), combined with
the presence of many soldiers discharged after the great war,
led to the great Peasant Revolt (1753) in the territories of
Bern, Soleure, Lucerne and Basel, interesting historically as being
the first popular rising in the Swiss cantons of the eighteenth
century, and because reminiscences of legends connected
with those times led to the appearance of the "three Tells,"
which greatly stirred up the people. The rising was put down at
the cost of much bloodshed, but the demands of the peasants
were not granted.

Yet during this period of political powerlessness
a Swiss literature first arises: Conrad Gesner and Giles
Tschudi in the 16th century are succeeded by J. J. Scheuchzer,
A. von Haller, J. C. Lavater, J. J. Bodmer, H. B. de Sausserre,
J. J. Rousseau, J. v. Müller; the taste for Swiss travel is
stimulated by the publication (1743) of the first real Swiss
guide-book by J. G. Ebel (q.v.), based on the old Dicia:u;
industry thrived greatly. The residence of such brilliant foreign
writers as Gibbon and Voltaire within or close to the territories
of the Confederation helped on this remarkable intellectual
revival. Political aspirations were not, however, wholly
crushed, and found their centre in the Helvetic Society,
launched in 1762 by F. U. Balthasar and others.

The Confederation and France had been closely connected for
so long that the outbreak of the French Revolution could
not fail to affect the Swiss. The Helvetic Club, chiefly
founded by the Unterwaldners and Fribourgers, was the centre from which the new
ideas were spread in the western part of the Confederation,
disorders rising or stirred up. In 1790 the
Lower Valais rose against the oppressive rule of the upper
districts; in 1791 Porrentruy defied the prince-bishop of Basel,
despite the imperial troops he summoned, and proclaimed (November 1792) the "Raourach republic," which three
months later (1793) became the French department of the
Mont Terrible; Geneva was only saved (1792) from France by
a force sent from Zürich and Bern; while the massacre of the
Swiss guard at the Tuileries on the 10th of August 1792 aroused
intense indignation. The rulers, however, unable to enter into
the new ideas, contented themselves with suppressing
them by force, e.g. Zürich in the case of Stäfa (1795). St Gall
managed to free itself from its prince-abbot (1795-1797), but the
Leagues of Raetia so opposed their subjects in the Valtellina
that in 1797 Bonaparte (after conquering the Milanese from the
Austrians) joined them to the Cisalpine republic. The Diet
was distracted by party struggles and the fall of the old Con-
federation was not far distant. The rumours of the vast
treasures stored up at Bern, and the desire of securing a bulwark
against Austrian attack, specially turned the attention of the
directory towards the Confederation; and this was utilized
by the heads of the Reform party in the Confederation—Peter
Ochs (1752-1821), the burgomaster of Basel, and Frédéric
César Laharpe (1754-1838; tutor, 1783-1794, to the later
tsar Alexander I.), who had left his home in Vaud through
disguise at Bernese oppression, now wished for aid from
outside in order to free their land from the rule of the oligarchy.

Hence, when Laharpe, at the head of some twenty exiles from
Vaud and Fribourg, called (Dec. 9, 1797) on the Directory
to protect the liberties of Vaud, which, so he said (by a bit of
purely apocryphal history), France by the treaty of 1565 was
bound to guarantee, his appeal found a ready answer. In
February 1798 French troops occupied Mühlhausen and Bienne
(Biel), as well as those parts of the lands of the prince-bishop
of Basel (St Imier and the Münstertal) as regards which he
had since 1579 the ally of the Catholic members of the
Confederation. Another army entered Vaud (February 1798),
then the "Lemanic republic was proclaimed, and the Diet
broke up in Zürich on May 5th, proceeding to the storm. Brune
and his army occupied Fribourg and Soleure, and,
affter, with violence engaging on Neuenegg, entered (March 5)
Bern, deserted by her allies and distracted by quarrels within.
With Bern, the stronghold of the aristocratic party, fell the
old Confederation. The revolution triumphed throughout the
country. Brune (March 16-19) put forth a wonderful
scheme by which the Confederation with its "associates " and
"subjects" was to be split into three republics—the Telligau
(i.e. the forest districts), the Rhodanische (i.e. Vaud, the Valais,
the Bresse), the Oberland or upper districts of the Valais,
and the Helvetic (i.e. the northern and eastern portions); but the
directory disapproved of this (March 23), and on the 29th of March
the "Helvetic republic, one and indivisible," was proclaimed.
This was accepted by ten cantons only as well as (April 12) the constitution drafted
by Ochs. By the new scheme the territories of the Everlasting
League were split up into twenty-three (later nineteen, Raetia
only coming in 1799) administrative districts, called " cantons,"
a name now officially used in Switzerland for the first
time, though it may have been found employed by foreigners in the French treaty of 1795, in Conwyom and Machiaveli, and in
the treaties of Westphalia (1648). A central government
was put up, with its seat at Lucerne, comprising a senate and a great
council, together forming the legislature, and named by electors
chosen by the people in the proportion of 1 to every 100 citizens,
with an executive of five directors chosen by the legislature,
and having four ministers as subordinates or "chief secretaries."
A supreme court of justice was set up; a status of Swiss citizens-
ship was recognized; and absolute freedom to settle in any
canton was given, the political "communes" being now com-
ting under the presidency of the Federal council, and the
individuals for the first time an attempt was made to organize the Confederation
as a single state, but the change was too sweeping to last, for
it largely ignored the local patriotism which had done so much
to create the Confederation, though more recently it had made
it politically powerless. The three Forest districts rose in
rebellion against the invaders and the new constitutions which
destroyed their ancient prerogatives; but the valiant resistance of the
Schwyzers, under Alois Reding, on the heights of
Morgarten (April and May), and that of the Unterwaldners (August and September), were put down by French armies.
The proceedings of the French, however, soon turned into disorder
and hatred the joyful feelings with which they had been hailed
as liberators. Geneva was annexed to France (April 1798);
Gersau, after an independent existence of over 400 years, was
made a mere district of Schwyz; immense fines were levied and
the treasury at Bern pillaged; the land was treated as if it had been
conquered. The new republic was compelled to make a
very close offensive and defensive alliance with France, and
its directors were practically nominated from Paris. In June-
October 1799 Zürich, the Forest cantons and Raetia became
the scene of the struggles of the Austrians (welcomed with joy)
against the French and Russians. The manner, too, in which
the reforms were carried out alienated many, and, soon after
the directory gave way to the consulate in Paris (18 Brumaire or
Nov. 10, 1799), the Helvetic directory (January 1800) was
replaced by an executive committee.
The scheme of the Helvetic republic had gone too far in the direction of centralization; but it was not easy to find the happy
mean, and violent discussions went on between the "Unitary"

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(headed by Ochs and Labarde) and "Federalist" parties. Many drafts were put forward and one actually submitted to be rejected by a popular vote (June 1802). In July 1802 the French troops were withdrawn from Switzerland by Bonaparte, ostensibly to comply with the treaty of Amiens, really to show the Swiss that their best hopes lay in appealing to him. The Helvetic government was gradually driven back by armed force, and the Federalists seemed getting the best of it, when (Oct. 4) Bonaparte, sending himself as dictator, and summoned ten of the chief Swiss statesmen to Paris to discuss matters with him (the "Consulta")—December 1802.

He had long taken a very special interest in Swiss matters, and in 1802 had given to the Helvetic republic the Frickthal (ceded to France in 1801 by Austria), the last Austrian possession within the borders of the Confederation. On the other hand, he had made (August 1802) the Valais into an independent republic. In the discussions he pointed out that Swiss needs required a federal constitution and a neutral position guaranteed. Finally (Feb. 19, 1803) he had before the Consulta the Act of Mediation which he had elaborated and which they had perforce to accept—a document which formed a new departure in Swiss history, and the influence of which is visible in the present constitution.

Throughout, "Switzerland" is used for the first time as the official name of the Confederation. The thirteen members of the old Confederation before 1798 are set up again, and to them are added six new cantons—two (St Gall and Graubünden or Grisons) having been formerly "associates," and the four others being made up of the subject lands conquered at different times—Aargau, Zurich, Solothurn, Thurgau (acquired by the Confederation in 1798). The latter was given to Obwalden. By the new constitution the sovereign rights of each canton were fully recognized, and a return made to the lines of the old constitution, though there were to be no subject lands, and political rights were not to be the exclusive privilege of any class of citizens. Each canton had one vote in the Diet, where an absolute majority was to decide all matters save foreign affairs, when a majority of three-fourths was required. The management of current business, &c., shifted every two years between the governments of Zurich, Bern and Lucerne (the last designated "the Vororte"). The monasteries were guaranteed in their rights and privileges; and no canton was to make any alliance contrary to the rights of the Confederation or of any other canton. Provision was made for a Federal army. Finally, the Congress, on the 20th of November 1815, placed Switzerland and parts of North Savoy (Chablais, Faucigny and part of the Genevois) under the guarantee of the Great Powers, who engaged to maintain their neutrality, thus freeing Switzerland from her 300 years' subservience to France, and compensating in some degree for the reactionary nature of the new Swiss constitution when compared with that of 1802.

The cities at once secured for themselves in the cantonal councils an overwhelming representation over the neighbouring country districts, and the agreement of 1805 as to migration from one canton to another was renewed (1819) by twelve cantons. For some time there was little talk of reforms, but in 1819 the Helvetic Society definitely became a political society, and the foundation in 1824 of the Marksmen's Association enabled men from all cantons to meet together. A few cantons (notably Tessin) were beginning to make reforms, when the influence of the July revolution (1830) in Paris and the sweeping changes in Zurich led the Diet to declare (Dec. 27) that it would not interfere with any reforms of cantonal constitutions provided they were in agreement with the pact of 1815. Hence for the next few years great activity in this direction was displayed, and most of the cantons reformed themselves, save the most conservative (e.g. Uri, Glarus) and the advanced who needed no changes (e.g. Geneva, Graubünden).

Attempts at Reform.

Another (though given by the constitution) was, by the Diet in 1805, restricted by requiring ten years' residence, and then not granting political rights in the canton or a right of profiting by the communal property. As soon as Napoleon's power began to wane (1812—1813), the position of Switzerland became endangered. Despite the personal wishes of the tsar (a pupil of Labarde's), the Austrians, supported by the reactionary party in Switzerland, and without any real resistance on the part of the Federalists, were allowed to occupy the country from the 21st of December 1813, and on the 29th of December the Diet was induced to declare the abolition of the 1803 constitution, guaranteed, like Swiss neutrality, by Napoleon. Bern headed the party which wished to restore the old state of things, but Zürich and the majority stood out for the nineteen cantons. The powers exercised great pressure to bring about a meeting of deputies from all the nineteen cantons at Zürich (April 6, 1814, "the long Diet"); party strife was very bitter, but on the 12th of September it decided that the Valais, Neuchâtel and the three "Vororte" should be raised from the rank of "associates" to full members of the Confederation (thus making up the familiar twenty-two). As compensation the congress of Vienna (March 20, 1815) gave Bern the town of Bienna (Biel), and all (save a small part which went to Basel) of the territories of the prince-bishop of Basel ("the Bernese Jura"); but the Valtellina was granted to Austria, and Mühlhausen was not freed from France.

On the 7th of August 1815 the new constitution was sworn to by all the cantons save Nidwalden, the consent of which was only obtained (Aug. 30) by armed force, a delay for which she paid by a second Engelberg, and the vast area (acquired by Nidwalden in 1798) given over to Obwalden. By the new constitution the sovereign rights of each canton were fully recognized, and a return made to the lines of the old constitution, though there were to be no subject lands, and political rights were not to be the exclusive privilege of any class of citizens. Each canton had one vote in the Diet, where an absolute majority was to decide all matters save foreign affairs, when a majority of three-fourths was required. The management of current business, &c., shifted every two years between the governments of Zürich, Bern and Lucerne (the last designated "the Vororte"). The monasteries were guaranteed in their rights and privileges; and no canton was to make any alliance contrary to the rights of the Confederation or of any other canton. Provision was made for a Federal army. Finally, the Congress, on the 20th of November 1815, placed Switzerland and parts of North Savoy (Chablais, Faucigny and part of the Genevois) under the guarantee of the Great Powers, who engaged to maintain their neutrality, thus freeing Switzerland from her 300 years' subservience to France, and compensating in some degree for the reactionary nature of the new Swiss constitution when compared with that of 1802.
question of revising the Federal pact was brought forward by a large majority of cantons in the Diet (July 17), whereon, by the league of Samen (Nov. 14), the three Forest cantons, with Neuchâtel, the city of Basel, and the Valais, agreed to maintain the pact of 1815 and to protest against the separation of Basel in two halves (for in the reform struggle Schwyz and Basel had been split up, though the split was permanent only in the latter case). A draft constitution providing for a Federal administration distinct from the cantons could not secure a majority in its favour; a reaction against reform set in, and the Diet was forced to sanction (1833) the division of Basel into the "city" and "country" divisions (each with half a vote in the Diet), though fortunately in Schwyz the quarel was healed. Religious questions were also involved in the struggle, which was a canton where religious parity prevailed, later in others. In Zürich the extreme pretensions of the Radicals and freethinkers (illustrated by offering a chair of theology in the university to D. F. Strauss of Tübingen because of his Life of Jesus, then recently published) brought about a great reaction in 1839, when Zürich was the "Vorort."

In Aargau the parties were very evenly balanced, and, when in 1840, on occasion of the revision of the constitution, the Radicals had a popular majority the aggrieved clerics stirred up a revolt (1840), which was put down early in which gave rise to a new crisis in the autumn of 1841. kicked the soil, with Koller, an attempt for carrying a vote in the great council to suppress the eight monasteries in the canton (Jan. 1841). This was flatly opposed to the pact of 1815, which the Diet by a small majority decided must be upheld (April 1841), though after many discussions it determined (Aug. 31, 1843) to accept the compromise by which the men's convents only were to be suppressed, and declared that the matter was now settled. On this the seven Romanist cantons—Urs, Schwyz, Unterwalden, Lucerne, Zug, Fribourg and the Valais—formed (Sept. 13, 1843) a "Sonderbund" or separate league, which (February 1844) was suppressed, but its head, by August, was the question and the restoration of all the monasteries. Like the Radicals in former years the Romanists went too far and too fast, for in October 1844 the clerical party in Lucerne (in the majority since 1841, and favouring the reaction in the Valais) officially invited in the Jesuits and gave them high posts, an act which created all the more sensation because Lucerne was the "Vorort." Twice (December 1844 and March 1845) parties of free aves tried to capture the city. In December 1845 the Sonderbund turned itself into an armed confederation, ready to rebel at war in the rights of each canton. The Radicals carried Zürich in April 1845 and Bern in February 1846, but a majority could not be secured in the Diet till Geneva (Oct. 1846) and St Gall (May 1847) were won by the same party. On the 20th of July 1847, the Diet, by a small majority, declared that the Sonderbund was contrary to the Federal pact, which on the 16th of August it was resolved to revise, while on the 3rd of September it was decided to invite each canton to expel the Jesuits. Most of the Great Powers favoured the Sonderbund, but England took the contrary view, and the attempt of Metternich, supported by Louis Philippe, to bring about European intervention, on the pret of upholding the treaties of Vienna, was frustrated by the policy of masterly inactivity pursued by Lord Palmerston, who delayed giving an answer till the forces of the Sonderbund had been defeated, a friendly act that is still gratefully remembered in the country.

On the 29th of October the deputies of the unyielding cantons left the Diet, which ordered on the 4th of November that its decree should be enforced by arms. The war was short (Nov. 10–30), mainly owing to the ability of the general, G. H. Dufour (1787–1873), and the loss of life trifling. One after another the rebellious cantons were forced to surrender, and, as the Paris revolution of February 1848, entailing the retirement of Guizot (followed three weeks later by that of Metternich), occupied all the attention of the Great Powers (who by the constitution of 1815 should have been consulted in the revision of the pact), the Swiss were enabled to settle their own affairs quietly. Schwyz and Zug abolished their 19th-century "landsgemeinden," and the seven were condemned to pay the costs of the war (ultimately defrayed by subscription), which had been waged rather on religious than on strict particularist or states-rights grounds. The Diet meanwhile debated the draft constitution drawn up by Johann Conrad Kern (1808–1888) of Thurgau and Henri Druey (1790–1853) of Vaud, in which the summer of 1848 was accepted by fifteen and a half cantons, the minority consisting of the three Forest cantons, the Valais, Zug, Tessin and Appenzell (Inner Rhoden), and it was proclaimed on the 12th of September.

The new constitution inclined rather to the Act of Mediation than to the system which prevailed before 1798. A status of "cantonal citizenship" was set up, closely joined to the Federal constitution; a man settling in a canton and taking his birthplace got cantonal citizenship after a residence of at most two years, but was excluded from all local rights in the "commune" where he might reside. A Federal or central government was set up, to which the cantons gave up a certain part of their sovereign rights, retaining the rest. The Federal Legislature (or assembly) was made up of two houses—the Council of States (Ständerat), composed of two deputies from each canton, whether small or great (44 in all), and the National Council (Nationalrat), made up of deputies elected for three years, in the proportion of one for every 20,000 souls or fraction over 10,000, the electors being all Swiss citizens.

The Federal council or executive (Bundesrat) consisted of seven members elected by the Federal Assembly sitting as a congress; they were jointly responsible for all business, though for sake of convenience there were various departments, and their chairman was called the president of the Confederation. The Federal judiciary (Bundesgericht) was made up of eleven members elected for three years by the Federal Assembly sitting in congress; its jurisdiction was chiefly confined to civil cases, in which the Confederation was a party (if a canton, the Federal tribunal), or cases of Federal law (the Federal tribunal), but took in also great political crimes—all constitutional questions, however, being reserved for the Federal Assembly. A Federal university and a polytechnic school were to be founded. All military capitulations were forbidden in the future. Every canton must treat Swiss citizens who belong to one of the Christian confessions like their own citizens, for the right of free settlement is given to all such, though they acquired no rights in the "commune." All Christians were guaranteed the exercise of their religion, but the Jesuits and similar religious orders were not to be received in any canton. German, French and Italian were recognized as national languages.

The constitution as a whole marked a great step forward; though very many rights were still reserved to the cantons, yet there was a fully organized central government. Almost the first act of the Federal Assembly was to exercise the power given them of determining the home of the Federal authorities, and on the 28th of November 1848 Bern was chosen, though Zürich still ranks as the first canton in the Confederation. Soon after 1848 a beginning was made of organizing the different public services, which had now been brought within the jurisdiction of the central Federal authority. Thus in 1849 a uniform letter post service was established, in 1854 telegraph replaced the intricate cantonal currencies, while all customs duties between cantons were abolished; in 1851 the telegraph service was organized, while all weights and measures were unified (in 1868 the metrical system was allowed, and in 1875 declared obligatory and universal), in 1854 roads and canals were taken in hand, while finally in 1855 the Federal Polytechnic School at Zürich was opened, though the Federal university authorized by the new constitution has not yet been set up. These were some of the non-political benefits of the creation of a Federal central executive. But in 1852 the Federal Assembly decided to leave the construction of railways to private enterprise and so had to buy them up in 1903 at a vastly enhanced price.

By this early settlement of disputes Switzerland was protected from the general revolutionary movement of 1848, and in later
years her political history has been uneventful, though she has felt the weight of the great European crises in industrial and social matters. The position of Neuchâtel, as a member of the Confederation (as regards its government only) and as a principality ruled by the king of Prussia, whose rights had been expressly recognized by the congress of Vienna, was uncertain. She had not sent troops in 1847, and, though in 1848 there was a republican revolution there, the prince did not recognize the changes. Finally, a royalist conspiracy in September 1856 to undo the work of the cantonal elections of 1848 and to revoke the constitution, and it was only by the mediation of Napoleon III and the other powers that the prince renounced (1857) all his rights, save his title, which his successor (the German emperor) has also dropped. Since that time Neuchâtel has been an ordinary member of the Confederation. In 1859-1860 the cession of Savoy (part of it neutralized in 1845) to France aroused considerable indignation, and in 1862 the long-standing question of frontiers in the Vallée des Dappes was finally arranged with France. In 1871 many French refugees, especially Bourbaki’s army, were most hospitably received and sheltered. The great influx of the new Catholics after the Vatican Council (1870) caused many disturbances in western Switzerland, especially in the Bernese Jura. The attack was led by Bishop Eugène Lachat (1819-1886) of Basel, whose see was suppressed by several cantons in 1873, but was set up again in 1884, though still not recognized by Bern. The appointment by the pope of the abbé Gaspard Mermilford (1824-1893) as “apostolic vicar” of Geneva, which was separated from the diocese of Fribourg, led to Monsieur Mermilford’s banishment from Switzerland (1873), but in 1883 he was raised to the vacant see of Lausanne and Geneva and allowed by the Federal authorities to return, though Geneva refused to recognize him, though he was created a cardinal in 1890. An event of great importance to Switzerland was the opening of the St Gotthard tunnel, which was begun in 1871 and opened in 1882; by it the Forest cantons seem likely to regain the importance which was theirs in the early days of the Confederation.

From 1848 onwards the cantons continually revised their constitutions, always in a democratic sense, though after the Sonderbund War Schwyz and Zug abolished their “lands-gemeinden” (1848). The chief point was the introduction of the principles of popular election and majority rule, developed by the growth of the Old Catholics. Laws on the “facultative” form; i.e. all federal laws must be submitted to popular vote on the demand of 30,000 Swiss citizens or of eight cantons. But the “Initiative” (i.e. the right of compelling the legislature to consider a certain subject or bill) was not introduced into the Federal Constitution till 1891 (when it was given to 50,000 Swiss citizens) and then only as to a partial (not a total) revision of that constitution. By the constitutions of 1848 and 1874 Switzerland has ceased to be a mere union of independent states joined by a treaty, and has become a single state with a well-organized central government, to which have been added two major cantons and several minor territories, and it is by no means certain that increased centralization would destroy the whole character of the Confederation, in which the cantons are not administrative divisions but living political communities. Swiss history teaches us, all the way through, that Swiss liberty has been won by a close union of many small states, and we cannot doubt that it will be best preserved by the same means, and not by obliterating all local peculiarities, nowhere so striking and nowhere so historically important as in Switzerland.

M. Numa Droz (who was for seventeen years—1876 to 1892—a member of the Federal executive, and twice, in 1883 and in 1887, president of the Swiss Confederation) expressed the opinion shortly before his death in December 1890 (he was born in 1844) that while the dominant note of Swiss politics from 1848 to 1874 was the establishment of a Federal state, that of the period extending from 1874 to 1899 (and this is true of a later period) was the direct rule of the people, as distinguished from government by elected representatives. Whether this distinction be just or not, it is certain that this advance towards democracy in its true sense is due indirectly to the monopoly of political power in the Federal government enjoyed by the Radical party (from 1898 onwards). Many were willing to go with it some part of the way, but its success in maintaining its close monopoly has provoked a reaction against it on the part of those who desire to see the Confederation remain a Confederation, and not become a strongly centralized state, contrary to its past history and genius. Hence after 1874 we find that democratic measures are not advocated as we should expect by the Radicals, but by all the other political parties with a view of breaking down this Radical monopoly, for it is a strange fact that the people elect and retain Radical representatives, though they reject the Federal executive, before they will give its approval by the said Radical representatives. For they represent the Radicals and Centralists (the two permanent political parties in Switzerland), which up to 1874 resulted in favour of the Centralists, has been turning gradually in favour of the Radicals, and that because of the adoption of such democratic institutions as the Referendum and the Initiative.

The general lines on which Swiss politics have run since 1874 may be most conveniently summarized under three headings—the working of the political machinery, the principal political events, and the chief economical and financial features of the period. But it must be always borne in mind that all the following remarks relate only to Federal politics, those of the several cantons being much more intricate, and of course turning more on purely local differences of opinion.

1. Political Machinery.—The Federal Constitution of 1848 set up a permanent Federal executive, legislature and tribunal, each and all quite distinct from and independent of any cantonal government. This system was a modified revival of the state of things that had prevailed from 1798 to 1803, and was an imitation of the political changes that had taken place in the cantonal constitutions after 1830. Both were victories of the Centralist or Radical party, and it was therefore but natural that this party should be called upon to undertake the Federal government under the new constitution, a supremacy that it has kept ever since. To the Centralists the Council of States (two members from each canton, however large or small) has always been a stumbling-block, and they have mockingly nicknamed it “the fifth wheel of the coach.” In the other house of the Federal legislature, the National Council (one member per 20,000, or fraction of over 10,000 of the entire population), the
Radicals have always since its creation in 1848 had a majority. Hence, in the Congress formed by both houses sitting together, the Radicals have had it all their own way. This is particularly important as regards the election of the seven members of the Federal executive which is made by such a Congress. Now the Federal executive (Federal Council) is in no sense a cabinet, i.e., a committee of the party in the majority in the legislature for the time being. In the Swiss Federal Constitution the cabinet has no place at all. Each member of the Federal executive is elected by a separate ballot, and holds office for the fixed term of three years, during which he cannot be turned out of office, while as yet but a single instance has occurred of the rejection of a Federal councillor who offered himself for re-election. Further, none of the members of the Federal executive can hold a seat in either house of the Federal legislature, though they may appear at its sittings, but this is an ex officio only, i.e., while the Federal Council as such has not necessarily any common policy, and never expresses its views on the general situation (though it does as regards particular legislative and administrative measures) in anything resembling the "speech from the Throne" in England. Thus it seems clear that the Federal executive was intended by the Federal Constitution of 1848 (and in this respect that of 1874 made no change) to be a standing committee of the legislature as a whole, but not of a single party in the legislature, or a "cabinet," even though it had the majority. Yet this rule of a single political party is just what has taken place. Between 1848 and the end of 1908, 38 Federal councillors were elected (24 from German-speaking, 12 from French-speaking and 2 from Italian-speaking Switzerland, the canton of Vaud heading the list with 7). Now of these 38 three only were not Radicals, viz. M. Paul Ceresole (1870-1872) of Vaud, who was a Protestant Liberal-Conservative, Herren Josef Zemp (1891-1908) and Josef Anton Schobinger (elected 1908), both of Lucerne and Romaniot Conservatives, yet the Conservative minority is a large one, while the Romanists form about two-fifths of the population of Switzerland. But despite this predominance of a single party in the Federal Council, no true cabinet system has come into existence in Switzerland, as members of the council do not resign even when their personal policy is condemned by a popular vote, so that the resignation of Herr Welti (a member of the Federal Council from 1867 to 1891), in consequence of the rejection by the people of his railway policy, caused the greatest amazement and consternation in Switzerland.

The chief political parties in the Federal legislature are the Right, or Conservatives (whether Romanists or Protestants), the Centre (now often called "Liberals," but rather answering to the Whigs of English political language, the Left (or Radicals) and the Extreme Left (or the Socialists of varying shades). In the first listed are all the Radicals, the second number (in this house the smaller cantons are on an equality with the greater ones, each indifferently having two members. But in the National Council (167 elected members) there has always (since 1848) been a considerable Radical majority over all other parties. The Socialists long worked under the wing of the Radicals, but now in every canton (save Geneva) the two parties have quarrelled, the Socialist vote having largely increased, especially in the town of Zürich. In the country the anti-Radical opposition is made up of the Conservatives, who are strongest in the Romanist, and especially the Forest, cantons, and of the "Federalists" of French-speaking Switzerland. There is no doubt that the people are really anti-Radical, though occasionally led away by the experiments made recently in the domain of State socialism: they elect, indeed, a Radical majority, but very frequently reject the bills laid before them by their elected representatives.

2. Politics.—The cantons had led the way before 1848, and they continued to do so after that date, gradually introducing reforms all of which tended to give the direct rule to the people. The Confederation was bound to follow this example, though it adopted it far more leisurely pace. Hence, in 1872 a new Federal Constitution was drafted, but was rejected on a popular vote by a small majority, as it was thought to go too far in a centralizing direction, and so encountered the combined opposition of the Conservatives and of the Federalists of French-speaking Switzerland. The last-named party was won over by means of concessions as to military matters and the proposed unification of cantonal laws, civil and criminal, and especially by three provisions as to religious freedom, since the "Kulturkampf" was then raging in French-speaking Switzerland. Hence a revised draft was accepted in 1874 by a considerable popular majority, and this is the existing Federal Constitution. But it bears marks of its origin as a compromise, and no one party has ever been very eager to support it as a whole. At first all went smoothly, and various very useful laws carrying out in detail the new provisions of the constitution were drafted and accepted. But divisions of opinion arose when it was proposed to reform the military system at a very great expenditure, and also as to the question of the limitation of the right to issue bank-notes, while (as will be seen under 3 below) just at this time grave financial difficulties arose with regard to the Swiss railways, and in consequence of Prince Bismarck's anti-free trade policy, which threatened the prosperity of Switzerland as an exporting country. Further, the disturbed political state of the canton of Ticino (or Tessin) became more or less acute from 1873 onwards. There the Radicals and the Conservatives are nearly equally balanced. In 1872 the Conservatives obtained the majority in this canton, and tried to assuage it by some certainly questionable means. The Radicals repeatedly appealed to the Federal government to obtain its armed intervention, but in vain. In 1876 the Conservatives at a rifle match at Stabio fired on the Radicals, but in 1880 the accused persons were acquitted. The long-desired detachment of Ticino from the jurisdiction of the foreign dioceses of Como and Milan was effected in 1888 by the erection of a see at Lugano, but this event caused the Radicals to bear an increase of clerical influence. Growing impatient, they finally took matters in their own hands, and in September 1890 brought about a bloody revolution. The partial conduct of the Radical Federal commissioner was much blamed, but after a state trial at Zürich in 1891 the revolutionists were acquitted, although they loudly boasted of their share in this use of force in political matters.

From 1885 onwards Switzerland had some troubles with foreign powers owing to her defence of the right of asylum for fugitive German Socialists, despite the threats of Prince Bismarck, who maintained a secret police in Switzerland, one member of which, Wohlgemuth, was expelled in 1889, to the prince's huge but useless indignation. From about 1890, as the above troubles within and without gradually subsided, the agitation in the country against the centralizing policy of the Radicals became more and more strongly marked. By the united efforts of the Federal government and of the Radicals themselves, the resistance of the Radicals, an amendment was introduced in 1891 into the Federal Constitution, by which 50,000 Swiss citizens can by the "Initiative" compel the Federal legislature and executive to take into consideration some point in the Federal Constitution which, in the opinion of the petitioners, requires reform, and to prepare a bill dealing with it which must be submitted to a popular vote. Great hopes and fears were entertained at the time as to the working of this new institution, but both have been falsified, for the Initiative has as yet only succeeded in inserting (in 1893) in the Federal Constitution a provision by which the Jewish method of killing animals is forbidden, and another (in 1906) prohibiting the manufacture or sale of absinthe in the country. On the other hand, it has failed (in 1894) to secure the adoption of a Socialist scheme by which the state was bound to provide work for every able-bodied man in the country, and (also in 1894) to carry a proposal to give to the cantons a bonus of two francs per head of the population out of the rapidly growing returns of the customs duties, similarly in 1900 an attempt to introduce the election of the Federal executive by a popular vote and proportional representation in the Nationalrat failed, as in 1903 did a proposal to make the elections to the Nationalrat depend on the Swiss population only, instead of the total population of the country.
The great rise in the productiveness of the customs duties (see 3 below) has tempted the Swiss people of late years to embark on a course of state socialism, which may be also described as a series of measures tending to give more and more power to the central Federal government at the expense of the cantons. So in 1890 the principle of compulsory universal insurance against sickness and accidents was accepted by a popular vote, in 1891 likewise that of a state or Federal bank, and in 1898 that of the unification of the cantonal laws, civil and criminal, into a set of Federal codes. In each case the Federal government and legislature were charged with the preparation of laws carrying out the new general principles. But in 1897 the Cantons, who had proposed cantons, but as to a Federal bank were rejected by the people, though another draft was accepted in 1905, so that the bank (with a monopoly of note issue, a provision accepted by a popular vote in 1891) was actually opened in 1907. At the beginning of 1900 the suspicion felt as to the insurance proposals elaborated by the Federal authorities was so keen that a popular demand for a popular vote was signed by 117,000 Swiss citizens, the legal minimum being only 30,000: they were rejected (May 20, 1900) on a popular vote by a nearly two to one majority. The prepara-
tion of these laws, however, was not interrupted, and in their final form, quietly, drafts being framed by experts and then submitted for criticism to special commissions and public opinion, but finally the civil code was adopted by the Federal Assembly in December 1907. By a popular vote in 1887 the Federal authorities were given a monopoly of alcohol, but a proposal to deal similarly with tobacco has been very ill received (though such a monopoly would undoubtedly produce a large amount), and would pretty certainly be refused by the people if a popular vote were ever taken upon it. In 1895 the people declared to sanction a state monopoly of matches, even though the unhealthy nature of the works was strongly urged, and have also resolutely refused on several occasions to accept any projects for the centralizing of the various branches of military administration, &c., though in 1897 the forests high up on the mountains were placed under Federal supervision, while in 1902 large Federal grants in aid were made to the cantons towards the expenses of primary education, and in 1908 the supervision of the employment of the power derived from rivers and streams was given to the Confederation. Among other reforms which have recently been much discussed in Switzerland are the introduction of the obligatory referendum (which was originally limited only to amendments to the Federal Constitution) and the extension of the initiative (now limited to piecemeal revision of the Federal Constitution) to all Federal laws, &c. The first-named scheme is an attempt to restrain important centralizing measures from being presented as laws (and as such exempt from the compulsory referendum), and not as amendments to the Federal Constitution.

Besides the insurance project mentioned above, two great political questions have engaged the attention of the Swiss.

a. State Purchase of the Railways.—In 1891 the purchase of the Central railway was rejected by a popular vote, but in 1897 by the aid of various baits thrown out, the people were induced to accept the principle of the purchase by the Confederation of the five great Swiss railway lines—three in 1901, viz. the Central, the North-Eastern, and the United Swiss lines; one (the Jura-Simplon) in 1903, and one (the St. Gotthard line) in 1909, this delay being due to international conventions that still have some years to run. Further, very important economical consequences, e.g. as to strikes, may be expected to result from the transformation of all railway officials of whatever grade into state servants, who may naturally be expected to vote (as in other cases) for their employers, and so greatly increase the strength of the Centralist political party.

b. The "Double Initiative."—This phrase denotes two purely political reforms that have been coupled together, though in reality they are by no means inseparable. One is the introduction of proportional representation (within the several cantons) into the elections for the National Council of the Federal parliament, the object being thus to secure for several large minorities a number of M.P.'s more in accordance with the size of those minorities in the country than is now possible under the régime of pure majorities; naturally these minorities would then receive a proper share of political power in the senate house, instead of merely exerting great political influence in the country, while if they were thus strengthened in the legislature they would soon be able to claim the right of naming several members of the Federal executive, thus making both legislature and executive a mirror of the actual political situation of the country, instead of the preserve of one political party. The other reform is the election of the members of the Federal executive by popular vote, the Swiss being given a vote on the 10th of August in the electoral constituency. This would put an end to the "lobbying" that goes on previously to the election of a member of the executive by the two houses of the Federal parliament sitting jointly in Congress; but, on the other hand, it might stereotype the present system of electing members of the executive by the majority system, and so reduce large minorities to political impotence. The "double initiative" scheme was launched in the beginning of 1899, and by the beginning of the following July secured more than the requisite number of signatures (50,000), the first-named item having been refused by nearly two to one, and the second by nearly three to one. Hence the Federal parliament was bound to take these two reforms into formal consideration, but in June 1900 it rejected both, and this decision was confirmed by a popular vote taken in the following November.

3. Economies and Finance.—Soon after the adoption of the Federal Constitution of 1874 the economical and financial state of the Confederation became very unsatisfactory. The great financial crisis in Vienna in 1873 was a severe blow to Swiss commerce, which had taken a very great start after the Franco-

German War of 1870-71. Beside this, too, the financial position of some of the great Swiss railway lines was very unfavourable: the bankruptcy of the National line ruined for the time (till a Federal loan at a very low rate of interest was forced upon them) the four Swiss towns which were its guarantors; the North-Eastern line had to beg for a "moratorium" (a legal delay of the period at which it had to pay its debts) from the Federal government; the Bern-Lucerne line was actually put up to auction, and was bought by the canton of Bern. Further, the expenses of constructing the St Gotthard railway vastly exceeded all estimates, and in 1876 over 100,000,000 francs more were required. Hence the government was in danger, and the tax rate had to be increased. Germany (which gave originally 20,000,000 francs) and Italy (original contribution 45,000,000 francs) each promised 10,000,000 francs more; the St Gotthard company itself gave 12,000,000, and the two Swiss railway lines interested (Central and North-Eastern) added 1,500,000 to the 20,000,000 they had already agreed to give jointly with the cantons interested in the completion of this great undertaking. But these latter refused to add anything to their previous contributions, so that finally the Federal government proposed that it should itself pay the 500,000 francs most urgently required. This proposal aroused great anger in east and west Switzerland, but the matter was ultimately settled by the Confederation paying 4,500,000 francs and the interested cantons 2,000,000, the latter gift being made dependent on a grant of 4,500,000 francs by the Federal government for new tunnels through the Alps in east and west Switzerland, and of 2,000,000 more for the Monte Cenerre tunnel between Bellinzona and Lugano. This solution of a most thorny question was approved by a popular vote in 1879, and the St Gotthard line was successfully completed in 1882. Gradually, too, the other Swiss railway lines, attained a state of financial equipoise, and thus the more careful management of new directors and managers. The completion of the Simplon tunnel (1906), the commencement (1909) of that beneath the Lötschen Pass (q.v.), and the rival claims of projected tunnels under the Splügen Pass (q.v.), besides the struggle for or against a tunnel under the Faclucie (supported by Geneva almost alone), show that railway politics play a very prominent part in Swiss national life. They are, too, complicated by many local rivalries, which in this country are of greater importance than
elsewhere because of the considerable share of power still legally belonging to the cantons. Another kindred question (owing to the rapid development of electric traction in Switzerland) is the equitable proposal (accepted in 1908) that the utilization of the immense force supplied by the many rivers and torrents in Switzerland should become a Federal monopoly, so as to supply the demand for objects that it cannot itself produce. But Prince Bismarck's protectionist policy in Switzerland should dwarf forever the whole question. The principle of the early Swiss. One of the earliest and most famous of these was composed by Hans Halsburter of Lucerne to commemorate the glorious fight of Sempach (1386), not far from his native town. The boisterous serenades of Näfels (1388) and the battles of Grandson and Morat (both 1476) in the Burgundian War, while in the 14th century the Dominican friar Ulrich Boner of Bern versified many old fables. Still more important are the historical documents relating to the liberation of Switzerland. In the 14th century we have Christian Kuchimich's continuation of the annals of the famous monastery of St Gall, in the early 15th century the rhymed and unrhymed histories of the war between the Swizer and the abbott of St Gall, and rather later in the same century the chronicles of Conrad Justinger of Bern and Hans Fründ (d. 1469) of Lucerne, besides the fantastical chronicle of Strattlingen and a scarcely less fanciful poem on the supposed Scaco Lavinian in the men of Schwyz and of Ober Hasle, both by Eulogius Kiburger (d. 1506) of Bern. In the 15th century, too, we have the White Legend of Sarnen and the first Tell song (see Tell), which gave rise to the well-known legend, as well as the rather later play named the Unersbieli dealing with the same subject. The Burgundian War witnessed a most outburst of historical ardour in the shape of works written by Ulrich von Hutten by order of the Swiss Russ (d. 1490), Diebold Schilling (d. between 1516 and 1523) and Petermann Eiterlin (d. 1509), all three of Lucerne as well as by Gerold Edlbich (d. 1530) of Zürich, and by Johannes Lenz (d. 1541) of St Gall. The veritable and the fable, the historical and the legendary, are united in the works of the Confederation, those by Albert von Bonstetten of Einsiedeln (1479) and by Conrad Türst of Zürich (1496), to whom also we owe the first map of the country (1496-1497).

Humanism in Latin, as did also, what was more surprising, the Swiss Reformers, at any rate for the most part, though the Zürich Bible of 1531 forms a striking exception. We have Hans Maninger (1484-1530), a well-known Swiss satirical poems in German against the pope, while Valerius Anshelm (d. 1540), also of Bern, wrote one of the best Swiss chronicles extant. Gilles Tschundi (q.v.) of Glarus, despite great literary activity, published a pamphlet (nicknamed the "Reussbiel") of 1498 by Aulfrich Rhaetae vom Tract der anderen Auffgeborgen (1538) besides his map of Switzerland (same date). Sebastian Münster (q.v.), who was a Swiss by adoption, published (1544) his Cosmographicum, a Latin geographical catalogue of the German, compiled by his son Hans, born in 1550. But the many-sided Conrad Gesner (q.v.), a born Swiss, wrote all his works in Latin, German translations appearing only at a later date. Thus the first important original product in German was the very remarkable and elaborate history and description of Switzerland, issued in 1548 at Zürich by Johannes Stumpf (q.v.) of that town. But Josias Simler (q.v.), who was in his way a continuator, wrote all his works in Latin. To the topographical and geographical literature (q.v.) engraved many plates, which were issued in a series of volumes (1562-1688) under the general title of Topographia, the earliest volume describing Switzerland, while all had a text in German by an adherent of the French, Martin Zeiller (q.v.). His cartography and the autobiography of the Valais scholar Thomas Platter (1499-1582) and the diary of his still more distinguished son Felix (1536-1614), both written in German, though not published till 1665, but gradually Swiss historical writers gave up the use of Latin for their native tongue, so Michael Stettler (1580-1642) of Bern, Franz Haffner (1609-1671) of Soleure, and quite a number of Grisons authors (though the earliest in date, Ulrich Campell of Surs, c. 1500-1582, still clung to Latin), such as Bartholomew Anhorn (1560-1640) and his son of the same name (1616-1670) and Johann Guler (1562-1677). Yet Fortunatus Sprecher (1545-1647) preferred to write his Palatinsregister in Latin as did Johann Haimbold (1565-1654) in the case of his autobiography. But we have some compensation in the delightful autobiography of Hans Arderuz of Davos (1557-1614) and in the numerous autobiographies of the Swiss by the Stockborn by Hans Rudolf Rebellmann (1665-1669), both composed in naive German. J. B. Plantin (1625-1697) wrote his description of Switzerland in Latin, Helvetia nova et antiqua (1699), while J. W. Rothensteiner (1639-1717) of Germany, despite its title Index memorabilium Helvetiae (1684) and Mercurius helveticus (1688), though he issued his scientific description of his native land in Latin, Historia naturalis Helvetiae cantonum (1721).

In the 18th century the intellectual movement in Switzerland greatly developed, though it was naturally strongly influenced by local characteristics. Basel, Bern and especially Zürich were the chief literary centres. Basel was particularly distinguished for its mathematicians, such as Jakob Bernoulli, whose eldest son Johann (1667-1705) and the latter's son Daniel (1700-1782). But its chief literary glory was Isaac Iselin (1728-1783), one of the founders of the Helvetian Society.
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(1760) and of the Economical Society (1777), and a treatise on the philosophy of history entitled Geschichte der Menschheit (1764), and of another on ideal politics, Philosophische und patriotische Schriften (1779). Among the economists of the first half of the 18th century, the most important were the Bernese Johann Kaspar von Thouret (1680-1868), the author of Tristis im Morgenrot (1842), which, set to music by the Cistercian monk Alberic Zwysig (1688-1854), is now known as the 'Swiss Psalm,' of La lèse in jeder Schweizerchristli and the song, Here, my Herr, such as to turn him Johannis Georg Krause (1792-1845), of Lucerne, wrote the Rüttileli, Von ferne sei herzlich gegrüsset, and Gottfried Keller himself was responsible for O mein Alpries (1835-36), the forerunner of the Swiss mountain novel in the Bernese dialect as to the Alps and their inhabitants. Less national in sentiment and more metaphysical are the lyrics of "Omarxon," the pen-name of the Bernese Ferdinand Schmid (1823-1888).

Among the chief contemporary Swiss writers in the department of belles-lettres, novelists, poets, &c., may be mentioned Ernst Zahn, Meinhard Lienert, Arnold Ott, Carl Spitteler, Fritz Marti, Walther Siegfried, Adolfr Frey, Hermann Hesse, J. C. Herz, J. V. Widmann, and Gottfried Strasser.

Isabella Kaiser, by her poems and stories, upholds the honour of the rural.
of Goulart and that (published officially by the government) attributed to Jean Sarasin (1754-1762), the author of the *Clavien de Genève* (1666), are more laconic and more striking. J. B. Planiot (1728-1769), whose three volumes of *La légende antique et nova* (1666), in Latin, but his *Abrégé de l'histoire générale de la Suisse* (1666) in French, while Georges de Montmollin (1628-1702) of Neuchâtel wrote, besides various works as to local history, *Histoire de l'Inquisition* (1697), besides the historical works by the other genealogists and the like, that is, such wanderings, so that, with obvious differences, he may be regarded not merely as the forerunner, but as the inspirer and model of the historians who were to follow. His title, incidentally, was *De la Suisse* and even his *Histoire de l'Inquisition* shows the impress of his native tongue, which was with his family, foxed thither after the Revocation of the Edict of Nantes (1689) and settled down there for the rest of their lives. Such was Louis Bourget (1768-1794), who, besides his geological work, was a prominent lawyer, Emomont in 1783 and 1785 to stimulate the intellectual life of the Suisse Romand; these were the *Bibliothèque italique* (1729-1734), which aimed at making more widely known the results of Italian research, and the *Mercure suisse* (1743-1757). Amongst the names (from 1738 onwards the literary section bore the name of *Journal helvétique*), and secured contributions from most of the leading writers of the Suisse Romand of the day, such as Alazard (1676-1767), Abraham Ruchat (1767-1792), and others. Ruchat is now best remembered as the author (under the pen-name of Gottlieb Kysycler) of an excellent guide-book to Switzerland, literature, as do later Jacob de Witte (q.v.), early in 1731 and 1732, published through many editions, the latest being issued in 1778; but his *Histoire de la Réformation de la Suisse* (1727-1728) was much esteemed in his day. Another Vaudois historian and antiquary was Charles de Saussure (1750-1802) of Genève, whose *Critiques sur divers points de l'ancienne histoire de la Suisse* (1757-1749) still form a treasure-house for archaeologists. Yet a third writer of the Swiss French school, of the type of *Dictionnaire de la langue française* and the *Histoire de la langue française* he produced there the philosophy of Descartes, and was, by his books, the master of Gibbon in logic. A French refugee at Lausanne, Jean Barbevray (1674-1744), published in 1712 the *Droit de la société* (the word is that of Diderot), which is regarded by some as the striking preface of his own. A precursor of Montesquieu and of Rousseau was Jean Jacques Burlamaqui (1664-1750) in his *Principes du droit naturel et politique* (1747 and 1751, issued together in 1763), which was awarded by the French Academy of Law and by the Genevois of the Philokrus (q.v.); besides this, he was an active editor of the *Annuaire de Genève* (1767), was a native of Neuchâtel by birth and descent, and, though he spent most of his life at foreign courts, died at Neuchâtel, not so very long after the publication of his famous *Droit des gens* (1758). The first edition of *Dictionnaire de l'histoire naturelle* (q.v.) was issued in 1749 by Roman de, in that year Rousseau came back for good to Geneva, and Voltaire established himself at Ferney, while in 1753 Gibbon had begun his first residence (which lasted till 1768) in Lausanne. The earlier writers mentioned above had then nearly all disappeared, and a more brilliant set took their place. But Rousseau (q.v.), though a Genevois, belongs rather to European than to Swiss literature, and the emigration of his celebrated disciple and principal guiding light did not hinder the Swiss from pursuing the same researches into the manners and local customs of genealogical families, and especially of the nobility. The friends of the arts and of military science, and the industrious fry that followed, were the efforts of a group of men to spread the cause of natural science by personal investigations in the higher Alps, but little known at the time or at least not generally disseminated, excepted by the scientific and psychological speculations of Charles Bonnet (q.v.). The chief of this school was H. B. de Saussure (q.v.) one of the founders of geology and meteorology, while his Alpine geologists and geographers, such as Paul de Vial, were more numerous than ever. Such were also the beginning of a process of researches in the causes of natural phenomena, and then the beginning of a world even than to the scientific traveller. The brothers De Luc (q.v.) devoted themselves mainly to questions of physics in the Alps, while Senevir (q.v.), the biographer of Saussure, was more known and his work is more widely disseminated. In 1849, while the* Britannica* was the earliest of the Vaudois poets by virtue of his *Poesies helvetiennes* (1782). But he is better known as the painter of the scenery and people among whom he worked as pastor at Basel, at Château d'Oex, and on Montreux successively. *Histoire de la Suisse* and others were published by the government. According to the government. A later writer, Charles de Girardin, who was a contemporary of Diderot, and who was one of the earliest Vaudois poets by virtue of his *Poesies helvetiennes* (1782). But he is better known as the painter of the scenery and people among whom he worked as pastor at Basel, at Château d'Oex, and on Montreux successively. *Histoire de la Suisse* and others were published by the government. According to the government. The first writer, Charles de Girardin, who was a contemporary of Diderot, and who was one of the earliest Vaudois poets by virtue of his *Poesies helvetiennes* (1782). 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was thoroughly revised (10th edition) in 1904, while it is not necessary to do more than mention the guide-books of Bädeker and Joos, of which the first appears (that by Iwan von Tschud) is no longer kept up to date.

The best maps of Switzerland are those published by the Federal Topographical Bureau at Bern. One, called the director of the cartographic department G. H. Dufour's map (3 vols., 1845-1865, 1: 100,000), was published in twenty-five sheets between 1845 and 1863 (see the detailed history of this map in the work entitled Die schweizerischen Landeskarten). Dufour's map, however, has been practically superseded by the issue (revised and corrected) of the original survey (scale 1: 25,000 for the plains and 1: 50,000 for the mountain districts) in 596 sheets, of which the publication began in 1952. (When this latter edition was executed, it is named the Siegfried Atlas, from the successor of Dufour at the head of the survey, Hermann Siegfried (1819-1879). The history of Swiss travel books is too long to be given here (see Baedeker, Bunsen, and W. A. B. Coolidge, Swiss Travel and Swiss Guide-Books (London, 1889). That of the exploration of the Swiss Alps is contained in Gottlieb Studer's of travel and science (Berlin, 3 vols., ed. 1866-1869), and also in the work Bernhard Studer's Geschichte der physischen Geographie der Schweiz bis 1815 (Bern, 1863) describes the gradual examination of the country from the scientific point of view. The last-named work Anfragen and the Schnell in 1802, considered as the later Die Landschaftsproben der Schweiz (Aarau, 1816).

The Archiv für Volktschulw, published by the Société des traditions populaires (Zurich, from 1897), contains much that is interesting in the way of folklore, while for Swiss legends in general consult Ed. Kohlmann, Schweizerische Sagenbuch (Leipzig, 1854); A. Lüttolf, Sagen, Bräuche, Legenden aus den fünf Orien (Lucerne, 1862); M. Teichmann and J. P. Ruppen, Wallis-Sagen (Sion, 1892), in 3 vols., and L. Bickel, Recherches sur le folklore du district de l'Engadin (Lucerne, 1900); the rest to the Ladin dialect of the Engadine. F. J. Stalder's Versuch eines schweizerischen Idiots (2 vols., 1876-1812) is a later work Die Landeskunde der Schweiz, is a later work Die Landeskunde der Schweiz, (Aarau, 1816).

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The best works on the political history of Switzerland are: E. Bührer, Die Politische Geschichte der Schweiz (2 vols., Basel, 1861-1864); and E. Bührer, Die Politische Geschichte der Schweiz (2 vols., Basel, 1861-1864). These works are followed by J. E. Kopp, Geschichte der Eidgenossenschaft (Zürich, 1891), and in the field of political science, see J. E. Kopp, Geschichte der Schweiz (Zürich, 1901).
SWOLD, BATTLE OF—SWORD

1. Historical.—There are some called swords of wood and even stone to be found in collections of savage weapons. But these are really flattened clubs; and the present writer *Origenas* and agrees with the late General Pitt-Rivers in not believing that such modifications of the club have had any appreciable influence on the form or use of true swords. For this point, however, the opinions of competent archaeologists have been much divided. We will only remark that the occurrence in objects of human craftsmanship of a form, or even a series of forms, intermediate between two types is not conclusive evidence that those forms are historical links between the different types, or that there is any historical connexion at all. In the absence of dates fixed by external evidence this kind of comparison will seldom take us beyond plausible conjecture. A traveller who had never seen velocipedes might naturally suppose, on a first inspection, that the tricycle was a modification of the old four-wheeled velocipede, and the bicycle a still later development. We will now show that in fact the order of development was quite different.

It is more difficult as a matter of verbal definition to distinguish the sword from smaller hand weapons. Thus an ordinary sword is four or five times as long as an ordinary dagger: but there are long daggers and short swords; neither will the form of blade or handle afford any certain test. The real difference lies in the intended use of the weapon; we associate the sword with open combat, the dagger with a secret attack or the sudden defence opposed to it. One might say that a weapon too large to be concealed about the person cannot be called a dagger. Again, there are large knives, such as those used by the Afriids and Afghans, which can be distinguished from swords only by the greater breadth of the blade as compared with its length.

Again, there are special types of arms, of which the yataghan is a good example, which in their usual forms do not look much like swords, but in others that occur must be classed as varieties of the sword, unless we keep them separate by a more or less artificial theory, referring the type as a whole to a different origin.

Of the actual origin of swords we have no direct evidence. Neither does the English word nor, so far as we are aware, any of the equivalent words in other languages, Arvand or otherwise, throw any light on the matter. Daggers shaped from reinder antlers occur among the earliest relics of man, and there are flint daggers of the Neolithic period, which may possibly have been the model for the first hand weapons made of copper. Bronze took the place of copper about 2000 B.C., and the transition from bronze to iron is assigned to the period from 1000 to 700 B.C.1 Whatever may be the further discoveries of archaeologists, we know that swords are found from the earliest times and an important weapon in the history of man. The *Discoveries in Crete* (1907), p. 214. As it Britain, O. Montellius in *Archaeologia*, 61, pp. 155-6; *Cowper, Art of Attack*, 124 sqq. (Ulverston, 1906).

SWORD (O. Eng. sword; ultimately from an Indo-European root meaning to wound), a general term for a hand weapon of metal, characterized by a longish blade, and thus distinct from all missile weapons on the one hand, and on the other hand from staff weapons—the pike, bill, halberd and the like—in which the metal head or blade occupies only a portion of the effective length. The handle of a sword provides a grip for the hand that wields it, or sometimes for two hands; it may add protection, and in most patterns does so to a greater or less extent. Still it is altogether subordinate to the blade. For want of a more impressed handle, a lance or axe, which indeed were of later invention, a sharpened pole or a thin-edged paddle will serve the turn. But a sword-handle without a blade is naught; and no true sword-blade can be made save of metal capable of taking an edge or point.

The formation of the Baltic coast has been much modified in the course of subsequent centuries, partly by the gradual settling up of the sea, and partly by the storms of the 19th century. The island was an island probably on the North German coast, near Rügen. The battle was fought between Olaf Trygvesson, king of Norway, and a coalition of his enemies—Eric Hakonson, his cousin and rival; Olaf, the king of Sweden; and Sweyn Forkbeard, king of Denmark. The poets, and the poetically minded authors of the sagas, who are the only authorities, have told the story with many circumstances of romance. But when the picturesque details, which also have no doubt at least a foundation of truth, and which add to the real value, the account of the battle still presents a very trustworthy picture. The sea-fights of the Norsemen. Olaf had been during the summer in the eastern Baltic. The allies lay in wait for him at the island of Swold on his way home. The Norse king had with him seventy-one vessels, but part of them belonged to an associate, Sigwald, a chief of the Jomsborg vikings, who was an agent of his enemies, and who deserted him. Olaf’s own ships went past the anchorage of Eric Hakonson and his allies in a long column without order, as no attack was expected. The king was in the rear of the whole of his best vessels. The allies allowed the bulk of the Norse ships to pass, and then partly by attack Olaf might have run past them by the use of sail and oar; escape, but with the true spirit of a Norse warrior he refused to flee, and turned to give battle with the eleven ships immediately about him. The disposition adopted was one which is found recurring in many sea-fights of the middle ages where a fleet had to fight on the offensive. Olaf lashed his ships side to side, his own—the “Long Serpent,” the finest war-vessel as yet built in the north—being in the middle of the line, where her bows projected beyond the others. The advantage of this arrangement was that it left all hands free to fight, a barrier could be formed with the oars and yards, and the enemy’s chance of making use of his superior numbers to attack on both sides would be, as far as possible, limited—a great point when all fighting was with the sword, or with such feeble missile weapons as bows and javelins. The Norse long ships were high in the bulwark—or, as the Greeks would have said, “ca photra.” Olaf, in fact, turned his eleven ships into a floating fort. The Norse writers, who are the only authorities, gave all the credit to their own countrymen, and according to them all the intelligence of Olaf’s enemies, and most of their valour, were to be found in this. It is said that the Danes and Swedes rushed at the front of Olaf’s line, which the Greek writer Eric Hakonson attacked the flank. His vessel, the “Iron Rock,” was “bearded,” that is to say, strengthened across the bows by bands of iron, and he forced her between the last and lost but one of Olaf’s line. In this way the Norse ships were carried one by one, till the “Long Serpent” alone was left. At last she too was overpowered. Olaf leapt into the sea holding his shield edgeways, so that he sank at once and the weight of his hauberk dragged him down. A legend of later days has it that at the last moment a sudden blaze of light surrounded the king, and when it cleared away he had disappeared.
times of which we have any record among all people who have acquired any skill in metal-work. There are two very ancient types, which we may call the straight-edged and the leaf-shaped. Assyrian monuments represent a straight and narrow sword, better fitted for thrusting than cutting. Bronze swords of this form have been found in many parts of Europe, at Mycenae, side by side with leaf-shaped specimens, and more lately in Crete. 

We have also from Mycenae some very curious and elaborately wrought blades, so broad and short that they must be called ornamental daggers rather than swords. The leaf-shaped blade is common everywhere among the remains of men in the "Bronze Period" of civilization, and this was the shape used by the Greeks in historical times, and is the shape familiar to us in Greek works of art. It is impossible, however, to say whether the Homeric heroes were conceived by the poet as wearing the leaf-shaped sword, as we see it, for example, on the Mausoleum sculptures, or a narrow straight-edged blade of the Minoan and Mycenaean pattern. In any case, the sword holds a quite inferior position with Greek warriors of all times.

Independence appears, on the whole, slightly more probable; the existence of specimens which might belong to an intermediate type is only an ambiguous fact without a more exact chronology than we have as yet, as it may be due to experiment or imitation after both types were in use. Strange as it is to a modern swordsmanship, representations in Minoan art seem to show that not only the bronze daggers but the long swords were used with an overhand stabbing action like a modern Asiatic dagger. The handles are too short for any but a rigid grip without finger-play. Before about 1500 B.C. the rapier type was the prevailing one; but there is no evidence of historical connexion between the Assyrian and the Minoan rapiers. It is thought that the leaf-shaped blade came to the Mediterranean countries from the north. So far as we know from works of art, it was mostly used with a downright cutting blow, regardless of the consequent exposure of the swordsman's body; this, however, matters little when defence is left to a shield or armour, or both. Attic vases also show warriors giving, point, though less often. The use of the sword as a weapon of combined offence and defence—swordsmanship as we now understand it—is quite modern. If the sword was developed from a spearhead or dagger, it would naturally have been (and it seems in fact to have been) a thrusting weapon before it was a cutting one. But when we come to historical times we find that uncivilized people use only the edge, and that the effective use of the point is a mark of advanced skill and superior civilization. The Romans paid special attention to it, and Tactius tells us how Agricola's levies made short work of the clumsy and pointless arms of the Britons when battle was fairly joined. The tradition was preserved at least as late as the time of Vegetius, who, as a technical writer, gives details of the Roman soldier's sword exercise. Asiatics to this day treat the sword merely as a cutting weapon, and most Asiatic swords cannot be handled in any other way.

The normal types of swords which we meet with in historical times, and which from all forms now in use among civilized nations are derived, may be broadly classified as straight-edged or curved. In the straight-edged type, in itself a very ancient type, the thrusting or cutting qualities may predominate, and the blade may be double-edged or single-edged. The double-edged form was prevalent in Europe down to the 17th century. The single-edged blade, or back-sword as it was called in England, is well exemplified among the Scottish weapons commonly but improperly known as claymores (the real claymore, i.e. great sword, claidheamh mor, is an earlier medieval form), and is now all but exclusively employed for military weapons. But these, with few exceptions, have been more or less influenced by the curved Oriental saber. Among nearly double-edged swords the Roman pattern (gladius, the thrusting sword, contrasted with the barbarian eunx) stands out as a workmanlike and formidable weapon for close fight. In the middle ages the Roman tradition disappeared, and a new start was made from the clumsy barbarian arm which the Romans had despised. Gradually the broad and all but pointless blade was lightened and tapered, and the thrust, although its real power was unknown, was more or less practised from the 12th century onwards. St Louis anticipated Napoleon in calling on his men to use the point; and the heroes of dismounted combat in the Mort de Arthur are described as "jouant" at one another. In the first half of the 16th century a well-proportioned and well-mounted cut-and-thrust sword was in general use, and great artistic ingenuity was expended, for those who could afford it, on the mounting and adornment. The growth and variations of the different parts of the hilt, curiously resembling those of a living species, would alone be matter enough for an archaeological study. One peculiar form, that of the Scottish basket-hilt, derived from the Venetian pattern known as schiavone, has persisted without material change. As the spear still retains historical times (Furtwängler-Reichold, Gr. Vasenmalerei, iii. 122).

1 The Cretan finds are fully described by Arthur J. Evans, "The Prehistoric Tombs of Knossos" (Archaeologia 1905), 59, pt. 2; also separately published (1906). There are long (61-95 cm., 34-1 in. -37 1 in.) and short (50-61 cm., 20-24 2 in.), swords, daggers and bronze knives. A fine original specimen and several facsimiles (Mycenaean as well as Minoan) may be seen in the Ashmolean Museum at Oxford. Bronze daggers preceded both swords and spearheads (Greenwell and Brewis, in Archaeologia, 61, pp. 443. 453).

2 Agric. 36: "Britannorum gladii sine murcore complexum armorum et in aperto pugnam non tolerabant." The short Roman infantry sword, however, dates only from the Second Punic War.
Quite different from the European models is the crescent-shaped Asiatic sabre, commonly called scimitar. We are not acquainted with any distinct evidence as to the origin of this in time or place. Dr. R. Forrer thinks the whole family of curved swords was developed from bronze knives. The Frankish *scimasax* would then represent an intermediate type. However that may be, the fame of the Damascus manufacture of sword-blades is of great antiquity, as is also that of Khorasan, still the centre of the best Eastern work of this kind. Whoever first made these blades had conceived a very definite idea—that of gaining a maximum of cutting power regardless of loss in other qualities—and executed it in a manner not to be improved upon. The action of the curved edge in delivering a blow is to present an oblique and therefore highly acute-angled section of the blade to the object struck, so that in effect the cut is given with a finer edge than could safely be put on the blade in its direct transverse section. In a well-made sabre the setting of the blade with regard to the handle ("leading forward") is likewise ordered with a view to this result. And the cutting power of a weapon so shaped and mounted is undoubtedly very great. But the use of the point is abandoned, Easterners adhere to their rigid grasp of a small handle and sweeping cut delivered from the shoulder, the Persian scimitar or Indian talwar will remain the natural weapon of the eastern horseman. Indian and Persian swords are often richly adorned; but their appropriate beauty is in the texture of the steel itself, the "damascening" or "watering" which distinguishes a superior from a common specimen.

There are special Asiatic varieties of curved blades of which the origin is more or less uncertain. Among these the most remarkable is perhaps the yataghan, a weapon pretty much conversant with the Mahommedan world, though it is reported to be not common in Persia. It was imported from Africa, through a French imitation, as the model of the sword-bayonets which were common for about a generation in European armies; probably the French authorities caught at it to satisfy the sentiment, which lingered in continental armies long after it had disappeared in England, that even the infantry soldier after the invention of the bayonet must have some kind of sword. A compact and formidable hand weapon was thus turned into a clumsy and top-heavy pike. If we try to make a bayonet that will cut cabbages, we may or may not get a useful chopper, but we shall certainly get a very bad bayonet. The modern short sword-bayonet is a reversion to the original dagger type, and not open to this objection. The double curve of the yataghan is substantially identical with that of the Gurkha knife (*kukri*), though the latter is so much broader as to be more like a woodman's than a soldier's instrument. It is doubtful, however, whether there is any historical connexion. Similar needs are often capable of giving rise to similar inventions without imitation or communication. There are yet other varieties, belonging to widely spread families of weapons, which have acquired a strong individuality. Such are the swords of Japan, which are the highly perfected working out of a general Indo-Chinese type; they are powerful weapons and often beautifully made, but a European swordsman would find them ill-balanced, and the Japanese style of sword-play, being two-handed, has little to teach us.

Other sorts of weapons, again, are so peculiar in form or historical derivation, or both, as to refuse to be referred to any of the normal divisions. The long straight gauntlet-hilted sword (pold, fig. 3) found both among the Maharratas in the south of India and among the Sikhs and Rajputs in the north, is an elongated form of the broad-bladed dagger with a broad-handled hilt (ko'der, figs. 9, 10), as is shown by a transitional form, much resembling in shape and size of blade the medieval English anlase, and furnished with a guard for the back of the hand. This last-mentioned pattern seems, however, to be limited to a comparatively small region. When once the combination of a long blade with the gauntlet hilt was arrived at, any straight blade might be so mounted; and many appear on examination to be of European workmanship—German, Spanish or Italian. There are various other Oriental arms, notably in the Malay group, as to which it is not easy to say whether they are properly swords or not. The Malay "parang latok" is a kind of elongated chopper sharpened by being bevelled off to an edge on one side, and thus capable of cutting only in one direction. The anlase incidentally mentioned above seems to be merely an overgrown dagger; the name occurs only in English and Welsh; in which language first, or whence the name or thing came, is unknown.

In the course of the 16th century the straight two-edged sword of all work was lengthened, narrowed, and more finely pointed, till it became the Italian and Spanish rapier, a weapon still furnished with cutting edges, but used chiefly for thrusting. We cannot say how far this transition was influenced by the *estoc* or Powerstecher, a late medieval thrusting weapon carried by horsemen rather as an auxiliary lance than as a sword. The Roman preference of the point was rediscovered under new conditions, and fencing became an art. Its progress was from pedantic complication to lucidity and simplicity, and the fashion of the weapon was

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1. Probably this was the kind of sword called *broch* in 14th-century English (Evre of Kent, Selden Soc., 1910, p. 100).
SWORD

simplified also. Early in the 18th century, the use of the edge having been finally abandoned in rapier-play, the two-edged blade was supplanted by the bayonet-shaped French duelling sword, on which no improvement has since been made except in giving it a still simpler guard. The name of rapier was often but wrongly given to this by English writers. About the same time, or a little earlier, the primacy of the art passed from Italy to France. There is still a distinct Italian school, but the rest of the world learns from French masters. It is unnecessary here to consider the history of fencing (q.v.); Mr Egerton Castle's book on the subject will be found a trustworthy guide, and almost indispensable for those who really wish to understand the passages relating to sword-play in our Elizabethan literature, of which the fencing scene in Hamlet is the most famous and obvious example.

![ Image of swords ]

(Fig. 3.—Typical European Swords, 16th-18th centuries.
2. German, c. 1550. 9. Venetian, c. 1560.
3. Italian rapier, third quarter 16th century.
4. Spanish rapier, late 16th century.
5. Italian, same period.
6. English, same period.
8. Spanish rapier, c. 1650.
9. German flamberg, early 17th century.
10. Small-swords, 1700-1750.

Meanwhile a stouter and broader pattern, with sundry minor varieties, continued in use for military purposes, and gradually the single-edged form or broadsword prevailed. The well-known name of Ferrara, peculiarly associated with Scottish blades, appears to have originally belonged to a Venetian maker.

or family of makers, towards the end of the 16th century. The Spanish blades made at Toledo had by that time acquired a renown which still continues. Somewhat later Oriental examples, imported probably by way of Hungary, induced the curvature found in most recent military sabres, which, however, is now kept within such bounds as not to interfere with the effective use of the point. An eccentric specialized variety—we may call it a "sport"—of the sabre is the narrow and flexible "Schläger" with which German students fight their duels (for the most part not arising out of any quarrel, but set trials of skill), under highly conventional rules almost identical with those of the old English "backswording" practised within living memory, in which, however, the swords were represented by sticks. These "Schläger" duels cause much effusion of blood, but not often serious danger to life or limb.

There are plenty of modern books on sabre-play, but comparatively little attention has been given to its scientific treatment. It is said that the Italian school is better than the French, and the modern German and Austrian the best of all. Some of the English cavalry regiments have good traditions, enriched by the application of a knowledge of fencing derived from eminent French masters.

The following description, written for the 9th edition of this work from personal inspection, applies to the process used by the best private makers till near the end of the 19th century, and is purposely left unchanged. The present method of making army swords is separately described, below. 'Mechanical invention has not been able to supersede or equal hand-work in the production of good sword-blades. The swordsmith's craft is still, no less than it was in the middle ages, essentially a handicraft, and it requires a high order of skill. His rough material is a bar of cast and hammered steel tapering from the centre to the ends; when cut in two each half is made into a sword. The "tang," which fits into the handle is not part of the blade, but a piece of wrought iron welded to its base. From this first stage to the finishing of the point it is all hammer and anvil work. Special tools are used to form grooves in the blade according to the regulation or other pattern desired, but the shape and weight of the blade are fixed wholly by the skilled hand and eye of the smith. [Machine forging in the early stages is now common, and there is no difficulty in making the blade and tang of the same metal.] Measuring tools are at hand, but are little used. Great care is necessary to avoid overheating the metal, which would produce a brittle crystalline grain, and to keep the surface free from oxide, which would be injurious if hammered in. In tempering the blade the workman judges of the proper heat by the colour. Water is preferred to oil by the best makers, notwithstanding that tempering in oil is much easier. With oil there is not the same risk of the blade coming out distorted and having to be forged straight again (a risk, however, which the expert swordsmith can generally avoid); but the steel is only surface-hardened, and the blade therefore remains liable to bend. [This is disputed.] Machinery comes into play only for grinding and polishing, and to some extent in the manufacture of hilts and appurtenances. The finished blade is proved by being caused to strike a violent blow on a solid block with the two sides flat, with the edge, and lastly with the back; after this the blade is bent flatwise in both directions by hand, and finally the point is driven through a steel plate about an eighth of an inch thick. In spite of all the care that can be used both in choice of material and in workmanship, about 40% of the blades thus tried will have only about 10% fail to stand the proof, and are rejected. The process we have briefly described is that of making a really good sword; of course, plenty of cheaper and commoner weapons are in the market, but they are hardly fit to trust a man's life to. It is an interesting fact that the peculiar skill of the swordsmith is in England so far hereditary that it can be traced back in the same families for several generations.

The best Eastern blades are justly celebrated, but they are not better than the best European ones; in fact, European swords are often met with in Asiatic hands, remounted in Eastern fashion.
The "damascening" or "watering" of choice Persian and Indian arms is not a secret of workmanship, but is due to the peculiar manner of making the Indian steel itself, in which a crystallizing process is set up; when metal of this texture is forged out, the result is a more or less regular wavy pattern running through it. There were early medieval damascened (in German called wurmbunte) blades. No difference is made by this in the practical qualities of the blade. (F. Po.)

The shape of the sword to be chosen depends obviously on the purpose for which it is mainly intended. If for cutting a curved blade, and for thrusting a straight or pointed one, will be adopted. The question naturally arises as to which is the better plan to adopt, and it is improbable that a definite answer can ever be given to it. The French, for instance, in 1822 adopted a curved blade for a short time for all their cavalry, and in 1823 again for a short time a straight blade, and in 1898 again a straight blade. In this much-debated matter the facts appear to be as follows: A determined thrust, especially when delivered by a horseman at full speed, is difficult to parry; if it gets home, it will probably kill the recipient outright or disable him for the rest of the campaign. Thus the case is borne out by the very large proportion of killed as compared with wounded in the British cavalry when engaged with that of the French in the Peninsular War, the French making much use of the point, and their heavy cavalry being armed with a long straight sword. On the other hand, to deliver a bold thrust, while disregarding the uplifted sword of the adversary, and leaving one’s own body and head open to an impending blow, demands complete confidence that the thrust will get home before the blow can descend, or that the adversary’s cut will probably be weakened by a momentary uncertainty as to whether it would not be better to convert the intended cut into a parry. Such confidence, it is argued with much truth, can only be the fruit of long training, especially as it is the natural tendency of all men to cut when excited; therefore, as the trooper in modern armies will often be a reservist who has not been able to keep up his swordsmanship, or a young soldier liable to lose his head and forget the lesson of peace in the excitement of the mêlée, it is considered by many most unwise to adopt a sword with which a powerful cut cannot be delivered as well as an effective thrust. The swords recently adopted by most nations have represented a compromise. They have blades which are nearly straight, but of sufficient weight towards their points to enable an efficient cut to be delivered with them. Frick decided on a long straight sword designed wholly for thrusting (see fig. 1), practically identical with that which was in use about a century ago. The following year Great Britain issued a slightly curved weapon, but in 1908 a new sword was adopted which has a long straight blade and is intended to be used chiefly for thrusting.

As regards the swords worn by officers and men of corps other than cavalry, no remarks are necessary. As long as they are worn they should be efficient; but with the officer the sword is largely a matter of rank. From 1908 the sword was worn only for ceremonial purposes by British infantry officers, but in the latter year it was again ordered to be worn on active service and at manoeuvres. Mounted men in general wear cavalry swords, and the swords warrant officers and by certain staff-sergeants of dismounted arms and branches. A good sword should be elastic, so as to stand bending or a heavy blow without breaking or permanent deformation, and yet stiff enough to deliver a thrust too readily for thrusting; it must also be as light as is possible consistently

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2. Modern Military Swords.—The present military swords are descended from the straight "back-sword" and the Eastern scimitar or talwar. The difference between the curved "sabre" and straight "sword" has been preserved abroad, not only in fact but in name (e.g. in German, Degen stands for the straight, and Säbel for the curved, sword), though in English the single word "sword" covers both varieties. The shape of the sword has varied considerably at different times; this is due to the fact that it is practically impossible to decide by trial whether a straight or a curved sword is the better under all circumstances. The trooper can use his sword in three different ways—to cut, to guard and to point; and his success depends upon the training of his horse, his skill in horsemanship, and, above all, upon the dexterity and methods of his adversary. Thus the effect the cavalryman can produce in combat depends upon much besides his arm or arms, and those other conditions cannot be reproduced accurately enough to make trustworthy tests. The result is that changes have often been made in cavalry armament under the erroneous impression that the arm used has been the main cause of success. The Ottoman cavalry up to the end of the 18th century was regarded as one of the best in Europe, and so much was it dreaded that the Austrians and Russians in their wars with Turkey at that time often carried "chevaux-de-frise" to protect their infantry against these redoubtable horsemen. The curved European cavalry sabre so long in use may undoubtedly be traced to this cause, the superiority of the Turks being put down to their curved scimitars, though there can be no doubt that horsemanship and dash were really the dominating factors.

Fig. 4.  
Fig. 5.  
Fig. 6.  
Fig. 7.  
Fig. 8.  
Fig. 9. (Figs. 6, 8, 9, Messrs Wilkins & Co. Fig. 7, H.M. War Office.)
SWORDFISH

with strength, and well balanced. All four desiderata are met in the main by the use of a suitable steel, properly treated and disposed, but, unfortunately, did not hold a straight edge on the blade and, as regards the effect of disposition, grooving or "fullering" the flats of the blade reduces weight without impairing strength, and is now very largely adopted.

The first stage of manufacture, as carried out at the Royal Small Arms Factory at Enfield, may be described briefly as follows, the weapon being the pattern 1899 cavalry sword, which was slightly curved.

The steelblank, about 17\*\times11\*\times1\*\,', is heated and drawn out to about double its length under a mechanical hammer; it is then reheated and rolled out between rolls suitably shaped, and the flat edges are brought to a rounded radius, and (ultimately attached) is then formed by stamping under a machine hammer, and the blade is cut to length and roughly pointed. The blade, though approximately in its finished form, is still too soft and is annealed, the blade set for grinding, and afterwards rough-ground. It is heated and set to curve in a press, then reheated and hardened by being plunged into a bath of oil kept cool by a water jet. On removal from the bath the blade is dead hard and so brittle that it can be broken by a slight blow, and consequently has to be let down by tempering. This is accomplished by heating in a bath of molten lead until the steel assumes a particular colour, at which stage, while hot, the blade is adjusted for straightness and curvature, this being a delicate operation, as it must be performed while the blade retains its temper and heat before finally cooling. It is now twisted to the correct angle, which, for the present, is the desired position, is hardened by being quenched in cold water, and is subjected to a final tempering machine and caused to strike an oak block with a blow of 12 lb with both its edge and back, and with similar blows, but with a force of 60 lb, with both flats. These tests detect flaws, and later are repeated and continued. The portion of the blade affected by the blows by the flat being particularly searching tests. If the blade passes the above tests, it is then placed vertically in a machine and shortened 5 in. The process continues, and consequently each flat, and must recover part of its original length; it is then shortened 1 in., and must recover itself when supporting a weight of 35 lb bearing on its tang. This tests the elasticity of the blade. After polishing it is again tested for fractures, and a perfect straight edge is maintained under 32 lb, and for elasticity by a further shortening of 5 in., but towards one flat only.

The introduction of the system described above has greatly simplified and cheapened the process of manufacture, while the greater excellence of the product and the severe and certain tests applied to it by mechanical means have increased the standard of efficiency in the swords of the troops. It is certainly true that, of old, excellent blades were occasionally turned out by hand, but they were exceedingly costly, and the average merit of sword-blades when turned out in numbers by entirely new and different processes to be something. It is clear that the regular methods described have eliminated this necessity for personal skill. The steel can still be spilt by over- or under-heating, whether for rolling or hardening, and tempering too can be injudiciously done, both in form and temper by unskilled grinding. Sword-making, therefore, though not the somewhat uncertain art it once was, still requires skilled craftsmen for its successful accomplishment.

(H. W. B. . F. Po.)

AUTHORITIES.—The following list of works is intended to guide the reader, if desired, to fuller acquaintance with the literature and authorities of the subject:

Archaeology and General History.—R. Forrer, "Der Werdegang von Dolch und Schwert," introduction to Die Schwertler und Schwerthände der Sammlung Carl von Schenck (Hamburg, 1905), the best monograph; Dr Julius Naege, Die norwegischen Schwertkutter aus Kupfer, Bronze und Eisen (Munich, 1903), with atlas of illustrations, a standard work for the prehistoric periods (neither of these authors havestudied the Sword of the Archer); R. F. Forrer, The Book of the Sword (only 1 vol. published; London, 1884); Colonel Lane Fox (afterwards Major-General Pitt-Rivers), Catalogue of Anthropological Collection, South Kensington Museum (London, 1884); Dr. E. Forrer, Die römisichen Schwertkutter der Kaiserzeit (Brussels, 1882); Edmund and Anderson, Ancient Scottish Weapons (Edinburgh and London, 1881). The general treatises and handbooks on arms and armaments will be found in the general works on the subject, and may be consulted with advantage, but with caution in details. The same may be said of published catalogues of museums and private collections.

W. Boehm, Handbuch der Waffenkunde (Leipzig, 1878); C. Forrer, Die Schwertkutter der Tabelle (Leipzig, 1891); W. and E. G. Forrer, The Armour of Medieval Times and of the Renaissance (London, 1900); Ashdown, British and Foreign Arms and Armour (London, 1909); and G. F. Laking, The Armour of Windsor Castle (Edinburgh, London, 1904), are trustworthy guides. The Forms and History of the Sword, by the present writer, reprinted in Oxford Lectures, &c. (London, 1890), gives further references and citations on various points.

Swordsmanship.—Egerton Castle, Schools and Masters of Fence from the Middle Ages to the Eighteenth Century (including a critical bibliography; London, 1892); Carl A. Thimm, Bibliography of Fencing and Duelling (London, 1896). For the beginnings of the art in Italy, Flav. duellatorum (a MS. of 1410 edited by Francesco da Montefeltro and accompanied by an MS. by Gentile, Vigent, Bibliographie de l'escrime ancienne et moderne (Paris, 1882); Gomard (assumed name of Possellier), Thiborde de l'escrime (historical introduction; Paris, 1845). Grieser, Les armes et le duel (preface by A. Dumais; Paris, 1847).


SWORDFISH, the name given to a small family of spinny-rayed fishes (Xiphiidae), the principal characteristic of which consists in the prolongation of the upper jaw into a long pointed sword-like weapon. The "sword" is formed by the coalescence of the intermaxillary and maxillary bones, which possess the back of a much elongated cone, more or less flattened throughout its whole length; the end is sharply pointed. It is smooth above and on the upper part of the sides, and rough below owing to the presence of innumerable rudimentary teeth, which have no function.

The general form of the body is well proportioned, somewhat elongated, and such as is always found in fishes with great power of swimming, as, for instance, in the mackerel and tuna, and the tail terminates in a powerful bilobed caudal fin. A long fin occupies nearly the whole length of the back, whilst the anal fin is generally intertial and much elongated; it has the back of a much elongated cone, more or less flattened throughout its whole length; the end is sharply pointed. It is smooth above and on the upper part of the sides, and rough below owing to the presence of innumerable rudimentary teeth, which have no function.

Some of the tropical forms are the largest of Acanthopterygian fishes, and not exceeded in size by any other Teleostean; such species attain to a length of from 12 to 15 ft., and swords have been preserved more than 3 ft. long and with a diameter of at least 3 in. at the base. The Histiophori, which inhabit chiefly the Indo-Pacific Ocean, but occur also in the Atlantic, seem to possess in their high dorsal fin an additional aid for locomotion. During the rapid movements of the fish this fin is folded downwards on the back, as it would impede the velocity of progress by the resistance it offers to the water; but, when the fish is swimming in a leisurely way, it is frequently seen with the fin

Sworfish (Histiophorus paletchus).
The food of the swordfishes is the same as that of tunnies, and consists of smaller fish, and probably also in great measure of pelagic cuttle-fishes. It has been ascertained by actual observation that swordfishes procure their food by dashing into a school of fishes, piercing and killing a number of them with their swords; and this kind of weapon would seem to be also particularly serviceable in killing large cuttle-fish, like the saw of sawfishes, which is used for the same purpose. But the sword is a thrusting weapon, whereas a swordfish does not thrust; besides, most formidable weapons of aggression. These fishes never hesitate to attack whales and other large cetaceans, and, by repeatedly stabbing them, generally retire from the combat victorious. That they combine in these attacks with the thresher-shark is an often-repeated story which is discredited by some naturalists on the ground that the dentition of the thresher-shark is much too weak to make an impression on the skin of any cetacean. The cause which excites swordfishes to such attacks is unknown; but they follow the instinct so blindly that they do not rarely assail boats and ships, retaining the sword in the water, and sometimes, for the sake of making themselves more noticeable sometimes, for the sake of making themselves more noticeable, they easily pierce the light canoes of the natives of the Pacific islands and the heavier boats of the professional swordfishermen, often dangerously wounding the persons sitting in them. Attacks by swordfishes on ocean-going ships are so common as to be included among sea-risks: they are known to have driven their weapon through copper-sheeting, oak-pank and timber to a depth of nearly 10 in., part of the sword projecting into the inside of the ship; and the force required to produce such an effect has been described by Sir R. Owen in a court of law as equal to "the accumulated force of fifteen double-handed hammer" and the velocity as "equal to that of a swivel-shot" and "as dangerous in its effects as a heavy artillery projectile." Among the specimens of planking pierced by swordfishes which are preserved in the British Museum there is one less than a foot square which encloses the broken ends of three swords, as if the fishes had had the object of concentrating their attack on the same vulnerable point of their supposed enemy. The part of the sword which penetrates a ship's side is almost always broken off and remains in the wood, as the fish is unable to execute sufficiently powerful backward movements to free itself by extracting the sword. In the Mediterranean and on the Atlantic coasts of the United States the capture of swordfishes forms a regular branch of the fishing industry. The object of the fishery in the Mediterranean is the common European swordfish (Xiphias gladius), the average weight of which is about 1 cwt., and which is abundant off the Sicilian coasts and on the opposite coast of Calabria. Two methods are employed—that by harpoons, chiefly used for larger fish, and that by peculiarly constructed nets called palamari. This fishery is very productive: a company of fishermen frequently capture from twenty to fifty fish in a single day, and the average annual catch in Sicily and Calabria is reported to be 140,000 killogrammes (138 tons). The products of the fishery are consumed principally in a fresh state, but a portion is preserved in salt or oil. The flesh of the swordfish is much preferred to that of the tunny, and always commands a high price. This species is occasionally captured on the British coast.

On the coast of the United States a different species, Histio- phorus gladius, occurs; it is a larger fish than the Mediterranean swordfish, attaining to a length of from 7 to 12 ft. and an average weight of 300 or 400 lb. It is captured only by the use of the harpoon. From forty to fifty vessels, schooners of some 50 tons, are annually engaged in this fishery, with an aggregate catch amounting annually to about 3400 swordfishes, of a value of $45,000. The flesh of this species is inferior in flavour to that of the Mediterranean species, and is principally consumed after having been preserved in salt or brine.

Useful and detailed information on the swordfish fishery can be obtained from A. T. Tozzetti, "La Pesca nei mari d'Italia e la pesca all' estero esercitata da Italiani," in Catalogo esposizione internazionale di pesca in Berlino (1880); also from La Pesca del pesce-spada nella Stretto di Messina (Messina, 1880); and from Tythoom Good, "Posidonia: Materiali di una storia del Sword-fish," in Report of the Commissioners of Fish and Fisheries in the United States (Washington, 1883).
the public service both under the French and the Prussians; in 1831 he had been raised to the hereditary nobility. His home was one of the centres of the vigorous literary and artistic life for which at that time Düsseldorf was renowned. Sybel was educated at the gymnasium of his native town, and then at the university of Berlin, where he came under the influence of Savigny and of Ranké, whose most distinguished pupil he was to become. After taking his degree, he settled down in 1841 as Privatdozent in history at the university of Bonn. He had already, in his early days, demonstrated his capacity for critical studies on the history of the middle ages, of which the most important was his Geschichte des ersten Kreuzzuges (Düsseldorf, 1841; new ed., Leipzig, 1881), a work which, besides its merit as a valuable piece of historical investigation, according to the critical methods which he had learnt from Ranké, was also of some significance as a protest against the vaguely enthusiastic attitude towards the middle ages encouraged by the Romantic school. Lady Duff-Gordon published in 1861 an English translation of part of this book, to which are added lectures on the crusades delivered in Munich in 1858 under the title History and Literature of the Crusades. This was followed by a study on the growth of German kingship (Die Entstehung des deutschen Königsus, Frankfort, 1844, and again 1881), after which he was appointed professor.

In the same year (1844) Sybel came forward prominently as an opponent of the Ultramontane party. The exhibition of the Holy Coat at Trier had attracted enormous numbers of pilgrims, and so, indignant at what appeared to him an imposture, he assisted to publish an investigation into the authenticity of the celebrated relic. From this time he began to take an active part in contemporary politics and in controversy as a strong though moderate Liberal. In 1846 he was appointed professor at Marburg, and though this small university offered little scope for his activities as a teacher, a seat in the Hessian Landtag gave him his first experience of political affairs. In 1848 he was present at Frankfort, but he did not succeed in winning a seat for the National Assembly. His opposition to the extreme democratic and revolutionary party made him unpopular with the mob, who broke his windows, as his liberalism made him suspected at court. He sat in the Erfurt parliament of 1850, and was attached to the Bonn party, which hoped for the re-organisation of Germany through a union of the liberal parties of Prussia.

During the years that followed all political activity was impossible, but he was fully occupied with his great work Geschichte der Revolutionzeit 1879-1800, for which he had made prolonged studies in the archives of Paris and other countries. The later editions of the earlier volumes are much enlarged and altered, and a new edition was published at Stuttgart in 1882. The first three volumes have been translated into English by W. C. Perry (1867-1869). In this work he for the first time showed the connexion between the internal and external history of France; he was also the first, by a systematic study of the records, to check and correct the traditional account of many episodes in the internal history. His dissertation that letters attributed to Marie Antoinette were not genuine roused much interest in France. For the history of German thought it was of the greatest importance that a Liberal from the Rhine, by a systematic history of the Revolution, attempted to over-throw the influence which the revolutionary legend, as expounded by French writers, had acquired over the German mind; and the book was an essential part of the influences which led to the formation of a National Liberal school of thought. Sybel had been much influenced by Burke, on whom he had published two essays. The work was in fact the first attempt to substitute for the popular representations of Thiers and Lamartine the critical investigation which has been carried on with such brilliance by Taine and Sorel.

In 1856, on the recommendation of Ranké, Sybel accepted the post of professor at Munich, where King Maximilian II. of Bavaria, a wise and generous patron of learning, hoped to establish a school of history. He found there a fruitful field for his activity. Besides continuing his work on the Revolution
over to the state. Böckh suggested that the word signified one who laid an information in reference to an object of trifling value, such as a fig (cf. "I don't care a fig about it"), but there seems no authority for this ininsignificance also in Greek. According to C. Stil (Die Gebiarden der Griechen und Römer, Leipzig, 1890), the word refers to an obscure gesture of phallic significance (see also A. B. Cook in Classical Review, August 1907), called "showing the fig" (faire la figue, far la fica or le fiché), originally prophylactic in character. Such gesture, directed towards an inoffensive person, became an insult, and the word sycophant might imply one who insulted another by bringing a frivolous or malicious accusation against him. According to S. Reinach (Revue des études grecques, xix., 1906), who draws special attention to the parallelism between his hierophant and the sycophants, the term sycophant survived in popular language in the sense of an informer or denouncer, whose charges deserved but little consideration. L. Shadwell suggests that the real meaning is "fig-discoverer," not "fig-informer," referring to the blackmailer who discovers the "figs" (that is, the money) of the rich man and forces him to hand it over by the threat of bringing a criminal accusation against him. It must be remembered that any Athenian citizen was at liberty to accuse another of a public offence, and the danger of such a privilege being abused is sufficiently obvious. The people naturally looked upon all persons of wealth and position with suspicion, and were ready to believe any charge brought against them. Such prosecutions also put money into the pockets of the judges, and, if successful, into the public treasury. In many cases the accused persons, in order to avoid the indignity of a public trial, bought off their accusers, who found in this a fruitful source of revenue. Certain legal remedies, intended to prevent the abuses of the system, undoubtedly existed. Persons found guilty of bringing false charges, of blackmail, or of suppressing false witnesses, were liable to criminal prosecution by the state and a fine on conviction. But it was difficult if another failed to carry the prosecution through or to obtain a fifth part of the votes. But these remedies were rather simple deterrents, and instances of informers actually brought to trial are rare. Sycophants were an inseparable accompaniment of the democracy, and the profession, at least from a political point of view, was not regarded as in any way honourable. The idea of encouraging the citizens to assist in the detection of crime or treason against the state was commendable; it was not the use, but the abuse of the privilege that was so injurious. Allusions to the sycophants are frequent in Aristophanes and the Attic orators. The word is now generally used in the sense of a cringing flatterer of the great.


SYDENHAM, CHARLES EDWARD POULETT-THOMSON, 1st Baron (1779-1841), British statesman, was born on the 13th of September 1779, being the son of John Buncombe-Poulett-Thomson, a London merchant. After some years spent in his father's business in Russia and in London he was returned to the House of Commons for Dover in 1806. In 1830 he joined Lord Grey's ministry as vice-president of the board of trade and treasurer of the navy. A free-trader and an expert in financial matters he was elected M.P. for Manchester in 1832, a seat which he occupied for many years. He was continuously occupied with negotiations affecting international commerce until 1839, when he accepted the governor-generalship of Canada, where it fell to his lot to establish the union of Upper and Lower Canada. His services in establishing the Canadian constitution were recognized in 1839 by a knighthood and a peerage. He took the title of Baron Sydenham of Sydenham in Kent and Toronto in Canada. He died unmarried on the 4th of September 1841, when his peerage became extinct.

His Memoirs were published by his brother, G. J. Poullett Scrope, in 1843.

SYDENHAM, THOMAS (1624-1689), English physician, was born on the 10th of September 1624 at Wynford Eagle in Dorset, where his father was a gentleman of property and good pedigree. At the age of eighteen he was entered at Magdalen Hall, Oxford; after a short period his college studies appear to have been abandoned, and he served for a time as an officer in the army of the parliament. He completed his Oxford course in 1648, graduating as bachelor of medicine, and about the same time he was elected a fellow of All Souls College. It was not until nearly thirty years later (1676) that he graduated as M.D., not at Oxford, but at Pembroke Hall, Cambridge, where his eldest son was then an undergraduate. After 1648 he seems to have spent some time studying medicine at Oxford, but he was soon again engaged in military service, and in 1654 he received the sum of £600, as a result of a petition he addressed to Cromwell, setting forth the various services which he had performed, and he served for a time as an officer in the army of the parliament. He completed his Oxford course in 1648, graduating as bachelor of medicine, and about the same time he was elected a fellow of All Souls College. It was not until nearly thirty years later (1676) that he graduated as M.D., not at Oxford, but at Pembroke Hall, Cambridge, where his eldest son was then an undergraduate. After 1648 he seems to have spent some time studying medicine at Oxford, but he was soon again engaged in military service, and in 1654 he received the sum of £600, as a result of a petition he addressed to Cromwell, setting forth the various services which he had performed, and he served for a time as an officer in the army of the parliament. He completed his Oxford course in 1648, graduating as bachelor of medicine, and about the same time he was elected a fellow of All Souls College. It was not until nearly thirty years later (1676) that he graduated as M.D., not at Oxford, but at Pembroke Hall, Cambridge, where his eldest son was then an undergraduate. After 1648 he seems to have spent some time studying medicine at Oxford, but he was soon again engaged in military service, and in 1654 he received the sum of £600, as a result of a petition he addressed to Cromwell, setting forth the various services which he had performed, and he served for a time as an officer in the army of the parliament.
SYDENHAM—SYDNEY

Hardly anything is known of Sydenham's personal history in London. He died in London on the 29th of December 1689, and was buried in the church of St James's, Piccadilly, where a mural slab was put up by the College of Physicians in 1810. Although Sydenham was a highly successful practitioner and said to have been among the ablest physicians of his day, his name is perhaps best known to modern readers through the various tractates called for in his lifetime, his fame as the father of English medicine, or the English Hippocrates, was decidedly posthumous. For a long time he was held in vague esteem for the success he achieved (or rather expectant) treatment of scrofula for his laudanum (the first form of a tincture of opium), and for his advocacy of the use of Peruvian bark in quaran agues. There were no other ingredients in his treatment, and he probably marked something of Sydenham's importance in larger matters than details of treatment and pharmacy, chief among them being the talented Richard Morton. But the attitude of the medicalacade of the three sects as indicated in Martin Lister's use of the term "sectaries" for Sydenham and his admirers, at a time (1694) when the leader had been dead five years. If there were any doubt that the opposition to him was quite other than political, it would be set at rest by the testimony of Dr Andrew Brown,1 who went from Scotland to inquire into Sydenham's practice and has happily revealed what was commonly thought of it at the time, in his... "Vindicatory orations; and this the New Cure of Fevers". In the series of Harveian orations at the College of Physicians, Sydenham is first mentioned in the oration of Dr John Arbuthnot (1727), who styles him "accurulus Hippocrates". H. Boerhaave, the Leyden professor of medicine, made the first of the orations (written probably by some pupils from England and Scotland) as "Angliae lumen, artis Phoebum. veram Hippocratiici virti speciem." A. von Haller also marked one of the epochs in his scheme of medical progress with the name of Sydenham, and it is quite possible because he had a new method and a better ethics of practice, the worth and difusive influence of which did not become obvious (except to those who were working closely with him) until a good many years afterwards. It remains to consider briefly what his innovations were.

First and foremost he did the best he could for his patients, and make them well, and I think he would be the last to deny it. All the tracts and traditions, and all the tricks of the craft. All the stories told of him are characteristic. Called to a gentleman who had been subjected to the lowering of the time, and finding him in a pitiful state of hysterical hypost, he "conceived that his complaint was too serious, perhaps the result of previous evacuations, and partly by emptines. I therefore ordered him a roast chicken and a pint of canary." A gentleman of fortune who was a victim to hypochondria was at length told by Sydenham that he could do no more for him, but that there was living in Inverness a certain Dr Robertson who had great skill in cases like his; the patient journeyed to Inverness full of hope, and, finding no doctor of the same name, came back to London full of rage, but cured withal of his complaint. Of a piece with this is his famous advice to Sir Richard Blackmore. When Blackmore first engaged in the study of physic he inquired of Sydenham what he thought of the doctrine of contagion, and whether that in Don Quixote, "which," said he, "is a very good book; I read it still." There were cases, he tells us, in his practice where "I have come to the conclusion that a primary notion may be formed by doing nothing at all." It was in the treatment of small-pox that his startling innovations in that direction made most stir. It would be a mistake, however, to suppose that Sydenham wrote no long descriptions, after the fashion of the time, or was entirely free from theoretical bias. Doctrines of disease he had, as every practitioner must have; but he was too much alive to the multiplicity of new facts and to the infinite variety of individual conditions to aim at symmetry in his theoretical views and at sistency between his practice and his doctrines; and his treatment was what he found to answer best, whether it were secondum artem or contum ac fortuitum. Acute diseases were usually treated by themselves in nature and to draw up a complete picture ("Krankheitsbild" of the Germans) of the objective characters of each. Most forms of ill-health, he insisted, had a definite type, characteristic of the disease, which could be found among the symptoms. The form of type in the symptoms and course of a malady was due to the uniformity of the cause. The cases that he dwelt upon were "conjectural and conjunct causes," or, in other words, the morboid phenomena. But his judgment of that came after. Acute diseases, such as fevers and inflammations, he regarded as a wholesome conservative effort or reaction of the organism to meet the exigencies imposed by the disease. In this he followed the Hippocratic teaching closely as well as the Hippocratic practice of watching and aiding the natural crises. Chronic diseases, on the other hand, were a depraved state of the humors which was the result of habit or manum or, in either case, which we ourselves were directly accountable. Hence his famous dictum: "acutos dico, qui ut plurimum Deum habent autorem, sicut chronici ipso nos." Sydenham's nosological method is essentially the modern one, except that it wanted the morbidity of form, not the term, which is a slight difference of definition, and a type of disease" by Morgani nearly a century later. In both departments of nosology, the acute and the chronic, Sydenham contributed largely to the natural history by his own accurate observation, and to the classification of disease by his use of the term "sectaries". The Observations medicae and the first Epistola responsoria contain evidence of a close study of the various levers, fluxes and maladies, and the main divisional characters. He describes the differences from year to year and from season to season, together with references to the prevailing weather—the whole body of observations being used to illustrate the doctrine of the "epidemic constitutions" of the year or season, which he considered to depend upon inscrutable telluric causes. The type of the acute disease varied, he said, according to the year and season, and the right treatment could not be adopted until the type was known. From same nothing came out of the first. The disease of the Hippocratic treatise, Hapli kénup, hêtau, tóma; and there are probably some gerns of truth in it still undevdoped, although the modern science of epidemiology has introduced a whole new set of considerations. Among other things Sydenham is credited with the first diagnosis of scarlatina and with the modern definition of chorea (in Sched. monts.). After small-pox, the diseases to which he refers most are hysteria and gout, his description of the latter (from the symptoms in his own person) being one of the classical pieces of medical writing. While Sydenham's "natural history" method has doubtless been the chief ground of his great posthumous fame, it is not the only reason for the admiration of posterity that was that which is indicated by R. G. Latham, when he says, "I believe that the moral element of a man is of the highest importance, and the only true and lasting' intellectual qualifications of observation, analysis, and comparison."

Among the lives of Sydenham are one (anonymous) by Samuel Johnson in John Swan's translation of his works (London, 1742), another by G. Kuhn in his edition of his works (Leipzig, 1873), and a third by Dr R. G. Latham in his translation of his works published in London by the Sydenham Society in 1848. See also Frédéric Simplicien Deum, au sel, ses essences (Paris, 1869), and J. F. Payne, T. Sydenham (London, 1880). Dr John Brown's "Horse subsectione" in Horae subsectione (Edinburgh, 1858), is of the nature of eulogy. Many collected editions of his works have been published as the New Cure of Fevers, and the Hippocratic treatise, the Italian. Dr W. A. Greenhill's Latin text (London, 1844, Syd. Soc.) is a model of editing and indexing. The most interesting summary of doctrine and practice by the author himself is the introduction to a selection of Observations medicæ (1667).

SYDENHAM, a large residential district in the south of London, England, partly within the metropolitan borough of Lewisham (q.v.). The Crystal Palace (q.v.) is in this district.

SYDNEY, the capital of New South Wales, Australia, in Cumberland county, on the east coast of the continent, situated on the south shore of Port Jackson (q.v.), in 33° 15' 44" S., 151° 12' 23" E. Few capitals in the world can rival Sydney in natural advantages and beauty of site. It stands on undulating and easily drained ground, upon a bed of sandstone rock, on a peninsula jutting into one of the deepest, safest and most hospitable harbours in the world, and in the centre of a great carboniferous area. The metropolitan area of Sydney consists of a peninsula, about 13 m. in length, lying between the Parramatta and George's rivers. The sea frontage of this area stretches for 12 m. from the South Head of Port Jackson to the North Head of Botany Bay; it consists of bold cliffs alternating with beautiful beaches, of which some are connected with the city by tramway, and form favourite places of resort. The city proper occupies two indented tongues of land, having a water frontage on Port Jackson, and extending from Rushcutters Bay westwards to Blackwattle Bay on the west, a distance of 8 m., nearly two miles of which is occupied by the Domain and the botanical gardens. The business quarter is a limited area lying between Darling Harbour and the Domain. The streets are irregular in width, some of them narrow and close together, while those leading down to Darling Harbour have a steep incline. Sydney has in consequence more than usually the appearance of an old-world town.

The main street of the city, George Street, is 2 m. long, running from north to south; it contains the town-hall, the post-office, and the Anglican cathedral. The post-office is a handsome sandstone building of perfect proportions. On the north side of the town-hall, on two sides with polished granite columns and surmounted by a clock tower, containing a peal of bells. The town-hall, a large

1 See Dr John Brown's Horae subsectione, art. "Dr Andrew Brown and Sydenham."
florid building of Classic order, stands on an eminence, and its clock tower forms a landmark; it contains the spacious Centennial Hall (commemorating the first Australian colonization here in 1787), and has one of the finest organs in the world. Opposite are the Queen Victoria Markets, a striking Byzantine erection, capped by numerous turrets and domes. Adjoining the town hall is the Anglican cathedral of St Andrew, in the Perpendicular style; it has two towers at the west end and a low central tower above the intersection of the nave and transepts, with a very handsome chapter house. Second in importance to George Street is Pitt Street, which runs parallel to it from the Circular Quay to the city. This is one of the narrowest streets in the Domain and contains a number of public buildings, including the treasury, the office of public works, the houses of parliament and the mint. In Bridge Street, behind the office of public works, are the exchange and the crown lands office. All these government offices are in classical style. The Roman Catholic Cathedral of St Mary lies on the north-east side of Hyde Park; it is a splendid Gothic structure, the finest in Australia. This cathedral has been twice destroyed by fire, and the existing building, from the designs of Mr. W. W. Wardell, was consecrated in 1905. Government House, the residence of the governor-general, is an excellent Tudor building erected in 1837, and several times enlarged, is delightfully situated in the Domain, overlooking Farm Cove. The residence of the state governor is at Rose Bay, east of the city. At the top of King Street there is a statue of Queen Victoria and close by a statue of Prince Albert, at the entrance to Hyde Park, in which the most elevated spot is occupied by a statue of Captain Cook. The university stands in its own grounds on the site of Grose Farm, the scene of one of the earliest attempts at government farming. Like most of the buildings at Sydney, the university is built of the excellent sandstone from the quarries of Pyrmont; it is 15th-century Gothic in style and stands at the top of a gentle slope, surrounded by gardens. Around it lie three Gothic colleges in the 14th-century style, affiliated to the university and known as St Paul's, St John's and St Andrew's. They are residential colleges belonging respectively to the Anglicans, Roman Catholics and Presbyterians. The university provides instruction and grants degrees in arts, law, medicine, science and engineering; instruction in theology, however, is given, not by the university, but by the different affiliated colleges.

To compensate for the narrow streets and its lack of charm, Sydney possesses a number of grand parks, surpassed in few other capitals. Hyde Park is a plateau almost in the centre of the city, which in the early days of Sydney was used as a race-course. Adjoining are two smaller parks, Cook Park and Phillip Park, while north of these stretches the Domain and the botanical gardens. The Domain embraces 138 acres, extending along one side of Woolloomooloo Bay and surrounding Farm Cove, in which the warships belonging to the Australian station are usually anchored; in this charming expanse of park land are the governor's residence and the National Art Gallery, which houses a splendid collection of pictures by modern artists, statutory, pottery and other objects of art. The botanical gardens on the southern shores of Farm Cove are the finest in the Commonwealth and are distinguished for their immense collection of exotics. On the south-east of the city lie Moore Park, 600 acres in extent, containing two fine cricket grounds and the show grounds of the agricultural society, and Centennial Park, formerly a water reserve of 768 acres. Adjoining Moore Park is the metropolitan race-course of Randwick. There are numerous other and smaller parks, of which the chief are Wentworth Park laid out on the site of Blackwattle Swamp, Prince Alfred Park, Belmore Park and Victoria Park adjoining the university grounds.

Sydney harbour is divided into a number of inlets by projecting headlands. The head of Woolloomooloo Bay, Sydney Cove, the shallow bay between Dawes and Millers Point, and Darling Harbour, are lined with wharves. The Circular Quay at the head of Sydney Cove is 3,000 ft. long, and here all the great ocean liners from Europe, China and Japan are berthed, while to the great wharf in Woolloomooloo Bay, 3,000 ft. in length, the American liners and the majority of the small coasting vessels come to discharge their cargoes. The whole of the eastern side of Darling Harbour is occupied by a succession of wharves and piers, there being in all 4,000 ft. of wharfage. Connected with the main railway system of the colony is the Darling Harbour Wharf 1,200 ft. long and equipped with electric light, stationary and travelling hydraulic cranes, machinery for meat freezing, and large sheds for storing corn and wool. In addition to these there are wharves at Pyrmont and Blackwattle Bay, 1,500 ft. and 1,400 ft. long. These harbours on the eastern side of Sydney have many vessels engaged in cargo boats trading in coal, corn, frozen meat, wool, hides and various ores. The total length of quays and wharves belonging to the port amounts to some 23 m. The dock accommodation is extensive. On Cockatoo Island, a few miles west of the city, the government have two large dry docks, the Fitzroy dock, 450 ft. long, and the Sutherland dock, 630 ft. Mort's dock, another large dry dock, is at Mort's Bay, Balmain, while there are five floating docks with a combined lifting power of 3,856 tons, and the three patent slips in Mort's Bay can raise between them 3,940 tons. Prior to 1891 the jurisdiction of the port was in the hands of a marine board, three members of which were elected by the shipping interest, and the remaining four nominated by the government, but in that year the board was replaced by a single official, known as the superintendent of the department of navigation and responsible to the colonial secretary.

Sydney has a great number of learned, educational and charitable institutions; it possesses a Royal Society, a Linnean Society and a Geographical Society, a women's college affiliated to the university, an astronomical observatory, a technical college, a school of art with library attached, a bacteriological institute, at Rose Bay, a museum, a free public library. Standing in the centre of a great coal-bearing basin, Sydney is naturally the seat of numerous manufactures, to the prosperity of which the abundance and cheapness of coal has been highly conducive. In addition to the industries connected with the shipping, large numbers of hands are employed in the government railway works, where the locomotives and rolling stock used by the state railways are manufactured. There are several large tobacco factories, flour mills, boot factories, sugar refineries, tanneries, tallow works, meat-preserving, glue and kerosene-oil factories. The warehouses, with their carriages, pottery, glass, paper and furniture are made, and there are numerous.

Sydney is governed municipally by a city council. The gas and electric lighting is in the hands of private firms. The administration of the park, the city improvements and the water and sewerage departments have been handed over to boards and trusts. The control of the traffic is in the hands of the police, who, with the wharves and the tramways, are directed by the state government. The whole district between Sydney and Parramatta on each side of the railway is practically one continuous town, the more fashionable suburbs lying on the east of the city while the business extension is to the westward, and the southern quarters are largely devoted to manufacturing. The suburbs comprise the following distinct municipalities, Alexandria, with a population in 1901 of 9341; Annandale, 8349; Ashfield, 14,329; Balmain, 30,976; Bexley, 3079; Botany, 3383; North Botany, 3772; Burwood, 7521; Camperdown, 7931; Canterbury, 4226; Concord, 2818; Darlington, 3746; Drummoine, 4244; Enfield, 2407; Erskineville, 6059; Glebe, 10,220; Hunter's Hill, 4232; Hurstville, 4019; Kogarah, 3892; Lane Cove, 191; Leichhardt, 17,445; Manly, 3053; Marrickville, 18,775; Maitland, 3053; Mosman, 5697; Newtown, 23,598; North Sydney, 22,501; Paddington, 21,981; Petersham, 15,377; Randwick, 9753; Redfern, 24,410; Rockdale, 7857; Ryde, 3222; St Peter's, 5906; Vaucluse, 11,52; Waterlooo, 6609; Waverley, 13,432; Willoughby, 6004; Woollahra, 12,351. These suburbs are connected with the city, some by railway, some by steam, cable and electric tramways, and others by ferry across Port Jackson. The tramway system is owned by the government.

There are numerous places of resort for the citizens. Many
of the bays in the harbour are largely visited on Sundays and holidays. The most popular resorts are Manly Beach, Chowder Bay and Watson's Bay, in the harbour; Cabarita, on the Parramatta river; Middle Harbour; and Coogee Bay and Bondi, on the ocean beach; Botany, Lady Robinson's Beach, Sandringham and Sans Souci on Botany Bay. Besides these there are two splendid national reserves, an hour's journey by rail from Sydney, viz. National Park, comprising an area of 36,810 acres, surrounding the picturesque bay of Port Hacking; and Kurrinang Chase, with an area of 35,300 acres.

The two principal cemeteries are at Waverley and Rookwood. The former is most picturesquely situated on the cliff overlooking the Pacific Ocean.

The climate of Sydney is mild and equable; in summer sea breezes blow from the north-east, which, while they temper the heat, make the air exceedingly humid; in winter the winds blow from the west and the climate is dry and bracing. The mean average temperature is 65° Fahr., and the rainfall 40-66 in.

The population has increased with marvellous rapidity. In 1861 it was (city and suburbs inclusive) 95,000; in 1881, 227,300; in 1891, 359,270; and in 1901, 437,900. The proportion of city dwellers to suburban is as follows: in 1901—city, 112,137; suburbs, 359,633; total, 437,900. The incorporated area of the metropolitan district is about 142 sq. m., or 91,220 acres, so that the average density of population was 5,935 persons per acre, some of the more immediate suburbs being more densely populated than the city itself.

SYDNEY, the chief town of Cape Breton county, Nova Scotia, on a good harbour, the eastern terminus of the Intercolonial railway. Pop. (1891), 2427, (1901), 5900. Formerly a quiet country town, it became between 1817 and 1901 the chief shipping port of the Dominion Coal Company, and the site of the large works of the Dominion Iron and Steel Company. On the opposite side of the harbour are the flourishing towns of North Sydney and of Sydney Mines. It is the starting point for the line of steamers to the Bras d'Or lakes, and a favourite summer resort.

SYENITE, a name first used by Pliny to designate rocks of the same type as the hornblende granite of Syene (Assouan) in Upper Egypt, so extensively used in ancient times for architectural work and monuments. Transferred by Werner to a rock of much the same appearance, though not identical in mineralogical character with the Egyptian granite, from the Plauen 'scher Grund near Dresden, it is now used as the group name for a class of holo-crystalline plutonic rocks composed essentially of an alkali felspar and a ferromagnesian mineral. The structure and appearance are very much the same as that of a hornblende granite; from which it is difficult to distinguish these rocks in hand specimens. The important difference, however, is the absence or scarcity of quartz in the syenites. Their essential components are orthoclase, often with some albite, and augite, hornblende or biotite. The orthoclase is white or pink, and forms nearly one half of the rock. It may be veined with albite (microperthite) and small crystals of plagioclase (mostly andesine and oligoclase) often are present, usually having better crystalline forms than the potash felspar. The prevalent hornblende is green, but brown hornblende and dark blue hornblende, of strong pleochroism, occur in some syenites which are rich in apatite, zircon, magnetite and pyrites; quartz as above stated is rarely absent but should never be abundant, otherwise the rock becomes a granite. Nepheline and sodalite occur only in those rocks which show transitions to the nepheline-syenites.

The structure of syenites is almost exactly the same as that of the granites; varieties with orthoclase felspar are known but rare; hornblende is present in some cases, but not abundant; amphiboles are included in the hornblende of syenites, or otherwise, in transition to the hornblende-tuff of the mica-syenites, and diopside in some transitional syenites. Some syenites show the presence of a yellow or a pink spherulitic quartz, and are known as quartz syenites. Some are of a yellowish grey colour and known as hornblendic syenites.

The following table shows the chemical composition of a few representative syenites and one hornblende-syenite in parts per 100.

<table>
<thead>
<tr>
<th></th>
<th>SiO₂</th>
<th>Al₂O₃</th>
<th>Fe₂O₃</th>
<th>FeO</th>
<th>MgO</th>
<th>CaO</th>
<th>Na₂O</th>
<th>K₂O</th>
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</thead>
<tbody>
<tr>
<td>I. Hornblende-syenite (Plauen 'scher Grund, Dresden)</td>
<td>69.83</td>
<td>16.85</td>
<td>7.01</td>
<td>2.61</td>
<td>4.43</td>
<td>2.44</td>
<td>6.57</td>
<td></td>
</tr>
<tr>
<td>II. Laurvikite (Laurvik, Norway)</td>
<td>68.58</td>
<td>20.30</td>
<td>3.63</td>
<td>2.58</td>
<td>0.79</td>
<td>3.03</td>
<td>5.73</td>
<td>4.50</td>
</tr>
<tr>
<td>III. Nordmarkite (Christiania)</td>
<td>69.87</td>
<td>17.87</td>
<td>2.67</td>
<td>1.50</td>
<td>0.54</td>
<td>0.90</td>
<td>7.96</td>
<td>5.69</td>
</tr>
</tbody>
</table>

SYLBURG, FRIEDRICH (1536—1596), German classical scholar, son of a farmer, was born at Wetter near Marburg. He studied at Marburg, Jena, Geneva, and, lastly, Paris, where his teacher was Henry Estienne (Stephanus), to whose great Greek Thesaurus Sylburg afterwards made important contributions. Returning to Germany, he edited a
SYLHET—SYLLABUS

useful edition of the Institutiones in graecam linguam (1580) of Nicolas Clerandus (Cleynaerts, 1495-1542). In 1583 he resigned his post at Lieb and moved to Frankfort-on-the-Main to act as corrector and editor of Greek texts for the enterprising publisher Johann Wechel. To his Frankfurt period belong the editions of Pausanias, Herodotus, Dionysius of Halicarnassus (one of his best pieces of work and highly praised by Niebuhr), Aristotle, the Greek and Latin sources for the history of the Roman emperors and the Ποι ουσίας of Apollonius Dyscolus. In 1591 he removed to Heidelberg, where he became librarian to the elector palatine. The Wechel series was continued by Hieronymus Comenius of Heidelberg, for whom Syllabus edited Clement of Alexander, Justin Martyr, the Elenchus logiorum, the Centuriator, the Greek epic poets, Xenophon, Nonnus and other works. All Syllburg's editions show great critical power and indefatigable industry. He died on the 17th of February 1596, a victim of over-work.


SYLHET, a town and district of British India, in the Surma valley, division of Eastern Bengal and Assam. The town is on the right bank of the river Surma, on rising ground, embowered in groves. Pop. (1901), 13,803. There are manufactures of mats, carved ivory and shells, and furniture. There is a unaided college, founded in 1802, which is mainly supported by a native gentleman. There are two dispensaries and an English church. The great earthquake of the 12th of June 1897 destroyed every substantial building, but caused very little loss of life. Sylhet is the largest town in Assam, but is steadily decaying, being 50 m. from a railway and inaccessible to steamers during the dry season.

The district of Sylhet has an area of 5388 sq. m. It consists of the lower valley of the Surma or Barak river, and for the most part is a uniform level broken only by scattered clusters of sandy hillocks called tilās, and intersected by a network of rivers and drainage channels. It is a broad and densely-cultivated plain, except in the extreme north, where the enormous rainfall converts many square miles of land into one huge lake during the rains, and in the south, where eight low ranges of hills, spars of the Tippera mountains, run out into the plain, the highest range being about 1500 ft. above sea-level. There is also a small detached group of mountains, comprising the Huril hills, to the south of the district, and watered by the branches of the Surma (q.v.) which are navigable by large boats, and support a busy traffic. The climate is extremely damp and the rainfall is heavy, reaching an annual average of over 150 in.; the rainy season generally lasts from April to October.

In 1901 the population was 2,241,848, showing an increase of 4% in the decade. More than half are Mahomedans. Tea cultivation is a flourishing industry in the southern hills. The Assam-Bengal railway crosses the district, but trade is still largely river-born. Great damage was done by the earthquake of June 1897, which was followed by an outbreak of malarial fever.

Sylhet passed into the hands of the British in 1765, with the rest of Bengal, of which it formed an integral part until 1874, being included in the Dacca division. In that year it was annexed, together with the adjoining district of Cachar, to the chief-commissionership of Assam which was amalgamated with eastern Bengal in 1905.

See Sylhet District Gazetteer (Calcutta, 1905).

SYLLABUS (from Gr. σyllαβατειν, to take together, cf. “syllable”), literally something taken together, a collection (Late Lat. syllabus), hence a compendium, table or abstract giving the heads, outline or scheme of a course of lectures, teaching, &c. The word in the sense of list or catalogue is uncommon. A collection of eighty condemned propositions, addressed by order of Pius IX. to all the Catholic episcopate, under the date of the 8th of December 1864. The official title is: “A collection (syllabus) containing the principal errors of our time as noted in the Allocutions, Encyclicals and other Apostolic Letters of our Holy Father Pope Pius IX.” This collection contains a rather curious history. As early as 1849, the council of Spoleto asked the pope for a collective condemnation of all errors concerning the Church, her authority and property. In 1851 the Civilia catholicæ proposed that this should be drawn up in connection with the definition of the Immaculate Conception of Mary. In 1852, Cardinal Fornari wrote by order of the pope to a certain number of bishops and laymen asking for their assistance in the study of the errors most prevalent in modern society. The answers are unknown; but after the definition of the Immaculate Conception (December 8, 1854), the pope accepted the proposals and entrusted the compilation and condemnation of the errors to the province of theology. The commission was entrusted with the further mission of studying modern errors. For six years it gave no outward signs of activity; but in 1860 Mgr Gerbet, bishop of Perpignan, published his Instruction pastorale sur diverses erreurs du temps présent; in it he enumerated 83 erroneous propositions, grouped under eleven heads. Pius IX. was much impressed by this work; he had it printed, and communicated it to the commission, to which he added a few new members, desiring them to take it as a fresh basis for their researches. In 1861 the commission had 27 meetings, at which the principal propositions were chosen and formulated in Latin and the theological council which they incurred applied to them. The result was a collection first of 70, and later of 61 propositions, of which only 27 have the note haereticæ; Mgr Gerbet’s divisions, and frequently his text, are adhered to. This Syllabus, which was excellently drawn up, was not promulgated, owing to an indiscretion. On the occasion of the festivals of the canonization of the Japanese martyrs, Pius IX. had gathered around him three hundred bishops from all parts of the world; he had the projected Syllabus communicated to each of them, under the seal of secrecy for the purpose of asking their opinion on each; but each bishop was also, still under the same secrecy, empowered to consult a theologian selected by himself. But in October 1862, the Turin Mediatore published the catalogue in full, and Mgr Bouquet, bishop of Montreal, thinking that it had been published in Rome, officially promulgated it for his diocese in December 1863. Pius IX. then modified his plans: a new commission was appointed to extract from the Allocutions, Encyclicals and papal Letters the chief errors dealt with in them. This work lasted about a year; the result of it was the Syllabus, in eighty propositions, arranged under the distinct heads; the propositions were not accepted by any theologian, but were simply struck out of the list by a reference to the Allocution, Encyclical or Letter from which each had been more or less textually extracted. This was addressed to the episcopate together with a letter from Cardinal Antonelli, and dated the 8th of December 1864, the same date as the Encyclical Quanta cura, from which, however, it remains quite distinct. Its publication aroused the most violent polemics; what was then called the Ultramontane party was loud in its praise; while the liberals treated it as a declaration of war made by the Church on modern society and civilization. Napoleon III.‘s government forbade its publication, and suspended the newspaper Il mediatore; public opinion was so strong that the book was reprinted, and was eventually numbers to as the theological value of the Syllab- uses. More Catholics saw in it as many infallible definitions as condemned propositions; others observed that the pope had neither personally signed nor promulgated the collection, but had intentionally separated it from the Encyclical by sending it merely under cover of a letter from his secretary of state; they said that it was hastily, and sometimes unfortunately drawn up (cf. prop. 61); they saw in it an act of the pontifical authority, but without any of the marks required in the case of dogmatic definitions; they concluded, therefore, that each proposition was to be appreciated separately, and in consequence that each syllabus was to be separated from the other. The same is the true view of the fact that Rome never censured the theologians who, like Newman, took up this position.

The errors enumerated in the Syllabus are grouped under the ten following heads: (1) Pantheism, naturalism and absolute
SYLLOGISM

rationalism; (2) Moderate rationalism; (3) Individualism, latitudinarianism; (4) Socialism, communism, secret societies, Bible societies, clerico-liberal societies; (5) Errors regarding the Church and her rights; (6) Errors regarding civil society both in itself and in its relations with the Church; (7) Errors regarding Christian and natural morality; (8) Errors regarding Christian marriage; (9) Errors concerning the temporal power of the pope; (10) Errors regarding the modern Liberalism. The modern Liberalism, however, the Syllabus did not contain a new doctrine; this Church was defending her traditional doctrine against the progressive invasion of what were called modern ideas of liberty, i.e. the independence of religious authority shown by secular societies, liberty of conscience, equality of all religious confessions before the state, &c. She upheld her theoretical position as in the time of Philip the Fair or of the Reformation, and the Syllabus goes no further in this respect than the Encyclical Quanta cura of the same date, or that of Gregory XV., Mirari vos, of the 1st of August 1832. But the unusual form of the document should be considered: instead of an exposition of doctrine it enumerates the errors in the form of bare propositions, without any qualification, and with no variation in the degree of condemnation; the result being that many people on both sides were misled.

The name Syllabus has sometimes also been given to the collection of 65 "modernist" propositions condemned by the decree Lamentabili of the Holy Office, dated the 3rd of July 1907; but this name is no wise official.

But we are concerned here only with those documents which the presentations of the Syllabus were collected together in the Recueil des allocutions consistoriales, &c. citées dans l'encyclopéie et le syllabus (Paris, 1865). For the history of the Syllabus: P. Hourat, Le Syllabus, étude documentaire (Paris, 1904); and P. Kinaldi, Il Valore del syllabo (Rome, 1888). For its theological value: Newman, A Letter Addressed to his Grace the Duke of Norfolk (London, 1875); P. Viollet, L'Infallibilité du pape et le syllabus (Paris, 1904); L. Choupin, Valeur des décisions doctrinales et disciplinaires du Saint Siège (Paris, 1907).

SYLLOGISM (Gr. συλλογισμος, from συν, and λογος, an argument resulting from combination, i.e. of premises), in logic, an argument consisting of premises and a conclusion. Aristotle's definition is (Anal. Pr. a i. 24 b 18; cf. Top. a 1. 100 a 25): συλλογισμος ειται λογος ιν ζ ἕκαστος των ἐκείνου τι των κειμενων ξ ἀνάγκης συνεκπερ φανετα είναι, "a syllogism is an argument in which, certain things being posited (the premises), something else (the conclusion) necessarily results from their being true." This definition, though it contains the really important facts, is too wide in two respects. (1) Aristotle himself and subsequent logicians restrict the term to arguments in which there are but two premises. (2) In point of fact, all logicians further confine the syllogism to arguments in which the terms are related as subject and predicate (or attribute in the widest sense). A fortiori arguments, for example, wherein relations of quantity are brought together, though syllogistic in type, are generally excluded. Owing largely to the simplicity and symmetry of the syllogism it has been a fundamental type of logic to make the syllogistic form the type of all thought. Modern logicians (cf. especially F. H. Bradley in his Logic) have, however, shown that in practice its importance is greatly exaggerated.

A. The Deductive Syllogism.—This argument is the simplest form of "mediate" inference, i.e. an argument in which two premises are brought into a necessary relation by the aid of a "middle" term which serves as a bridge. It requires, therefore, two propositions known as premises 1 (also spelled premises, as being more in accordance with the Lat. praemissae [propositions sententiae], things put or posited in advance) which contain one common term and one other term each. In the conclusion the middle term disappears and the other two are brought together. The premises are assumed: whether true or false, the conclusion follows necessarily. If the premises are true, the conclusion must be true: if they are false the great probability is that the conclusion is false. The predicate of the conclusion is called the major term, the subject the minor term; the term which is common to the premises and disappears in the conclusion is the middle term. Hence the premise which contains the major term is called the major premise: that which contains the minor, the minor premise. The form of the syllogism is therefore:—

\[ \begin{align*}
A & \equiv B \\
C & \equiv A \\
\therefore & \quad C \equiv B
\end{align*} \]

Major premise

Major premise

Minor

Conclusion

Syllogisms differ in (a) "figure" and (b) "mood." (a) Difference of figure depends on the order of the terms in the premises. The above is the scheme of figure I. If the middle term is the predicate in both premises, the syllogism is in figure II.; if the subject in both, figure III. These are the only figures recognized by Aristotle, though he points out that the premises in figure I. may justify a conclusion in which the predicate is not, as normally, the major term, but the minor. According to Galen, the physician of the so-called fourth figure, in which the middle term is predicate of the major and subject of the minor. This, however, destroys the appropriateness of the phrases major and minor term which are specially chosen because in fact the major term does imply the more comprehensive notion. The conclusion is an artificial proposition which would be stated naturally in the converse.

b. The distinction of moods is according to the quantity or quality of the propositions of the syllogism (universal, particular, affirmative, negative, in all the possible combinations). So far as mere form goes, each mood may occur in every figure, though in many cases the conclusion apparently yielded from the premises is invalid. A simple calculation shows that formally there are 64 possible moods. Investigation shows that of these nineteen 2 only are valid, and rules have been formulated which give the reasons for the invalidity of the remaining 45.

The rules which govern syllogistic arguments (thus described are:—

(i) A syllogism must contain three and three terms only. (a) Four terms would mean the absence of a connecting link. (b) If the middle term is ambiguous there are really four not three terms. The violation of (a) is the fallacy "Quaternio terminorum"; of (b) "ambiguous middle." (ii) The middle term must be distributed in one premise at least, i.e. it must be taken universally, as including all the particulars over which it extends (see Extension). Violation of this is the fallacy of "undistributed middle." (iii) No inference can be made from two negative premises. (iv) If either premise is negative, the conclusion is negative. (v) The conclusion cannot be negative, if both premises are affirmative. (vi) No term may be distributed in this conclusion which was not distributed in the premise in which it occurs. Violation of this rule is called an "illicit process of the major (or the minor) term." (vii) From two particular premises nothing can be inferred. If either premise is particular, the conclusion must be particular. 3 (viii) If either premise is particular, the conclusion must be affirmative.

The following mnemonic hexameter verses are generally given (first in Aldrich and later in more modern work) to aid in remembering these moods. The vowels in the words, A, E, I, O, show the quantity and quality of the premises:

1 Aristotle ἐπιστήμη, originally translated propositions; praemissae (propositiones sententiae), things put or posited in advance which

2 These latter are corollaries of previous rules.
The general criticism of the syllogism as a means of discovering truth is that it is a petitio principii, or begging of the question. This accusation is based to some extent on the Aristotelian "Dictum de omni et nullo" (Anal. Pr. a i. 24, b 26-30), generally stated as "That which is affirmed or denied of any whole may be affirmed or denied of anything contained within (or 'any part of') that whole." To take a concrete instance of a valid mood: all men are mortal, all Frenchmen are men, therefore all Frenchmen are mortal (the mood Barbara). It is argued that either there is here no real discovery (i.e. new truth) made or else an impure syllogism (begs the question) is used (bogus the question) as much as we must acknowledge that all Frenchmen are mortal we could not state that all men are mortal. The problem raised is a real one, and has been discussed by all logicians, from the time of Mill especially. In brief, the solution depends upon the view we take of the major premise, "all men are mortal." If that judgment is taken as a mere enumeration of particulars, i.e. in extension, as meaning that all men have been investigated and found to be mortal, clearly it could not be used to make the new discovery that a particular group of men are mortal; the syllogism so understood is a petitio principii. If, however, we take that judgment as a major premise, that it is not a mere summary of observed particulars but the enunciation of a necessary connexion between two concepts or universals, then the conclusion assumes a different character. The "whole" (omne) of the dictum, the major term, ceases to be taken in extension, and becomes intensive or connotative, and the inference consists in subsuming the minor under (bringing it into connexion with) the major. This is the true view of the scientific or inductive universal (as opposed to that of nominalism or pure empiricism). It remains true that in fact the conclusion is contained in the premises; this is essential to the validity of the syllogism—but the inference is a real one because it brings out and shows the necessity of a conclusion which was not before in our minds.

Hypothetical and Disjunctive Syllogisms.—The term syllogism has been extended to cover certain forms of ratiocination which are not based on categorical propositions. The property of this extended use is open to question and is denied by some logicians.

a. Hypothetical "Syllogisms" are those in which one premise is a hypothetical proposition, the other a categorical proposition which states or denies one of the two alternatives set forth. Again two forms occur: (i.) modus ponendo tollens which by the affirmation of one alternative denies the other (A is either B or C; A is B; therefore it is not C; or either A is B, C is D; A is B; therefore C is not D; or either A or B is C; A is C; therefore B is not C); (ii.) modus tollendo ponens which by the denial of the one, establishes the validity of the other alternative (A is either B or C; A is not B; therefore C is true; or either A or B is C; A is C; therefore B is not C). The validity of such arguments depends upon the sense in which we understand the disjunctive proposition: we must assume that the alternative is to be exclusive.

b. Disjunctive "Syllogisms" are those in which one premise is a disjunctive proposition, the other a categorical proposition which states or denies one of the two alternatives set forth. Again two forms occur: (i.) modus ponendo tollens which by the affirmation of one alternative denies the other (A is either B or C; A is B; therefore it is not C; or either A is B, C is D; A is B; therefore C is not D; or either A or B is C; A is C; therefore B is not C); (ii.) modus tollendo ponens which by the denial of the one, establishes the validity of the other alternative (A is either B or C; A is not B; therefore C is true; or either A or B is C; A is C; therefore B is not C). The validity of such arguments depends upon the sense in which we understand the disjunctive proposition: we must assume that the alternative is to be exclusive.

Sortes.—Finally it is necessary to mention a complex syllogistic argument known as the Sortes (Gr. ἄκριβος, heap). It has been described as "a guessing game" (I. e. guessing the answer by having the question repeated). It is, really a series of syllogisms (a polysyllogism), each one proving a premise of another, the intermediate conclusions being suppressed. Its form is A is B, B is C, C is D, . . . Y is Z, therefore Z is V. Each syllogism of the series is called a "sorte" and is defined as a "sorte decidendi" in relation to the one that succeeds, and an "epilegism" in relation to its predecessors. Resolution of the sortes into its constituent elements gives the rules (a) that no premise except the first may be particular and (b) that no premise except the last may be negative.

B. The Inductive Syllogism, like the deductive, is first systematized by Aristotle, who described it as a δς ἔναγγειλη συλλογιζόμενος. Unlike the deductive it consists in establishing a conclusion from particular premises, i.e. of referring the major term to the middle by means of the minor. The form is "A B C, &c., are P; A B C D are all M; thus all M are P." This so-called syllogism has been much criticized by modern logicians on various grounds (see Logic).

Discussions of the syllogism will be found in all textbooks on Logic. The more elaborate syllogistic forms are discussed in the article Logic.

SYLPH, an imaginary spirit of the air; according to Paracelsus, the first modern writer who uses the word, an air-elemental, coming between material and immaterial beings. In current usage, the term is applied to a feminine spirit or fairy, and is often used in a figurative sense of a graceful, slender girl or young woman. The form of the word points to a Greek origin, and Aristotle's ὁ πνεῦμα, a kind of beetle (Hist. anim. 8. 17. 8), has usually been taken as the source. Similarly, the earth-elemental or earth-spirit is called a gnomon (Gr. γνώμη, intelligence, γεγνώςαν, to know) as being the spirits that gave the secrets of the earth to mortals. Littéré, however, takes the word to be Old Celtic, and meaning "genius," and states that it occurs in such forms as sulvi, sulfi, &c., in inscriptions, or latinized as sullae or sullaeae.

SYLT (probably from the O. Fris. Silendi, i.e. sealand), the largest German island in the North Sea, being about 38 sq. m. in area and nearly 23 m. long. It is, however, very narrow, being generally about half a mile in width, except in the middle, where it sends out a peninsula to the east 7 m. across. It belongs to the Prussian province of Schleswig-Holstein, and lies from 7 to 12 m. from the Schleswig coast. The central peninsula contains some marshland and moorland pasture, on which a few thousand sheep graze; but the rest of the island consists merely of dunes or sandhills. These attain at places a height of from 100 to 150 ft., and are continually shifting to the westward. The inhabitants (3500) are of Frisian origin, and the official language is German, though in the extreme north of the island, known as Lüt, Danish is spoken. Their occupations are fishing, oyster-dredging, seafaring and wild-duck catching. The chief places are Ecke, Flensig, Morsum, Rantum and Westerland, one of the most frequented sea-bathing places of Germany, lies on the west side of the island, separated from the sea, which is seldom perfectly calm, by a chain of sand dunes, across which board walks lead to the beach. The island is reached by a regular steamboat service from Hoyer on the mainland to Munkmarsch, which is connected by a steam tram with Westerland. Another line of steamers runs from Hamburg to Sylt via Heligoland. During the Danish War of 1864, after suffering severely at the hands of the Danes, the island was occupied by the Prussians on the 13th of July (see FRIESEN INLAND)...

Sylvanite, mineral consisting of gold and silver telluride, AuAgTe₄, containing gold 24-2 and silver 13-5%; an important ore of gold. Crystals are monometric and often very rich in spaces; they are frequently twinned, giving rise to branching forms resembling written characters; on this account the mineral was early known as "graphic gold" or "graphic tellurium" (Ger. Schrifters). It was also known as "white gold," the colour being tin-white with a brilliant metallic lustre. The hardness is 2 and the specific gravity 8-2. It occurs with native gold in veins traversing porphyry at Olenbânya and Nagyag, near Děva in Transylvania (from which country it takes its name); also at several places in Boulder county, Colorado, and at Kalgoorlie in Western Australia. Sylvanite may be

1 For a dilemma which includes both hypothetical and disjunctive reasoning see DILEMMA.
2 Where one premise of a syllogism is omitted (see ENTHENYME), this argument is sometimes called an "epichirema."
SYLVESTER, J. J.—SYMBOL

readily distinguished from calaverite (AuTe₅) by its perfect cleavage in one direction (parallel to the plane of symmetry), but in this character it resembles the very rare orthorhombic mineral krennecite (Au, AgTe₅).

SYLVESTER, JAMES JOSEPH (1814–1897), English mathematician, was born in London on the 3rd of September 1814. He went to school first at Highgate and then at Liverpool, and in 1831 entered St John's College, Cambridge. In his Tripos examination, which through illness he was prevented from taking till the following year, he placed second wrangler, but being unwilling to sign the Thirty-nine Articles, he could not compete for one of the Smith's prizes and was ineligible for a fellowship, nor could he even take a degree: this last, however, he obtained at Trinity College, Dublin, where religious restrictions were no longer in force. After leaving Cambridge he was appointed to the chair of natural philosophy at University College, London, where his friend A. De Morgan was one of his colleagues, but he resigned in 1840 in order to become professor of mathematics in the university of Virginia. There, however, he remained only six months, for certain views, skeptical in the case of the administrative conspirators, entailed unpleasant consequences, and necessitated his return to England, where he obtained in 1844 the post of actuary to the Legal and Equitable Life Assurance Company. In the course of the ensuing ten years he published a large amount of original work, much of it dealing with the theory of invariants, which marked him as one of the foremost mathematicians of the time. But he failed to obtain either of two posts—the professorships of mathematics at the Royal Military Academy and of geometry in Gresham College—for which he applied in 1854, though he was elected to the former fifteen years later. The death of his wife in 1857 was a great sorrow to him. At Woolwich he remained until 1870, and although he was not a great success as an elementary teacher, that period of his life was very rich in mathematical work, which included remarkable advances in the theory of the partition of numbers and further contributions to that of invariants, together with an important research which yielded a proof, hitherto lacking, of Newton's rule for the discovery of imaginary roots for algebraical equations up to and including the fifth degree. In 1874 he produced several papers suggested by A. Peacock's discovery of the straight line link motion associated with his name, and he also invented the skew pentagon. Three years later he was appointed professor of mathematics in the Johns Hopkins University, Baltimore, stipulating for an annual salary of $5000, to be paid in gold. At Baltimore he gave an enormous impetus to the study of the higher mathematics in America, and during the time he was there he contributed to the American Journal of Mathematics, of which he was the first editor, no less than thirty papers, some of great length, dealing mainly with modern algebra, the theory of numbers, theory of partitions and universal algebra. In 1883 he was chosen to succeed Henry Smith in the Savilian chair of geometry at Oxford, and there he produced his theory of reciprocants, largely by the aid of his "method of infinitesimal variation." In 1893 loss of health and failing eyesight obliged him to give up the active duties of his chair, and a deputy professor being appointed, he went to live in London, where he died on the 15th of March 1897. Sylvester's work suffered from a certain lack of steadiness and method in his character. For long periods he was mathematically unproductive, but then sudden inspiration would come upon him and his ideas and theories poured forth far more quickly than he could record them. All the same his output of work was as large as it was valuable. The scope of his researches was described by Arthur Cayley, his friend and fellow worker, in the following words: "They relate chiefly to finite analysis, and cover by their subjects a large part of it—algebra, determinants, elimination, the theory of equations, partitions, tacit, the theory of forms, matrices, reciprocants, the Hamiltonian numbers, &c.; analytical and pure geometry occupy a less prominent position; and mechanics, optics and astronomy are not absent." Sylvester was a good linguist, and a diligent composer of verse, both in English and Latin, but the opinion he cherished that his poems were on a level with his mathematical achievements has not met with general acceptance.


SYLVESTER, JOSHUA (1563–1618), English poet, the son of a Kentish clothier, was born in 1563. In his tenth year he was sent to school at Southampton, where he gained a knowledge of French. After about three years at school he appears to have put to business, and in 1581 the title-page of his Verses states that he was in the service of the Merchant Adventurers' Company. He was for a short time a land steward, and in 1606 Prince Henry gave him a small pension as a kind of court poet. In 1613 he obtained a position as secretary to the Merchant Adventurers. He was stationed at Middelburg, in the Low Countries, where he died on the 28th of September 1618. He translated into English heroic couplets the scriptural epic of Guillaume du Bartas. His Essay of the Second Week was published in 1598; and in 1604 The Divine Weeks of the World's Birth. The ornate style of the original offered no difficulty to Sylvester, who was (somewhat bright in the) Amphitheatre, and added many adornments of his own invention. The Septaines of Du Bartas appealed most to his English and German co-religionists, and the translation was immensely popular. It has often been suggested that Milton owed something in the conception of Paradise Lost to Sylvester's translation. His popularity ceased with the Restoration, and Dryden called his verse "abominable fustian."

His works were reprinted by Dr A. B. Grosart (1880) in the Livre des Worthies and Historical &c.

See also C. Dunster's Considerations on Milton's early Reading (1890).

SYLVITE, a mineral consisting of potassium chloride (KCl), first observed in 1823, as an encrustation on Vesuvian lava. Well-formed crystals were subsequently found in the salt deposits of Stassfurt in Prussia and Kalusz in Austrian Galicia. It crystallizes in the cubic system with the form of cubes and cubic-octahedra and possesses perfect cleavages parallel to the faces of the cube. Although the crystals are very similar in appearance to crystals of common salt, they are proved by etching experiments to possess a different degree of symmetry, namely plagioclase-cubic, there being no planes of symmetry but the full number of axes of symmetry. Crystals are colourless (sometimes a slight tint of the) transparent; the hardness is 2 and the specific gravity 1.98. Like salt, it is highly diathromenous. The name sylvite or sylvin is from the old pharmaceutical name, sal digestivus sylviis, for this salt.

SYMBOL (Gr. σύμβολον, a sign), the term given to a visible object representing to the mind the semblance of something which is not shown but realized by association with it. This is conveyed by the ideas usually associated with the symbol; thus the palm branch is the symbol of victory and the anchor of hope. Much of early Christian symbolism owes its origin to pagan sources, the interpretations of the symbols having a different meaning; thus "the Good Shepherd with the lamb" is thought by some to have been derived from the figure of Hermes (Mercury) carrying the goat to sacrifice, and "Orpheus charming the wild beasts," which, when painted in the catacombs, was probably intended as the representation of a type of Christ. One of the earliest symbols of the Saviour, the fish, was derived from an acrostic of the Greek word Ἠχθος, the component letters of which were the initials of the five words Ἰησοῦς Χριστός, θεὸς τῶν, σώτηρ. Jesus Christ, Son of God, Saviour. The ship, another early symbol, represented the Church as a sanctuary of the faithful and a boat of safety on the sea of life. Other symbols are those which were represented by animals, real or fabulous, and were derived from Scripture: thus the lamb typified Christ from St John's Gospel (i. 29 and 36), and the lion from the Book of Revelations, in which Christ is called the "Lion of the tribe of Judah." The peacock stood for immortality; the phoenix for the Resurrection; the dragon or the serpent for Satan; and the stag for the soul thirsting for baptism. The sacred monogram Chi Rho, Χไข suppressed to have been the celestial sign seen by the emperor Constantine on the eve of the defeat of Maxentius, represents the two first letters of the Greek word
**SYME—SYMMACHUS**

Xρεσις which Constantine figured on his labarum, or standard, and is found on early Christian coins, bearing also the favourite decoration of the Byzantine sarcophagi. The four evangelical symbols are taken from the book of Ezekiel and from the Book of Revelations; thus the winged man is St Matthew, the winged lion St Mark, the winged ox St Luke and the eagle St John; and these four symbols became the favourite subject for representation in the Church. Besides these the other evangelists and the saints carry emblems by which they may be recognized; thus St Andrew by the cross, St Peter by the keys, St Paul by the sword, St Edward by a cup and dagger, St Mary Magdalene by a box or vase, St Lawrence by a gridiron, St Faith also by a gridiron, &c.

**SYME, JAMES** (1799-1879), Scottish surgeon, was born at Edinburgh on the 7th of November 1799. His father was a writer to the signet and a landowner in Fife and Kinross, who lost most of his fortune in attempting to develop the mineral resources of his property. James was sent to the high school at the age of nine, and remained until he was fifteen, when he entered the university. For two years he frequented the arts college, but his mind was really enlisted in his own community, devoting himself with particular keenness to chemistry. His chemical experiments led him to the discovery that "a valuable substance is obtainable from coal tar which has the property of dissolving india-rubber," and could be used for waterproofing silk and other textile fabrics—an idea which was patented a few months afterwards by Charles Mackintosh, of Glasgow. In the session 1818-1819 Syme became assistant and demonstrator of the dissecting room of Robert Liston, who had started as an extra-mural teacher of anatomy in competition with his old master, Dr John Barrell. In those years he held also resident appointments in the infirmary and the fever hospital, and spent some time in Paris practising dissection and operative surgery. In 1823 Liston handed over to him the whole charge of his anatomy classes, retaining his interest in the school as a pecuniary venture; the arrangement did not work smoothly, and a feud with Liston arose, which did not terminate until twenty years later, when the latter was settled in London. In 1824-1825 he started the Brown Square school of medicine, but again disagreed with his partners in the venture. Announcing his intention to practise surgery only, Syme started a surgical hospital of his own, the Minio Hoůho hospital, with which he carried on from May 1829 to September 1833, with great success as a surgical charity and school of clinical instruction. It was here that he first put into practice his method of clinical teaching, which consisted in having the patients to be operated or predicted upon brought from the ward into a lecture-room or theatre where the students were seated conveniently for seeing and taking notes. His private practice had become very considerable, his position having been assured ever since his amputation at the hip joint in 1823, the first operation of the kind in Scotland. In 1833 he succeeded James Russell as professor of clinical surgery in the university. Syme's accession to the clinical chair was marked by two important changes in the conditions of it: the first was that the professor should have the care of surgical patients in the infirmary in right of his professorship, and the second, that attendance on his course should be obligatory on all candidates for the medical degree. When Liston removed to London in 1835 Syme became the leading consulting surgeon in Scotland. On Liston's death in 1847 Syme was offered his vacant chair of clinical surgery at University College, London, and accepted it. He began practice in London in February 1848. The year 1849 was a difficult one; two of his colleagues at Gower Street and a desire to "escape from animosity and contention" led him to throw up his appointment. He returned to Edinburgh in July, and was reinstated in his old chair, to which the crown authority had meanwhile found a difficulty in appointing. The judgment of his friends was that "he was always right in the matter, but often wrong in the manner, of his quarrels." In 1849 he broached the subject of medical reform in a letter to the lord advocate; in 1854 and 1857 he addressed open letters on the same subject to Lord Palmerston; and in 1858 a Medical Act was passed which largely followed the lines laid down by himself. As a member of the general medical council called into existence by the act, he made considerable stir in 1868 by an uncompromising statement of doctrines on medical education, which were thought by many to be reactionary; they were, however, merely an attempt to recommend the methods that had been characteristic of Edinburgh teaching since William Cullen's time—namely, a constant reference of facts to principles, the subordination (but not the sacrifice) of technical details to generality, and the preference of large professional classes and the "magnetism" of the individual to the "cramping". In April 1869 he had a paralytic seizure, and at once resigned his chair; he never recovered his powers, and died near Edinburgh on the 26th of June 1870.

Syme's surgical writings were numerous, although the terseness of his style and directness of his method saved them from being bulky. In 1851 he published A Treatise on the Excision of Diseased Months of the Years, easily recognizable among his name. His Principles of Surgery (often reprinted) came out a few months later; Diseases of the Rectum in 1839; Stricture of the Urethra and Fistula in Ano in 1849; and Excision of the Scrota in 1864. In 1848 he collected into a volume, under the title of Some Remarks to the Pathology and Practice of Surgery, thirty-one original memoirs published in periodicals from time to time; and in 1861 he issued under the title of Operative Observations of Clinical Surgery. Syme's character is not inaply summed up in the dedication to him by his old pupil, Dr John Brown, of the series of essays Loche and Sydenham: "Verax, capax, perspicac, sagax, efficax, tenax."

**SYMMACHUS**

The most renowned of the Byzantine hagiographers. Scholars have been very much divided as to the period in which he lived, dates ranging from the 9th to the 14th having been suggested; but it is now generally agreed that he flourished in the second half of the 10th century. Still greater divergences of opinion have existed as to the lives of saints coming from his pen, and here again the solution of the problem has been attained by studying the composition of the great Greek menologies. The menology of Metaphrastes is a collection of lives of saints for the twelve months of the year, ranging in style and importance, consisting of about 150 distinct pieces, some of which are taken bodily from older collections, while others have been subjected to a new recension (metaphaping). Among other works attributed (though with some uncertainty) to Symmachus are a Chronicle, a canonical collection, some letters and poems, and other writings of less importance. Symmachus' great popularity is due more particularly to his collection of lives of saints. About his life we know only very few details. The Greeks honour him as a saint on the 28th of November, and an office has been composed in his honour.

See L. Allatius, De Symmacho scriptis dioecesis (Paris, 1664); F. Hirsch, Byzantinische Studien, pp. 303-355 (Leipzig, 1870); A. Ehrhard, Die Legensammlung des Symmachus Metaphrastes (Rome, 1897); and in Römische Quartalschrift (1897), pp. 67-205 and 531-551; H. de Beihay, La Vie de St. Paul le Jeune et la chronologie de Metaphraste (1893); Anetologia Bollandiana, xvi. 312-327 and xvii. 448-452.

**SYMMACHUS**, pope from 498 to 514, had Anastasius II. for his predecessor and was himself followed by Hormisdas. He was a native of Sardinia, apparently a convert from paganism, and was in deacon's orders at the time of his election. The choice was not unanimous, another candidate, Laurentius, having the support of a strong Byzantine party; and both were more consecrated by their friends, the Constance of the Lateran Church and the other in that of St Mary, on the 22nd of November 498. A decision was not long afterwards obtained in favour of Symmachus from Theodoric, to whom the dispute had been referred; but peace was not established until 505 or 506, when the Gothic king ordered the Laurentian party to surrender the churches of which they had taken possession. An important incident in the protracted controversy was the
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decision of the “palmyr synd.” The remainder of the pontifi-
cate of Symmachus was uneventful; history speaks of various
churches in Rome as having been built or beautified by him.
SYMMACHUS, the name of a celebrated Roman family of
the 4th to 6th centuries of our era. It belonged to the gens Aurelia
and can be traced back to Aurelius Julianus Symmachus, pro-
consul of Achaea (according to others, vicar or vice-prefect
of Macedonia) in the year 319. Lucius Aurelius Avianius
Symmachus, who presumably was consul in 320 and 324, was
a great administrator, and his reputation for eloquence, marked
him out as the champion of the pagan senate against the
measures which the Christian emperors directed
against the old state religion of Rome. In 382 he was banished
from Rome by Gratian for his protest against the removal of
the statue and altar of Victory from the senate-house (see Gibbon,
Decline and Fall, ch. 28), and in 384, when he was prefect of the
city, he addressed to Valentinian II a letter praying for the
restoration of these symbols. This is the most interesting of his
literary remains, and called forth two replies from St Ambrose,
as well as a poetical refutation from Prudentius. After this
Symmachus was involved in the rebellion of Maximus, but
obtained his pardon from Theodosius, and appears to have
continued in public life up to his death. In 391 he was Consul
ordinarius. His honesty, both in public and in private affairs,
and his amiability made him very popular. The only reproach
that could be made against this last valiant defender of paganism
is a certain aristocratic conservativeness, and an exaggerated
love of the past. As his letters do not extend beyond the year
402, he probably died soon after that date.

Of his writings we possess: (1) Panegyrici, written in his youth in
a very archaic style, two on Valentinian I. and his mother Theodora;
(2) nine books of Epistles, and two from the tenth book,
published after his death by his son. The model followed by the
writer, he tells us, was Ammianus (see above), and his admiration
for the style and dignity of Macrobius (bk. v., § 7), in which Symmachus is introduced as
one of the interlocutors, it appears that his contemporaries deemed
him second to none of the ancients in the “rich and florid” style.
With the death of Valentinian II. this style and order were
soon effaced. (3) Fragments of Complimentaria Orations,
five from a pamphlet (also containing the Panegyrici), of
which part is at Milan and part in the Vatican, discovered by
Mai, who published the Milan fragments in 1815, the Roman in his
Scriptorum veterum nova collectio, vol. i. (1825), and the whole
in 1846. (4) The Relations, which contain an interesting account
of public life in Rome, composed for the emperor. In these official
writings (reports as prefect of the city), Symmachus is not preoccu-
pied by style and becomes sometimes eloquent: especially so in his
remarkable report on the altar of Victory.

His son, Quintus Fabius Memmius Symmachus, was pro-
consul of Africa (415) and prefect of the city (418). He was
probably the father of the Symmachus who was consul in 440,
and whose son was Quintus Aurelius Memmius Symmachus
(d. 525), patrician, one of the most cultivated noblemen of Rome
of the beginning of the 6th century, editor (e.g. of Macrobius,
Sommum Scriptiorum) and historian, and especially celebrated
for his building activity. He was consul in 455. Theodoric
charged him with the restoration of the theatre of Pompey.
He was father-in-law of Boëtius (q.v.), and was involved in his
fate, being disgraced and finally put to death by Theodoric
in 525.

All editions of the works of Symmachus are now superseded by that
of O, Seeck in Monumenta Germaniae historic a. Auctores antiqui-
issimi (1853), vol. i., with instructions on his life, works and chronology, and
a genealogical table of the family.

SYMONDS, JOHN ADDINGTON (1840–1893), English critic
and poet, was born at Bristol, on the 5th of October 1840. He
was the only son of John Addington Symonds, M.D. (1807–
1871), the author of an essay on Criminal Responsibility (1866),
to which he contributed a postscript (1878), and of Shorter
memoirs and Reminiscences, 1805–1875, published at Oxford
in 1875). His mother, Harriet Symonds, was the eldest daughter
of James Sykes of Leatherhead. He was a delicate boy, and
at Harrow, where he was entered in 1854, took no part in
school games and showed no particular promise as a scholar.
In 1858 he proceeded to Balliol as a commoner, but was
elected to an exhibition in the following year. The Oxford training
and association with the brilliant set of men then at Balliol
called out the latent faculties in Symonds, and his university
career was one of continual distinction. In 1860 he took a
first in “ Mods,” and won the Newdigate with a poem on The
reawakening of the spirit; in 1862 he was placed in the first class in Literae
Humanae, and in the following year was winner of the Chan-
cellar’s English Essay. In 1863 he had been elected to an open
fellowship at Magdalen. The strain of study unfortunately
proved too great for him, and, immediately after his election to a
fellowship, his health broke down, and he was obliged to seek
rest in Switzerland. There he met Janet Catherine North,
whom, after a romantic betrothal in the mountains, he married
at Hastings on the 9th of November 1864. He then attempted
to settle in London and study law, but his health again broke
down, and obliged him to travel. Returning to Clifton, he lectured
there, both at the college and to ladies’ schools, and the fruits
of his work in this direction remain in his Introduction to the
Study of Dante (1872) and his admirably vivid Studies of the
Greek Poets (1873–1876). Meanwhile he was occupied upon
the work to which his talents and sympathies were especially
attracted, his Renaissance in Italy, which appeared in seven
volumes at intervals between 1875 and 1886. The Renaissance
had been the subject of Symonds’ prize essay at Oxford, and
the study which he had then given to the theme aroused in him
a desire to produce something like a complete picture of the
renawakening of art and literature in Europe. This work, how-
ever, was again interrupted by illness, and this time in a
more serious form. In 1877 his life was in acute danger, and, upon
his removal to Davos Platz and subsequent recovery there it
was felt that this was the only place where he was likely to be
able to enjoy life. From that time onward he practically
made his home at Davos, and a charming picture of his life there
will be found in Our Life in the Swiss Highlands (1891). Symonds,
indeed, became in no common sense a citizen of the town; he
took part in its municipal business, made friends with the
peasants, and shared their interests. There he wrote most of his
books: biographies of Shelley (1878), Sir Philip Sidney (1886),
Ben Jonson (1886), and Michelangelo (1893), several volumes
of poetry and of essays, and a fine translation of the Autobiography
of Benvenuto Cellini (1887). There, too, he completed his
study of the Renaissance, the work by which he will be longest
remembered. He was assiduously, feverishly active through-
out the whole of his life, and the amount of work which he
achieved was wonderful when the uncertainty of his health is
remembered. He had a passion for Italy, and for many years
resided during the autumn in the bosom of his friend, Horatio
F. Brown, at the Villa Ventale, near Rome. He died at Rome
on the 19th of April 1893, and was buried close to Shelley.
He left his papers and his autobiography in the hands of Mr
Brown, who published in 1895 an excellent and comprehensive
biology. Two works from his pen, a volume of essays, In
the Key of Blue, and a monograph on Walt Whitman, were
published in the year of his death. His activity was unbroken to
the last. In life Symonds was morbidly introspective, a Hamlet
among modern men of letters, but with a capacity for action
which Hamlet was denied. Robert Louis Stevenson described
him, in the Opalstein of Talks and Talkers, as “the best of talkers,
"
singing the praises of the earth and the arts, flowers and jewels, wine and music, in a moonlight, serenading manner, as to the light guitar.” But under his excellent good-fellowship lurked a haunting melancholy. Full of ardour and ambition, sympathy and desire, he was perpetually tormented by the riddles of existence; through life he was always a seeker, ardent but unsatisfied. This side of his nature stands revealed in his gnomic poetry, and particularly in the sonnets of his Animus F igura (1883), where he has portrayed his own character with great subtlety. His poetry is perhaps rather that of the student than of the indented bard, but it has moments of deep thought and emotion. It is, indeed, in passages and extracts that Symonds appears at his best. Rich in description, full of “purple patches,” his work has not that harmony and unity that are essential to the conduct of philosophical argument. He saw the part more clearly than the whole; but his view, if partial, is always vivid and concentrated. His translations are among the finest in the language; here his subject was found for him, and he was able to lavish on it the wealth of colour and quick sympathy which were his characteristics. He was a lover of beauty, a poet and a philosopher; but in his life and work he failed to like the idea that absolute harmony of conviction and concentration under which alone the highest kind of literature is produced.

(A. W.)

SYMONDS, WILLIAM SAMUEL (1838-1887), was born in Hereford in 1818. He was educated at Cheltenham and Christ’s College, Cambridge, where he graduated B.A. in 1842. Having taken holy orders he was appointed curate of Offenham, near Evesham in 1843, and two years later he was presented to the living of Pendock in Worcestershire, where he remained until 1877. While at Offenham he became acquainted with H. E. Strickland and imbibed from him an interest in natural history and geology, that his leisure was henceforth devoted to these subjects. He was one of the founders of the Woolhope Naturalists’ Field Club (1851) and of the Malvern Naturalists’ Field Club (1853), and was an active member of the Cotteswold Field Club and other local societies. In 1858 he edited an edition of Hugh Miller’s Cruise of the “Blessey.” He was the author of numerous essays on the geology of the Malvern country, notably of a paper “On the passage-beds from the Upper Silurian rocks into the Lower Old Red Sandstone at Ledbury” (Quart. Journ. Geol. Soc. 1860). His principal work was a work of great excellence, The Wye (1871), Old Bones, or Notes for Young Naturalists (1859), 2nd ed. 1864), and other popular works. He died at Cheltenham on the 15th of September 1887.

See A Sketch of the Life of the Rev. W. S. Symonds, by the Rev. J. D. La Touche.

SYMONDS’S YAT, one of the most famous view points on the river Wye, England. At a point 9 m. above Monmouth and 12 m. below Ross by water, the Wye makes a sweep of nearly 5 m. round a peninsula whose neck is only some 500 yds. across. The peninsula is occupied by the limestone acclivity of Hunts- ham Hill. Caverns are seen in the limestone on both precipitous banks of the river. The Yat or Gate is situated on the west side of the neck, which reaches an elevation over 500 ft., and a road from the east drops to a ferry, which was of early importance as a highway between England and Wales. The boundary between Herefordshire and Gloucestershire crosses the neck; the Yat is in the county first named, but the railway station, on the east side (left bank) is in Gloucestershire. It is on the Ross-Monmouth line of the Great Western railway. There are here groups of cottages and several inns on both banks, while opposite the Yat itself is the hamlet of New Weir, and a little above it the village of Whitchurch. The rivers banks are densely wooded, except where they become sheer cliffs, as at the Coldwell rocks above the station. The surrounding country is hilly and rich, and the views from the Yat are superb, embracing the Forest of Dean to the south and east, and backed by the mountains of the Welsh border in the west.

SYMONS, ARTHUR (1865- ), English poet and critic, was born in Wales on the 28th of February 1865, of Cornish parents. He was educated privately, spending much of his time in France and Italy. In 1884-1886 he edited four of Quaritch’s Shakespeare Quartos Facsimiles, and in 1888-1889 seven plays of the “Henry Irving” Shakespeare. He became a member of the staff of the Athenaeum in 1891, and of the Saturday Review in 1894. His first volume of verse, Days and Nights (1889), consisted of dramatic monologues. His later verse is influenced by a close study of modern French writers, of Baudelaire and especially of Verlaine. He reflects French tendencies both in the subject-matter and style of his poems, in their eroticism and in their expression of a kind of despair, the evidence of which is recorded in the volumes of verse are: Silhouettes (1892), London Nights (1895), Amors victima (1897), Images of Good and Evil (1899), A Book of Twenty Songs (1905). In 1902 he made a selection from his earlier verse, published as Poems (2 vols.). He translated from the Italian of Gabriele d’Annunzio The Dead City (1900) and The Child of Pleasure (1898), and from the French of Émile Verhaeren The Dawn (1903). To The Poems of Ernest Dowson (1903) he prefixed an essay on the deceased poet, who was a kind of English Verlaine and had many attractions for Mr Symonds. Among his volumes of collected essays are: Studies in Two Literatures (1897), The Symbolist School in Literature (1899), Cities (1903), Pictures of Rome, Venice, Naples, Seville, &c., Plays, Acting and Music (1903), Studies in Prose and Verse (1904), Spiritual Adventures (1905), Studies in Seven Arts (1906).

SYMONS, GEORGE JAMES (1838-1900), English meteorologist, was born in Pimlico, London, on the 6th of August 1838. In 1866 he obtained a post in the meteorological department of the Board of Trade under Admiral Robert Fitzroy, who was then deeply interested in the subject of storm-warnings, and in the same year he published the first annual volume of British Rainfall, which contained records from 168 stations in England and Wales, but none from Scotland or Ireland. Three years later he resigned his appointment at the Board of Trade, where his rainfall inquiries were not appreciated—at least not as a prior study of storm-warnings—and devoted his whole energies to the organization of a band of volunteer observers for the collection of particulars of rainfall throughout the British Isles. So successful was he in this object that by 1866 he was able to show results which gave a fair representation of the distribution of rainfall, and the number of recorders gradually increased until the last volume of British Rainfall which he lived to see published in 1899 contained records from 2894 stations in England and Wales, 446 in Scotland, and 188 in Ireland. Apart from their scientific interest, these annual reports are of great practical importance, since they afford engineers and others engaged in water supply much-needed data for their calculations, the former absence of which had on some occasions given rise to grave mistakes. Symons himself devoted special study not only to rainfall, but also to the evaporation and percolation of water as affecting underground streams, and his extensive knowledge rendered him a valuable witness before parliamentary committees. In other branches of meteorology also he took a keen interest, and he was particularly indefatigable, though consistently unsuccessful, in the quest of a genuine thunderbolt. The history of the science too attracted his attention, and he possessed a fine library of meteorological works, which passed to the Meteorological Society at his death. Of that society he became a member when only eighteen, and he retained his connexion with it in various official capacities up to the end of his life. He served as its president in 1880, and in view of the celebration of its jubilee was re-elected to that office in 1900, but the illness that caused his death prevented him from acting. He died in London on the 10th of March 1900.

SYMPATHIC SYSTEM. 1. Physiology. By the “sympathetic system” is understood a set of nerves and ganglia more or less sharply marked off from the cerebro-spinal, both functionally and anatomically. (For anatomy see NERVOUS SYSTEM.) Formerly it was thought more independent from the rest of the general nervous system than recent discoveries have found it actually to be. It used to be supposed that the ganglia of the sympathetic system were analogous in function to the
great central nervous masses forming the brain and spinal cord. These latter masses, as now becomes more and more evident, are the only structures in which occurs the work of transmitting afferent-nerve impulses into efferent-nerve impulses with all the accompanying changes in intensity, rhythm; &c., which make up reflex action. Such functions, it is now known, are not attributable to sympathetic ganglia. These last are structures in which one neurone makes communication with other neurones. To that extent, therefore, the distribution of nervous impulses does occur in them, impulses arriving by a few neurones being distributed so as to affect many. But the sympathetic ganglia are not the seat of reflex action. The sympathetic system is now known to consist entirely of conducting paths which, like the nerve-trunks of the cerebro-spinal system, merely conduct nerve impulses either toward the great nervous centres of the spinal cord and brain, or, on the other hand, away from those great centres. In the cerebro-spinal nerves the preponderance of the conduction is toward the centres, in the sympathetic system the preponderance of conduction is away from the centres.

More is known of the sympathetic system from its efferent aspect than it afferent, and we shall consider the former first. One great difference between the efferent paths of the sympathetic and those of the ordinary cerebro-spinal system is that the latter carry nervous impulses not only to muscular tissue but to secreting glands, whereas the latter convey them to muscle only, indeed only to muscle of the striated kind. Another difference is that the efferent path which the sympathetic affords from the great central nervous centres to its muscles and glands consists of two neurones, whereas the efferent path afforded by the cerebro-spinal motor nerves consists of one neurone only. The two neurones forming the sympathetic path are so arranged that one of them whose cell-body lies in the spinal cord has a long axone-process passing out from the cord in the motor spinal root, and this extends to a group of nerve-cells, a sympathetic ganglion, quite distant from the spinal cord and somewhere on the way to the distant organ which is to be innervated. In this ganglion the first sympathetic neurone ends, forming functional connexion with ganglion cells there. These ganglion cells extend each of them an axone-process which attains the organ (muscular cell or gland cell), which is the office of the sympathetic path to reach and influence. The axone-process of the first nerve cell is a myelinated nerve-fibre extending from the spinal cord to the ganglion; it constitutes the pre-ganglionic fibre of the conduction chain. The axone-process of the second nerve-cell, that is the neurone whose cell-body lies in the ganglion, is usually non-myelinate and constitutes the post-ganglionic fibre of the chain.

This construction, characteristic as it is of the sympathetic efferent path, has been found also in certain other efferent paths outside the sympathetic proper. And as these other efferent paths convey impulses to the same kind of organs and tissues as do those of the sympathetic itself, it has been proposed to embrace them and the sympathetic under one name, the autonomic system. This term includes all the efferent paths of the entire body excepting only those leading to the voluntary muscles.

That the term "autonomic system" is not merely a convenience of nomenclature, but really represents a physiological entity, seems indicated by the action of nicotine. This drug acts selectively on the autonomic ganglia and not on the cerebro-spinal. In the former it paralyses the nexus between pre-ganglionic and post-ganglionic fibre. It is by taking advantage of this property that many of the recent researches which have done so much to elucidate the sympathetic have been executed. The term "autonomic system" must not be taken to imply that this system is independent of the central nervous system. As mentioned above in regard to the sympathetic, that is not the case. The autonomic system is closely connected with the central nervous system through the ordinary channel of the nerve-roots, spinal and cranial. It may, in fact, be regarded as an appendage of the cranial and spinal roots, or rather of certain of them, for with a considerable proportion of their number it is not connected.

The sympathetic is that part of the autonomic system which is connected with the spinal roots from the second thoracic to the second lumbar inclusive (man). Its ganglia are divided by anatomists into the vertebral, those which lie as a double chain on the ventral face of the vertebral column, and those which are scattered at various distances among the viscera, the pre-vertebral. Langley has shown that there is no essential difference between these except that the vertebral send some of their post-ganglionic fibres into the spinal nerves, whereas the latter send all their fibres to the viscera. The sympathetic sends its post-ganglionic fibres—

1. To the muscular costs of the whole of the alimentary canal from the mouth to the rectum; to the glands opening into the canal from the salivary glands in front back to the intestinal glands; to the blood vessels of the whole of the canal from mouth to anus.

2. To the generative organs, external and internal, and to the muscular costs of the urinary bladder.

3. To the skin; (a) to its blood vessels, (b) to its cutaneous glands, (c) to unstriated muscle in the skin, e.g. the erectors of the hairs.

4. To the iris muscles and blood vessels of the eyeball.

The sympathetic nervous system is sometimes called the visceral. It will be seen from the above that this term is not well suited in some respects, because the sympathetic supplies many structures which are not visceral. Another objection is that the great part of important nerve-supply to the viscera is furnished by parts of the autonomic system other than sympathetic. That the sympathetic does, however, of itself constitute a more or less homogeneous entity is indicated by a curious fact. The substance adrenalin, which is the active constituent of extracts of the adrenal gland, has the property when introduced into the circulation of exciting all over the body just those actions which stimulation of the efferent fibres of the sympathetic causes, and no others. It is possible that when a nerve is stimulated some body at the nerve ending is set free, and this by combining with another chemical substance induces activity in the end organ (gland or muscle). It may be that when a sympathetic nerve is excited adrenalin is set free and combines with some substance which induces activity.

The rest of the autonomic system consists of two portions, a cranial and a sacral, so called from their proceeding from cranial and sacral nerve-roots respectively. The cranial portion is subdivided into a part belonging to the mid-brain and a part belonging to the hind-brain. The ciliary ganglion belonging to the eyeball is the ganglion of the former part, and its post-ganglionic fibres innervate the iris and the ciliary muscles. The hind-brain portion gives pre-ganglionic fibres to the facial (intermedius) glossopharyngeal and vagus nerves; its post-ganglionic distribution is to the blood vessels of the mucous membrane of the mouth and throat, to the musculature of the digestive tube from the oesophagus to the colon, to the heart, and to the musculature of the windpipe and lungs.

The sacral part of the autonomic system issues from the spinal cord with the three foremost sacral nerves. Its ganglia are scattered in the neighbourhood of the pelvic organs, which they innervate. The distribution of its post-ganglionic fibres is to the arteries of rectum, anus and external genitalia, to the musculature of colon, rectum and anus, and the urinary bladder, and to that of the external genitalia.

The part played by the sympathetic and the rest of the autonomic system in the economy of the body is best considered by following broad divisions of organic functions.

**Movements of the Digestive Tube.**—It is those movements of alimentation not usually within range of our consciousness which the autonomic system regulates and controls. Nor is its control over them apparently essential or very complete. For instance, the pendular and peristaltic movements of the intestine still go forward when all nerves reaching the viscous
have been severed. Extirpation of the abdominal sympathic has not led to obvious disturbance of digestion or nutrition in the dog. It is noteworthy that the sympathetic inhibits contraction of the musculature of the stomach and intestine, while the other, the vagus, portion of the autonomic system excites it. The actions of these two components of the system are, therefore, mutually opposed on the viscera innervated by both.

Action on the Circulation.—The blood supply of most organs is under the control of vaso-constrictor nerves. All vessels of striated muscle are sympathetic. Organs to which vaso-constrictor nerves are supplied either poorly or not at all are the lungs, heart, liver, brain and probably the skeletal muscles. The blood vessels of certain parts of the body have, in addition to vaso-constrictor nerves, nerves which relax their muscular wall, vaso-dilator nerves. The latter are never furnished by the sympathetic, they are in the mucous membranes and glands at the oral end of the body furnished by the cranial portion of the autonomic system. In regions at the aboral end of the body they are furnished by the sacral portion of the autonomic system. Elsewhere the vessels are derived from the nerve-cells of the spinal ganglia (Bayliss).

The control of the calibre of the blood vessels by the autonomic system is of importance in several well-ascertained respects. By constricting the blood vessels of the viscera the system is able to favour an increase of blood supply to the brain. A noteworthy instance of such an action occurs when the erect attitude is assumed after a recumbent posture. Were it not for vaso-constriction in the abdominal organs the blood would then, under the action of gravity, sink into the more dependent parts of the body and the brain would be relatively emptied of its supply, and fainting and unconsciousness result. Again, it is essential to the normal functioning of the organs of warm-blooded animals that their temperature, except in the surface layer of the skin, should be kept constant. Part of the regulative mechanism for this lies in nervous control of the quantity of blood flowing through the surface sheet of the skin. That sheet is a cool zone through which a greater or smaller quantity of blood may, as required, be led and cooled. By the sympathetic vaso-constrictors the capacity of these vessels in the cool zone can be reduced, and thus the loss of heat from the body thereby diminished. Ibns when the weather is severe are derived from the nerve-cells of the spinal ganglia (Bayliss).

The heart itself is but a specialized part of the blood-vascular system, and its musculature, like that of the arteries, receives motor nerves from the sympathetic. These nerves to the heart from the sympathetic are known as the accelerators, since they quicken and augment the beating of the cardiac muscle. The heart receives also nerves from the cranial part of the autonomic system, and the influence of these nerves is antagonistic to that of the sympathetic supply. The cranial autonomic nerves to the heart pass via the vagus nerves and lessen the beating of the heart both as to rate and force. These inhibitory nerves of the heart are analogous to the dilator nerves to the blood vessels, which, as mentioned above, come not from the sympathetic, but from the cranial and sacral portions of the autonomic system.

Skin-glands.—In close connexion with the temperature regulating function of the sympathetic stands its influence on the sweat secreting glands of the skin. Secretory nerves to the sweat glands are furnished apparently exclusively by the sympathetic.

Pilomotor Nerves.—The skin in many places contains muscle of the unstriped kind. Contraction of this cutaneous muscular tissue causes knotting of the skin as in "goose-skin," and erection of the hairs as in the cat, or of the quills as in the hedgehog and porcupine. The efferent nerve-fibres to the unstriped muscles of the skin are always furnished by the sympathetic (pilomotor nerves, &c.). In this case the sympathetic contributes to emotional reactions and perhaps further to the regulation of temperature, as by ruffling the fur or feathers in animals exposed to the cold.

The Respiratory Tube.—The windpipe and the air passages of the lungs contain in their walls much unstriped muscular tissue, arranged so as to control the calibre of the lumen. The nerve-supply to this muscular tissue is furnished by the cranial autonomic system via the vagus nerves.

Inhibiting Nerve.—An important office of the sympathetic is the controlling of the brightness of the visual image by controlling the size of the pupil. The sympathetic sends efferent fibres to the dilator muscle of the pupil. In this case, as in others noted above, the cranial part of the autonomic system supplies nerves of antagonistic effect to those of the sympathetic, first through the third cranial nerves from the efferent fibres to the constrictor muscle of the pupil. This same part of the cranial autonomic system supplies also motor fibres to the ciliary muscle, thus effecting the accommodation of the lens for focusing clearly objects within the range of what is termed near-vision.

Origin of the efferent fibres of the sympathetic is known save that they are, relatively to the efferent, few in number, and that they, like the afferents of the cerebro-spinal system, are axones of nerve-cells seated in the spinal ganglia. (C. S. S.)

SYMPHONIA (Gr. συμφωνία), a much discussed word, applied at different times (i) to the bagpipe, (ii) to the drum, (iii) to the hurdy-gurdy, and finally (iv) to a kind of clavichord. The sixth of the musical instruments enumerated in Dan. iii. 5, 10, 15, erroneously translated "dulcimer," in all probability refers to the bagpipe (q.v.). Symphonia, signifying drum, occurs in the writings of Isidor of Seville. "Tympanum est pellis vel corium ligne ex una parte extemum. Est enim pars media symphonie in similitudinem cribri. Tympanum autem dictum quod medi est. Unde, et margaritum medium tympanum dicitur, et ipsum ut symphonia ad virgulam percutitur." The reference comparing the tympanum (kettledrum) to half a pearl is borrowed from Pliny (Nat. hist. IX. 35, 23). Symphonia or Chifonis was applied during the 13th and 14th centuries, in the Latin countries more especially, to the hurdy-gurdy. "Symphonia is applied by Praetorius1 to an instrument which he classed with the clavichord, spinet, or zither, and which, instead of the normal, but without giving any clue to its distinctive characteristics.

SYMPHONIC POEM (Symphonische Dichtung, Tonidichtung, Poème symphonique, &c.). This term covers the experiments in a new style of instrumental music which first showed a coherent method in the twelve Symphonische Dichtungen of Liszt. The term at present implies a large orchestral composition which, whatever its length and changes of tempo, is not broken up into separate movements, and which, moreover, illustrates a definite poetic train of thought that can be expressed in literature, whether it is actually so expressed or not. Thus the form of the symphonic poem is the form dictated by its written programme or unwritten poetic idea; and so it is not every piece of "programme music" that can be called a symphonic poem. Beethoven's sonata Les Adieux, and his Pastoral Symphony, are, for instance, works in which the poetic idea does not interfere with the normal development of sonata style required by the musical nature of Beethoven's material.

Great disturbances in musical art have always been accompanied by constant appeals to external literary ideas; and there is nothing peculiarly modern in the present tendency to attack and defend the rising style of large indivisible schemes of instrumental music by unprofitable metaphysical discussions as to the claims of "absolute music" against "music embodying poetic ideas." New art-forms are not born mature, and in their infancy their parent arts naturally invite other arts to stand godfather. If the rise of the sonata style was not accompanied by as much "programme music" as the new art of the present day (and as a matter of fact it was accompanied by a good deal), it at all events coincided with highly Wagnerian discussions

1 See "Syntagma mus." pt. ii., De organographia, pp. 72, 73, 178 (Wolfenbüttel, 1618).
SYMPHONY

of dramatic music on literary grounds. What is certain is, firstly, that no amount of theorizing can prevent a musician from developing his musical ideas; secondly, that musical ideas are just as likely to be inspired by literature and other arts as by any other kind of experience; and lastly, that, as musicians attain greater mastery in the handling of their ideas, their musical realism soon outstrips their poetic or imaginative function for literary analysis, at all events while they are working at the music. Hence the frequent ability of great composers to set inferior words to music which is not only great but evidently based upon those words. Hence the digest of great composers at even the clearest unauthorized literary interpretations of their works. Hence, on the other hand, the absence of any general classical attitude of vigorous protest against the use of music to convey external ideas. Be this as it may, we believe the importance of the symphonic poem to lie not in its illustrative capacity, but in its evident tendency towards a new kind of instrumental art.

It is not mere convention and prejudice that has delayed the ripening of this art. Every classical art-form is made by the greatest artists to be a natural thing in every individual case, no matter how artificial the conditions of the form become in ordinary hands. In the highest-classical art not even a thousand examples identical in form would really be examples of an art-form set up like a mould for the material to be shovelled into it. In each case, however much the artist may have been helped by custom, his material would have taken in its own nature. A sufficient number of sufficiently similar cases of this kind may conveniently, though dangerously, be regarded as establishing an art-form; and most art-forms coincide to a striking degree with practical and local limitations, for in these a great artist can almost always find suggestions for the character of his material instead of mere hindrances to its development. Thus art-forms become the vehicle for perfectly natural works in the hands of great artists, even when in the abstract they are highly artificial and conventional. But there is probably no case of an important art-form (and still less of a whole style of art) remaining productive in its artificial condition when the facts which made that condition natural are changed. The great works in such forms remain, and are thoroughly natural, for they express their environment so perfectly as to recall it. It makes singularly little difference to the value of a great work of art, in the long run, whether its vividness is in the light it throws on a remote and forgotten past, or on a living and actual present. When Aloysius welcomes Odysseus, on hearing that he is an honourable pirate and not one of those disreputable merchants, our pleasure at the realistic glimpse of Homeric society differs from the pleasure of the Homeric audience only so far as our point of view is more romantic. But new art must, if it is to live, be produced, like the classics, on conditions which the artist himself understands; and it is improbable that these conditions (if they admit of healthy art at all) will be of a less common-sense character than those of older art.

In the absence of musical criteria for a future art, perhaps the analogy of drama may be useful here. The chorus of Greek tragedy can by no stretch of imagination be said to behave like a corresponding group of persons in real life. Yet the Greek chorus becomes natural enough when we realize the necessary material circumstances of Greek drama; indeed in the best examples it becomes the only natural (or even, in a certain religious aspect, realistic) treatment of a natural set of materials. In the same way we are taught that Shakespeare's dramatic technique becomes perfectly natural when we realize his equally natural type of stage, which was so constructed and situated in regard to the audience that scenery would obstruct the view just as it would in a circus. But with the modern conception of a stage as a kind of magnified peep-show, with the audience looking into a painted landscape seen through an impossible; and perhaps illusion of scenery comes so realistic that the use of verse and other classical resources is attended with dangers hitherto unknown. At the same time the condition of the modern stage obviously approximates far more closely to such an idea of the art of imitating human life by human speech and action, as would most naturally occur to a common-sense mind at any period. And it is probable that the final condition of an art will always tend to approximate to such an idea. In the same way it cannot be doubted that the sonata form, with its subtle balance between independence of form and interdependence of contrast, is far too artificial to be such a final form of instrumental music as would commend itself in the abstract to ordinary common sense. And we may look forward to a time, perhaps by the middle of the century, when the new and single continuous forms now adumbrated by the symphonic poems shall be the greatest forms of instrumental music, and shall need no literary crutches to make them intelligible. The pioneers of these forms at the present day frequently and sometimes justifiably claim that their art is intelligible apart from its "programme," but this is far from being so constantly the case that the symphonic poem can as yet be regarded as a mature kind of art. But when the mature art it foreshadows shall appear, then critics will need to face the fact that its genuine achievements will outwardly resemble the immature efforts which led to them, while the spiritual resemblance to classical music will lie too deep for the recognition of any but those who have the courage to make the new art their own. The symphonies of Mozart are in texture and phraseology far more like those of Philipp Emanuel Bach than they are like the great works of Johann Sebastian Bach; and if we try the experiment of reminding one of John Sebastian's most characteristic forms, a long course of Palestrina, we may realize that a lover of the Palestina style living during the monodic revolution would really have had no means of telling the difference between Bach's art and the squallid sensational impressionism of Gesualdo, the prince of Venosa. Yet the impassable gulf is in all cases that between the great art and the crude efforts that foreshadow it, while the universal spirit of mature art remains the same whether the age or style be called "classical," "romantic," or "secessionist."

See also Programme Music and Sonata Forms (ad fin.).

SYMPHONY in music. 1. The term συμφωνία was used by the Greeks, firstly, to denote the general conception of concord, both between successive sounds and in the union of simultaneous sounds; secondly, in the special sense of concordant pairs of successive sounds (i.e. the "perfect intervals" of modern music; the 4th, 5th and octave); and thirdly as dealing with τὸ διώρωφον, the concord of the octave, thus meaning the art of singing in octaves, or magazising, as opposed to μονοφωνία, or singing and playing in unison. In Roman times the word appears in the general sense which still survives in poetry, viz. as harmonious concourse of voices and instruments, which in the middle ages to mean a concert. In St Luke xv. 25, it is distinguished from χορός, and the passage is appropriately translated in the English Bible as "music and dancing." Polybius and others seem to use it as the name of a musical instrument.

2. In the 17th century the term is used, like "concerto," for certain vocal compositions accompanied by instruments, e.g. the Kleine gesätzliche Concerte and Symphoniae sacre of Schütz. Most of Schütz's works of this class are for one to three solo voices in various combinations with instruments. The Gesätzliche Concerte are generally accompanied by figured bass and are to German texts; and the voices may in many cases be choral. The Symphoniae sacre are to Latin texts and are written for various combinations of instruments, while the voice parts are evidently for solo singers. The word symphony is sometimes used for the instrumental ritornello of songs and vocal movements in aria form. In this sense it already appears in No. 28 of the second book of Schütz's Gesätzliche Concerte.

3. The principal modern meaning of the word is a sonata for orchestra (see SONATA FORMS). The orchestral symphony originated in the second quarter of the 18th century began to assimilate the essentials of the sonata style. At first such sonata-style overtures consisted of
three movements, viz. a moderately quick binary movement, a short slow movement, and a lively finale. Thus Mozart, at the age of twelve, used his 7th symphony as the overture to 'La Finta semplice', and Haydn's maturest symphonies are still called overtures in some early editions. 'La Finta giardiniera', written by Mozart in his eighteenth year, marks the differentiation of the opera overture from the independent symphony, since it contains the usual first movement and slow movement, but the curtain rises with what sounds like the beginning of the finale.

The sonata style was not at first invariably associated with what we now call sonata form, nor indeed was that form at first the most favourable to the dramatic expression desirable for operatic music. Hence the overtures of Gluck are generally in forms based on the 4th and 5th of a series of related chords, forms which are probably learned from the Van Swieten, and which may be found in the concertos of Vivaldi, so many of which were freely transcribed by Sebastian Bach. These methods are no less evident in the symphonies of Philippe Emmanuel Bach, which thus occupy an analogous place, away from the normal line of the sonata style. The differentiation between symphony and overture was of immense importance in raising the dignity of the symphony; but the style was more essential than the form; and in Mozart's and Haydn's mature works we find the sonata form as firmly established in the overture as in the symphony, though not necessarily the style and scope of the two forms are quite distinct. Mozart's most elaborate overture, that of 'Die Zauberflöte', could not possibly be the first movement of one of his later symphonies; nor could the finale of his 'Jupiter' symphony (which has often been compared with that overture because of its use of fugato) conceivably be used as the prelude to an opera.

See also Music; Sonata Forms; Instrumentation; Overture; Scherzo; Variations. (D. F. T.)

SYMPHOSIUS, or Symposius, the name given to the author of a collection of 100 riddles of uncertain date, but probably composed between 425 and 500. They have been attributed to Lactantius, and identified with his 'Symposium', but this view is not generally accepted. The style and versification of the riddles, each of which consists of three hexameter lines, are good. They were written to form part of the entertainments at the Saturnalia.

Text in E. Bährn's, Poëtae latini minores, vol. iv.; there is a good French metrical version by F. E. Corpet (1858); monograph by W. T. Paul (Berlin, 1854); see also Teufel, Hist. of Roman Literature, 449 f., and Chaucer, 'Canterbury Tales'.

SYMPOSIUM (Gr. συμπόσιον, a drinking party, from συμπόνοειν, to drink together, σύ, with, and πόνο, in drink, root σό, cf. Lat. potare, to drink, poculum, cup), the convivial drinking which took place after a great banquet, accompanied by intellectual or witty conversation, and by music, or dancing, performed by slaves or attendants. The term has been applied in modern usage, due to Plato's 'Symposium', to a collection of opinions of different writers on a given subject.

SYNAGOGUE (συναγωγή), literally ' assemblage,' is the term employed to denote either a congregation of Jews, i.e. a local circle accustomed to meet together for worship and religious instruction, or the building in which the congregation met. In the first sense the word is a translation of τάξις, keneseth (assemblage), in the second of reu nó, beth hakeneseth (house of assemblage). Further the term is often used to denote the system of Judaism, as when the 'Synagogue' is contrasted to the 'Church.' The germ of the synagogue, that is, of religious assemblages dissociated from the ancient ritual of the altar, may be found in the circle of the prophets and their disciples (see especially Isa. viii. 16 seq.); but the synagogue as an institution characteristic of Judaism arose after the work of Ezra, and is closely connected with the development of Judaism, to which its reformation gave definite shape. From the time of Ezra downwards it was the business of every Jew to know the law; the school (bēth hammidrâsh) trained scholars, but the synagogue, where the law was read every Sabbath (Acts xv. 21), was the means of popular instruction. Such synagogues existed in all parts of Judæa in the time of P's. lxixv. 8 (probably a psalm of the Persian period); in Acts xv. 21 it appears that they had existed for many generations 'in every city.' This held good not only for Palestine, but for the Dispersion; in post-Talmudic times the rule was that a synagogue must be built wherever there were ten Jews. In the Dispersion the synagogue filling a greater place in the communal life, for on Palestinian soil the Temple enjoyed a predominant position. In this sense the synagogue is a child of the Dispersion, but this does not imply that it was a product of the Hellenic diaspora. For the Aramaic papyri discovered at Assuan show that in the 5th century B.C. the Egyptian Jews had their place of worship in Syene long before Greek influences had begun to make themselves felt there. The fact that the Books of the Maccabees never refer to synagogues is not evidence that synagogues were not known in Judæa in the Maccabean period. These books refer mostly to a time of war, when assemblages in the cities were impossible; their interest, moreover, is concentrated in the Temple and the restoration of its services. During the second Temple there is no doubt but that public worship was organized in the provinces as well as in the Jewish settlements outside the Holy Land. And though the name "synagogue" varies with the prefixed words ("place of prayer"), it appears that everywhere the assemblage was primarily one for instruction in the law; the synagogue as Philo puts it, was a ἱστορικόν. Prayer, in the more restricted sense, invariably accompanied the instruction, and several parts of the extant liturgy go back to the 3rd century B.C. A formed institution of this sort required some organization; he general order of the service was directed by one or more "rulers of the synagogue" (ἀρχισυναγωγοί, Luke xili. 14; Acts xiii. 15), who called on fit persons to read, pray and preach; alms were collected by two or more "collectors" (ἀπόδοτες ἀδότατος); and a "minister" (βασιλιάς, βραχύτης, Luke iv. 20) had charge of the sacred books (preserved in an "ark") and of other ministerial functions, including the teaching of children to read. The discipline of the congregation was enforced by excommunication (ἱεραμωσία) or temporary exclusion (νικῆ); and also by the minor punishment of scourging (Matt. x. 17), inflicted by the ἀρχιερεῖς. The disciplinary power was in the hands of a senate of elders (ὑπερβεβλητοί, γερουσία), the chief members of which were ἀρχιερεῖς. The principal service of the synagogue was held on Sabbath morning, and included, according to the Mishnah, the recitation of the shema' (Deut. vi. 4-9, xi. 13-21; Num. xv. 37-41), prayer, lessons from the law and prophets with Aramaic translation, a sermon (dorashah) based on the lesson (Acts xiii. 15), and finally a blessing pronounced by the priest or invoked by a layman. On Sabbath afternoon, and on Monday and Thursday there was a service without a lesson from the prophets; there were also services for all feast-days. Synagogues were built by preference beside water, in order to avoid proximity to the idol temples, rather than as some think, for the convenience of the ceremonial ablutions (cf. Acts xvi. 13). Remains of very ancient buildings of this class exist in several parts of Galilee; they generally lie north and south, and seem to have had doors to the south, and sometimes to have been divided by columns into a nave and two aisles.

Modern synagogues are mostly built of oblong shape, with a gallery for women. Since the middle ages, Renaissance and Moorish types of decoration have been generally favoured, but there is nowadays a great variety of types. The ancient synagogue of Alexandria (destroyed by Trajan) was a basilica. A number of recent synagogues have been built in octagonal form. The main interior features of the synagogue are the "ark" (a cupboard containing the scrolls of the law, &c.) and the almenar (or reading-desk, from the Arabic al-minbar, pulpit). This is sometimes in the centre, sometimes at the eastern end of the building. The Talmud prescribed an elevated site for the synagogue; but this rule has been impossible of observance in modern times. The synagogues are theoretically "orientated" —i.e. the ark (which worshippers face during the principal prayer)
is on the eastern side. But this rule, too, is often ignored under the stress of architectural difficulties.

Jewish tradition has a great deal to say about a body called "the great synagogue," which is supposed to have been the supreme religious authority from the cessation of prophecy to the time of the high priest Simeon the Just, and is even said to have fixed the Old Testament canon (cf. v. 3 seq.). But Kuenen in his essay "Oor de Mannen der Groote Synagoge" (Verslagen of the Amsterdam Academy, 1876) has powerfully argued that these traditions are fiction, and that the name seen in the older literature is a standing authority, but the great convocation of Neh. vii. 39. That more recent scholars, however, more willing to attach credence to the older tradition.

Compare, in general, Schrör, Geschichte des jüdischen Volkes, § 27, where the older literature is catalogued. For some unconvincing views of the matter may refer to M. Friedländer, Synagoge und Kirche in ihren Anfängen (Berlin, 1908). For the usages of the synagogue in more recent times, see Buxtorf, Synagoga judaica (Basil, 1641). On the history of synagogue services the works of Zimmern are the chief authorities; there is also a good article on Liturgy in the Jewish Encyclopedia. Useful summaries in English are to be found in Dembitz, Jewish Services in Synagogue and Home (Philadelphia, 1888); and Oesterley and Box, The Religion and Worship of the Hebrews (London, 1907). The article "Synagogue" in the Jewish Encyclopedia is illustrated with numerous pictures of buildings and plans.

SYNAGOGUE, UNITED, an organization of London Jews, founded, with the sanction of an act of parliament, in 1870. It is confined in its direct work, to the metropolis, but it exercises, indirectly, considerable influence over the Jews of the British Empire. It is governed by a general council representing the constituent congregations. In religious and ritual matters it is under the jurisdiction of the chief rabbi, who is, to a certain extent, recognized throughout the empire. The president of the United Synagogue in 1910 was Lord Rothschild. Besides providing the worship of some twenty congregations, the United Synagogue directs and supports educational and charitable work. The title "chief rabbi" is not found in the pre-expulsion records, though, before the Jews were banished in 1390, there was an official named "presbyter omnium Judaeorum Anglicarum." The functions of this official cannot be proved to have been ecclesiastical. The title "chief rabbi" has become well known through the eminence of recent occupants of the position such as Solomon Hirschell (1762-1842). He was succeeded by Dr. Nathan Marcus Adler (1803-1890), who was followed by his son, Hermann Adler, who raised the position to one of much dignity and importance. Dr. Hermann Adler was born in Hanover in 1839, graduated at Leipzeg, and received honorary degrees from Scotch and English universities, including Oxford. In 1909 he received the order of M.V.O. Dr. Adler was elected chief rabbi in 1869, the second of that title. Dr. Adler has written extensively on topics of Anglo-Jewish History and published two volumes of sermons.

SYNANTHY (Gr. συναντησθη, with, and ἄνθος, a flower), a botanical term for the adhesion of two or more flowers.

SYNAXARIUM (Gr. συνάξαριον, from συνάγειν, to bring together), the name given in the Greek Church to a compilation corresponding very closely to the martyrlogy (q.v.) of the Roman Church. There are two kinds of synaxaria—simple synaxaria, which are merely lists of the saints arranged in the order of their anniversary, e.g. the Compendium of Martyrology, and historical synaxaria, which give biographical notices besides, e.g. the menology of Basil and the synaxarium of Sirmond. The notices given in the historical synaxaria are summaries of those in the great menologies, or collections of lives of saints, for the twelve months of the year. The oldest historical synaxaria apparently go back to the tenth century. The heterodox Eastern churches also have their synaxaria.

The publication of the Arabic text of the synaxarium of the Church of Alexandria was started simultaneously by J. Forget in the Corp. script. orient. and by R. Basset in the Patrologia orient. The Armenian synaxarium, called the synaxarium of Ter Israel was published by Constantinople in 1834.

See S. A. Morelli, Kalendarii ecclesiae Constantinopolitanae (Rome, 1788); H. Delehaye, "Le Synaxaire de Sirmond," in Analecta bullar. de xiv. 390-434, where the terminology is explained; idem, Synaxarium ecclesiae Constantinopolitanae codice Sirmondianno (Brussels, 1902), forming the volume Propylaen in acta sanctorum novembris. (H. Dir.)

SYNCELLUS, a hybrid word (Gr. συνκέλλος, Lat. cella), meaning literally "one who shares his cell with another." In ecclesiastical usage it refers to the very early custom of a priest or deacon living continually with a bishop, proper testimoniun ecclesisticum; the bishop was supposed to have the synkelloi of Gregory the Great. The term came into use in the Eastern Church, where the synkelloi were the chaplains of metropolitan and patriarchs. At Constantinople they formed a corporation, and the protosynkelloi took precedence of metropolitans and ranked next to the patriarch, to whose office he generally succeeded.

SYNCOPE (Gr. συνκόπη, a cutting up or short, from κόπεω, to cut), a term used in grammar for the elision of a letter or syllable in the middle of a word (e.g. "ne'er" for "never"); and in medicine for the condition of fainting or shock (q.v.); and so technically in a general sense of the suspension of a subject or function. "Syncope" and "syncopation" are analogous derivatives; and in music a syncopation is the rhythmical method of tying (') two beats of the same note into one tone in such a way as to displace the accent.

SYNCRETISM (Gr. συνκρητισμός, from σύν and κράτις, mingle or blend, or, according to Plutarch, from σύν and κρατίζω, to combine against a common enemy after the manner of the cities of Crete), the act or system of blending, combining or reconciling inharmonious elements. The term is used technically in politics, literature, and the Church, especially as having been the syncretism of Gregory the Great. The term was applied by the Eastern Church, where the synkelloi were the chaplains of metropolitan and patriarchs. At Constantinople they formed a corporation, and the protosynkelloi took precedence of metropolitans and ranked next to the patriarch, to whose office he generally succeeded.

SYNCRETISTS, a term applied to the members of the Church of Crete, who, as a result of the general suspension of knowledge of the world's religions made possible by the gathering of known cult of importance into the religious system of the Roman Empire, believed in the identity of many deities which resembled each other, and indeed in the essential identity of all, received a special impulse. Not only were various forms of the same deity, such as, for example, Jupiter Capitolinus and Jupiter Latinius, recognized as being really the same under different aspects, but even the gods of different nations were seen to be manifestations of a single great being. Roman Jupiter, Greek Zeus, Persian Mithras and Phrygian Attis were one. The Great Mother, Isis, Cybele, Demeter, Ops, Rhea, Tellus, were the same great mother deity under different masks (see GREAT MOTHER OF THE GODS). Venus and Cupid, Aphrodite and Adonis, the Great Mother and Attis, Astarte and Baal, Demeter and Dionysus, Isis and Serapis, were essentially the same pair. Syncretism even went so far as to blend the deities of paganism and Christianity. Christ was compared with Attis and Mithras, Isis with the Virgin Mary, &c. Isis, perhaps more than any other deity, came to be regarded as the great maternal goddess of the universe whose essence was worshipped under many different names. In the East the spread of the doctrine of the Holy Ghost was a form of syncretism, as well illustrated by Apuleius (Metamorph. xi. 2 and 5). Lucius invokes Isis: "Queen of Heaven, whether thou art the genial Ceres, the prime parent of fruits, who, joyous at the discovery of thy daughter, didst banish the savage nutriment of the ancient acon, and, pointing out a better food, dost now till the Eleusinian soul; or whether thou art celestial Venus, who, in the first origin of things, didst

1 Apollinaris Sidonius uses the pure Latin term concellum.
associate the different sexes, through the creation of mutual love, and having propagated an eternal offspring in the human race, art now worshipped in the sea-girl shrine of Paphos; or whether thou art the sister of Phoebus, who, by relieving the pang of women in travail by soothing remedies, hast brought into the world multitudes so innumerable, and art now venerated in the far-famed shrines of Ephesus; or whether thou art Proserpine, terrific with midnight bowings by whatever name, by whatever ceremonies, and under whatever form it is lawful to invoke thee; do thou graciously, &c."

The goddess replies: "Behold me ... I, who am Nature, the parent of all things, the mistress of all the elements, the primordial offspring of time, the supreme among divinities, the queen of departed spirits, the first of the celestials, and the uniform manifestation of the gods and goddesses; who govern by my rod the luminous heights of heaven, the salubrious breezes of the ocean, and the anguished silent realms of the shades below; whose one sole divinity the whole orb of the earth venerates under a manifold form, with different rites, and under a variety of appellations. Hence the Phrygians, that primeval race, call me Pessinuntica, the Mother of the Gods; the Aborigines of Attica, Cecropian Minerva; the Cyprians, in their sea-girl isle, Paphian Venus; the arrow-bearing Cretans, Diana Dictynta; the three-tongued Sicilians, Stygian Proserpine; and the Eleusinians, the ancient goddess Ceres. Some call me Juno, others Bellona, others Hecate, others Rhamnusa. But those who are illumined by the earliest rays of that divinity, the Sun, when he rises, the Aeolian bards, who have let fall the secrets of the Egyptian signs, sublime learning, worshipping me with ceremonies quite appropriate call me by my true name, Queen Isis. Behold, then, &c." (Trans. Bohn's Lib.)

Naturally, the influence of Greek philosophy was very pronounced in the growth of syncretism. Plutarch and Maximus of Tyre affirmed that the gods of the different nations were only different aspects of the same deity, a supreme intelligence and providence which ruled the world. The Neoplatonists, however, were the first school to formulate the underlying philosophy of syncretism: "There is only one real God, the divine, and the subordinate deities are nothing else than abstractions personified, or celestial bodies with spirits; the traditional gods are only demons, that is, being intermediate between God and man ... All, like every other created being, are emanations from the absolute God" (Jean Réville, *La Religion à Rome sous les Sétières*). Care must be taken, however, not to place too much emphasis upon syncretism as a conscious system. The movement which it represented was not new in the 2nd century A.D. The identification of Latin with Etruscan gods in the earliest days of Rome, and then of Greek with Italian, and finally of Oriental with the Graeco-Roman, were all alike syncretistic movements, though not all conscious and reasoned. The ideal of the common people, who were unreflecting, as well as of philosophers who reflected, was "to grasp the religious verity, one and constant, under the multiplex forms with which legend and tradition had enveloped it" (Réville). The advent of Greek philosophy only hastened the movement by conscious and systematic effort.

Syncretic, being a movement toward monothesism, was the converse of the tendency, so prominent in the early history of Rome, to increase the number of deities by worshipping the same god under special aspects according to special activities. In the hands of the Neoplatonists it was instrumental in retaining somewhat the fall of paganism for the time, but in the end contributed to the success of Christianity by familiarizing men with the belief in one supreme deity. The triumph of Christianity itself represented a result of syncretism, the Church being a blending of the beliefs and practices of both the new and old religions.

SYNERESIS—SYNECHISM

SYNERESIS, a term in scholastic philosophy applied to the inborn moral consciousness which distinguishes between good and evil. The word is really *syneresis* (Gr. *συνέρησις*, from *συνέρειν*, to look after, take care of), but syneresis is the commoner form. Diogenes Laërtius in his account of the Stoics (Vol. II, pp. 71-72, 74-75) uses the phrase *συνέρειν ἱστη* to describe the instinct for self-preservation, the inward harmony of Chrysippus, the recognition of which is *συνέρησις*. The term *syneresis*, however, is not found till Jerome, who in dealing with Ezek. i. 4-15, says the fourth of the "living creatures" of the vision is what the Greeks call *συνέρησις*, i.e. *scintilla conscientiae* the "spark of conscience." Here apparently syneresis and conscience (*συνέρησις*) are equivalent. By the schoolmen, however, the terms were differentiated, conscience being the practical envisaging of good and evil actions; syneresis being, so to speak, the tendency toward good in thought and action. The exact relation between the two was, however, a matter of controversy. Aquinas and Duns Scotus holding that both are practical reason, while Bonaventura narrows syneresis to the volitional tendency to good actions.

SYNDIC (Late Lat. *syndicus*, Gr. *συντικός*, one who helps in a court of justice, an advocate, representative, *στίχ*, with, and *δικα*, justice), a term applied in certain countries to an officer of government with varying powers, and secondly to a representative or delegate of a university, institution or other corporation, entrusted with special functions or powers. The meaning which underlies these applications is a special form of delegated power, especially of the type of the delegated or representative, the meaning of "syndic" in the first sense is that of the Italian *sindaco*, who is the head of the administration of a commune, answering to a "mayor"; he is a government official but is elected by the communal council from their own members by secret ballot.

Nearly all the companies, guilds, and the university of Paris had representative bodies the members of which were termed *syndici*. Similarly in England, the senate of the university of Cambridge, which is the legislative body, delegates certain functions to special committees of its members, appointed from time to time by Grace, i.e. a proposal offered to the senate and confirmed by it; these committees are termed "syndicates" and are permanent or occasional, and the members are styled the "syndics" of the particular committee or of the institution which they administer; thus there are the syndics of the Fitzwilliam Museum, of the University Press, of the Observatory, of local examinations and lectures, of the Antiquarian Committee, &c.

SYNDICATE, a term originally meaning a body of syndics. In this sense it is still sometimes used, as at the university of Cambridge, for the body of members or committee responsible for the management of the University Press. In commerce, a syndicate is a body of persons who combine to carry through some financial transaction, or who undertake a common adventure. Syndicates are very often formed to acquire or take over some undertaking, hold it for a short time, and then resell it to a company. The profits are then distributed and the syndicate dissolves. Sometimes syndicates are formed under agreements which constitute them mere partnerships, the members being therefore individually responsible, but they are now more generally incorporated under the Companies Acts.

The more usual cases in which syndicates are commonly formed will be found in F. B. Palmer's *Company Precedents*, 10th ed., vol. i. pp. 129 seq.

SYNECHISM (from Gr. *συνέχης*, continuous, from *σύν*, *εχθρον*, to hold together), a philosophical term proposed by C. S. Peirce (Monist, Vol. XXXII, 534) to express the general theory that the essential feature in philosophic speculation is continuity. It is specially directed to the question of hypothesis, and holds that a hypothesis is justifiable only on the ground that it provides an explanation.
All understanding of facts consists in generalizing concerning them. The fact that some things are ultimate may be recognized by the synecist without abandoning his standpoint, since synecism is a normative or regulative principle, not a theory of existence. The adjective "syneciological" is used in the same general sense; "synecology" is a theory of continuity or universal causation; "synecism" is a term in ophthalmology for a morbid union of parts.

SYNEDRIUM (συνεδρίον), a Greek word which means "assembly" and is especially used of judicial or representative assemblies, is the name by which (or by its Hebrew transcription, συναθρόν, σαναθρόν, σαναθρίδρον) that Jewish body is known which in its origin was the municipal council of Jerusalem, but acquired extended functions and received a small authority and influence over the Jews at large (see xii. 244 seq.). In the Mishnah it is called "the sanhedrin," "the great sanhedrin," "the sanhedrin of seventy-one [members]" and "the great court of justice" (bēth din haggadol). The oldest testimony to the existence and constitution of the synedrium of Jerusalem is probably to be found in 2 Chron. xix. 8; for the priests, Levites and hereditary heads of houses there spoken of as sitting at Jerusalem as a court of appeal from the local judicatures does not correspond with anything mentioned in the old history, and it is the practice of the chronicler to refer the institutions of his own time to the antiquities of the past. And, again, the aristocratic council is what seems to be meant by the gerousia or senate of "elders" repeatedly mentioned in the history of the Jews, both under the Greeks from the time of Antiochus the Great (Jos. Ant. xii. 3, 3) and under the Hasmonian high priests and princes. The high priest as the head of the state was doubtless also the head of the senate, which, according to Eastern usage, exercised both judicial and administrative or political functions (cf. 1 Macc. xii. 6, xiv. 20). The exact measure of its authority must have varied from time to time at first with the measure of autonomy left to the nation by its foreign masters and the more or less autocratic power claimed by the native sovereigns.

The original aristocratic constitution of the senate began to be modified under the later Hasmonaeans by the inevitable introduction of representatives of the rising party of the Pharisees, and this new element gained strength under Herod the Great, the bitter enemy of the priestly aristocracy. Finally under the Roman procurators the synedrium was left under the presidency of the chief priest as the highest native tribunal, though without the power of life and death (John xvii. 31). The aristocratic and Sadducean element now again preponderated, as appears from Josephus and from the New Testament. And, again, mention is made of "elders" and "rulers" as synonymous expressions. But with these there sat also "scribes" or trained legal doctors of the Pharisees and other notables, who are simply called "elders" (Mark xv. 1). The Jewish tradition which regards the synedrium as entirely composed of rabbins sitting under the presidency and vice-presidency of a pair of chief doctors, the nasi and ab beth din, is inconsistent with the evidence of Josephus and the New Testament. It is generally held that it was after the fall of the state that a merely rabbinical bēth din sat at Jabneh and afterwards at Tiberias, and gave legal responses to those who chose to admit a judicature centered by the civil power. Dr. A. Büchler has sought to reconcile the various accounts by the theory that there were two great tribunals in Jerusalem, one wielding religious, the other civil authority (Das Synedrium in Jerusalem, Vienna, 1902).

The council chamber (bōvāh) where the synedrium usually sat was between the Xystus and the Temple, probably on the Temple-hill, the Mishnah states that the meetings were held within the inner court. The meeting in the palace of the high priest which condemned Jesus was exceptional. The proceedings also on this occasion were highly irregular, if measured by the rules of procedure which, according to Jewish tradition, were laid down to secure order and a fair trial for the accused.

Of the older literature of the subject it is enough to cite Selden, De synedris. The most important critical discussion is that of Kuenen in the Verlagen, &c., of the Amsterdam Academy (1866), p. 131 seq. A good summary is given by Schürer, Geschichte des jüdischen Volkes, 4th ed., § 23. Cf. also G. A. Smith, Jerusalem (1907), vol. i. ch. 9.

SYNESIUS (c. 373-c. 414), bishop of Ptolemais in the Libyan Pentapolis after 410, was born of wealthy parents, who claimed descent from Spartan kings, at Cyrene between 370 and 375. While still a youth (393) he went with his brother Eupolius to Alexandria, where he became an enthusiastic Neoplatonist and disciple of Hypatia (q.v.). On returning to his native place about the year 397 he was chosen to head an embassy from the cities of the Pentapolis to the imperial court to ask for remission of taxation and other relief. His address to Arcadius (De regno) is full of advice as to the studies of a wise ruler in such perilous times. His three years' stay in Constantinople was wearisome and otherwise disagreeable; the leisure it forced upon him he devoted in part to literary composition. The Aegyptius sive de providentia is an allegory in which the gods Osiris and Typhon, who represent Aurelian and the Goth Gainas (ministers under Arcadius), strive for mastery; and the question of the divine permission of evil is handled. After the successful Aurelian had granted the petition of the embassy, Synesius returned to Cyrene in 400, and spent the next ten years partly in that city, when unavoidable business called him there, but chiefly on an estate in the interior of the province, where in his own words "books and the chase" made up his life. His marriage took place at Alexandria in 403; in the previous year he had visited Athens, where he was received by Olympius, who, it seems, in his zeal against the "heresy" had been by no means very pronounced, was popularly chosen to be bishop of Ptolemais, and, after long hesitation on personal and doctrinal grounds, he ultimately accepted the office thus thrust upon him, being consecrated by Theophilus at Alexandria. One personal difficulty at least was obviated by his being allowed to retain his wife, to whom he was much attached; but as regarded orthodoxy he expressly stipulated for personal freedom to dissent on the questions of the soul's creation, a literal resurrection, and the final destruction of the world, while at the same time he agreed to make some concession to popular sensibilities. His public career was not without trouble, which had been by no means very pronounced, but which was partially due to the attacks of his enemies. His tenure of the bishopric was troubled not only by domestic bereavements but also by barbaric invasions of the country (in repelling which he proved himself a capable military organizer) and by conflicts with the prefect Andronicus, whom he excommunicated for interfering with the Church's right of asylum. The date of his death is unknown; it is usually given as c. 414. His many-sided activity, as shown especially in his letters, and his selflessly mediating position between Neoplatonism and Christianity, make him a subject of fascinating interest. His scientific interests attracted to him, especially in his later years, a circle of the earliest known reference to astronomy, and by a work on alchemy in the form of a commentary on pseudo-Democritus. He was a man of the highest personal character.

His extant works are—(1) A speech before Arcadius, De regno; (2) Dio, sive de suo ipissimo instituto, in which he signifies his purpose to devote himself to true philosophy; (3) Encomium calvitii (he was himself bald), a literary jeu d'esprit, suggested by Dio Chrysostom's Praise of Hair; (4) De providentia, in two books; (5) De insomniis; (6) 157 Epistolae; (7) 12 Hymni, of a contemptible, Neoplatonic character; and several homilies and occasional speeches. The editio princeps is that of Turrenbus (Paris, 1553); it was followed by that of Morell, with Latin translation by Petaius (1612; greatly enlarged and improved, 1637); and, more recently, by Pyne, 1869). The Epistolae, which for the modern reader greatly exceed his other works in interest, have been edited by Demetriades (Venice, 1792) and by Glukus (Venice, 1812), the Caliciti encomium by Krabinger (Stuttgart, 1834), the De providentia by Krabinger (Sulzbach, 1835), the De regno by Krabinger (Munich, 1825), and the Hymnus by Flach (Tübingen, 1875).

See Clausen, De Synesio philosopho (Copenhagen, 1831); R. Vollmer, Synesius von Cyrene (Berlin, 1866); A. Gardner's monograph in The Fathers for English Readers (London, 1886); and a life by W. S. Crawford (London, 1901).

SYNOD (Gr. συνόδος), a term denoting an assembly of ecclesiastical officials legally convoked to discuss and decide points of discipline and morals. It is practically synonymous with the word council (q.v.). It is employed in the same technical sense by Tertullian c. 200, and συνόδος a century or so later in the Apostolic Canons. In time, however, the word council came to be restricted to eccumenical gatherings, while synod was applied to meetings of the eastern or western branches of the Church.
SYNODIC PERIOD—SYRA


Sixty-two Syriac tablets, also translated from Syriac into Greek, are attributed to the same Syntipas (ed. C. F. Matthijs, 1781).

SYRA, or SYROS (anc. Σίρος, perhaps Homeric Σφίς), a Greek island in the middle of the Cyclades, which in the 15th century became the commercial centre of the Archipelago, and is also the residence of the patriarch of the Cyclades and the seat of the central law courts. The length of the island is about 10 m., the breadth 5, and the area is estimated at 424 sq. m. The population rose to about 33,700, of whom about 20,500 were in the chief town, Hermoupolis, but that of the town had in 1907 declined again to 18,132. Syra is also a province of the department of the Cyclades (pop. 1907, 31,930). The importance of the island in prehistoric times is attested by considerable remains of early Aegaean antiquities. In ancient times it was remarkably fertile, as is to be gaot not elsewhere from the Turf. It was a commercial entrepôt (Od. xvi. 403), which might be of doubtful application, but also from the remains of olive presses and peculiarities in the local nomenclature. The destruction of its forests has led to the loss of all its alluvial soil, and now it is for the most part a brown and barren rock, covered at best with scanty aromatic scrub, pastured by sheep and goats.

Hermopolis (better Hermoupolis), the chief town, is built round the harbour on the east side of the island. It is governed by an active municipality, whose revenue and expenditure has rapidly increased. Among the public buildings are a spacious town-hall in the central square, a club-house, an opera-house and a Greek theatre. Old Syra, on a conical hill behind the port town, is an interesting place, with its old Roman Catholic church of St George's still crowning the summit. This was built by the Capuchins, who in the middle ages chose Syra as the headquarters of a mission in the East. Louis XIII., hearing of the dangers to which the Syra priests were exposed, took the island under his especial protection, and since that time the Roman Catholic bishops of Syra have been elected by the pope. About the beginning of the 19th century the inhabitants of Syra numbered only about 1000, and whenever a Turkish festival appeared they made off to the interior and hid themselves. On the outbreak of the war of Greek independence refugees from Chios, after being scattered throughout Tenos, Spezia, Hydra, &c., and rejected by the people of Ceos, took up their residence at Syra under the protection of the French flag. Altogether about 40,000 had sought this asylum before the freedom of Greece was achieved. The chief city was called Hermoupolis after the name of the ship which brought the earlier settlers. Most of the immigrants elected to stay, and, though they were long kept in alarm by pirates, they continued to prosper. In 1875 358 sailing ships and 698 steamers (with a total of 740,731 tons) entered and 758 sailing ships and 700 steamers (with a total of 756,807 tons) cleared this port; in 1883 3379 sailing and 1126 steam vessels (with a total of 1,056,201 tons) entered and 3276 sailing and 1120 steam vessels (with a total of 966,229 tons) cleared. Most of the sailing vessels were Greek and Turkish, and most of the steamers were Austrian, French and Turkish.

But since the energetic development of Peiraus, Syra has ceased to be the chief commercial entrepôt and distributing centre of this part of the Levant, and consequently its trade has seriously diminished. Its chief export is stone, and the export trade of 1883 was £1,313,750, in 1900 it only amounted to £6408,350. Coal, textiles and iron and steel goods figure prominently amongst the imports, and emery, leather, lemons, sponges, flour, valonia and iron ore amongst the exports. Syra is the seat of several industries, ship-building, tanneries, flour and cotton mills, rope-walks, factories for confectionery ("Turkish delight"), hats, kerchiefs, furniture, pottery and distilleries. The harbour, which is protected by a breakwater 273 yds. long, has a depth of 25 ft., diminishing to 12 ft.

SYNTIPAS, the Greek form of Sindbad or Sendabar, an Indian philosopher supposed to have lived about 100 B.C., and the reputed author of a collection of tales known generally in Europe as the story of the Seven Wise Masters. They enjoyed immense popularity, and appeared in many Oriental and Western languages. A Greek translation (probably from a Syriac version), the earliest specimen of Romanae prose (11th century), is extant under the title of The most pleasing Story of Syntipas the Philosopher. It is preceded by an introduction in iambic verse by a certain Michael Andreopulos, who states that it was executed by order of Michael, probably the duke of Meltene in Armenia. The translator is evidently a Christian, although he has generally preserved the Oriental colouring. The main outline is the same in the different versions, although they vary in detail and include different stories. A certain prince, who had taken a vow of silence for a time on the advice of his tutor, was tempted by his stepmother. Her advances being rejected, she accused him to his father, who decided to put him to death. The device of the Arabian Nights is introduced by the wise men of the court, who in turn relate stories to dissuade the king from over-hasty punishment, each story being answered by the queen, who desires instant action to be taken. When the period of silence is over the prince speaks and establishes his innocence. In the Greek version the king is a king of Persia, named Cyrus, and Syntipas himself is the prince's tutor (text in A. Eberhard, Fabulae Romanenses, I., 1872; "Teubner Series").
SYRACUSE (Gr. Συράκους; Lat. Syracusae, Ital. Siracusa), a city of Sicily, the capital of a province of the same name, situated on the east coast of the island, 54 m. by rail S. by E. of Catania, and about 32 m. direct. Pop. (1881), 21,739; (1906), 25,250 (towns), 35,000 (commune).

History.—Syracuse was the chief Greek city of ancient Sicily, and one of the earliest Greek settlements in the island. According to Strabo (vi. 4, p. 269) Chersocrates and Archias of Corinth, both Heraclidae, left their native city together with a band of colonists, the former stopping with half the force at Corcyra, where he expelled the Liburnians and occupied the island, while Archias proceeded to Syracuse.¹ Thucydides (vi. 3) gives the Phoenician settlement on the island,² though it is certainly such a place as Thucydides (vi. 2) describes as occupied by them for purposes of trade with the Sicels. The name of the island, Ortygia (ορτυγία, a quail), has, again, been held to point to the possible existence of an Aetolian settlement on the island before Archias came. But it is more probable that the name was given to the island owing to the establishment there by the first settlers of a special cult of Artemis (the name Ortygia appears in Homer, Odyssey, v. 123, as an island sacred to Artemis, though the identification with Delos (g.v.) is not certain), though why Corinthians should have worshipped Artemis in preference to any other deity is not clear.

Till the beginning of the 5th century B.C. our notices of Syracuse's history are quite fragmentary. Almost the only question is whether, as some stray notices (see Freeman, History of Sicily, ii. 431) might suggest, the primitive kingship was retained or renewed at Syracuse, as it certainly was in some other Greek colonies. A king Polis is spoken of; but nothing is known of his actions. It is far more certain that Syracuse went through the usual revolutions of a Greek city. The descendants of the original settlers kept the land in their own hands, and they gradually brought the Sicel inhabitants to a state not unlike villeinage. Presently other settlers, perhaps not always Greek, gathered round the original Syracusan people; they formed a distinct body, δῆμος or πλῆθος, personally free, but with an inferior political franchise or none at all. The old citizens thus gradually grew into an exclusive or aristocratic body, called γαμευοι or landowners.

We hear incidentally of disputes, seditions and changes, among others the expulsion of the Gamori early in the 5th century B.C. (Thuc. v. 5; Arist. Pol. v. 3, 5; 4, 4).

In its external development Syracuse differed somewhat from other Sicilian cities. Although it later grew in early times bilaterally, both Gela and Acragas (Agrigentum), it very soon began to aim at a combination of land and sea power.³ In 663 it founded the settlement of Acrae, in 643 Casmenae,⁴ and in 508 Camarina, of which the first was unusually far inland. The three together secured for Syracuse a continuous dominion to the south-east.

¹ Strabo goes on to say that Archias fell in with certain men who had come from the Sicilian Megara, and took them with him to share in his enterprise. But this version implies that Megara was founded before Syracuse, which is contrary to all other authorities. The whole question of the various tales relating to the foundation of Syracuse is discussed by E. A. Freeman, History of Sicily, i. 335 sqq., 572 sqq.

² The origin of the name Συράκους is quite uncertain. It has been suggested that it may be Phoenician: and, again, the plural form has been thought to point perhaps to the combination of two originally distinct posts,¹ one on the island, the other on the mainland on the hill where the ruins of the Olympium stand, known as νομαί— the latter being the original Syracuse.

³ The site of Casmenae is uncertain; it was to the south-west of Syracuse, and not improbably at Spaccaforno (Freeman ii. 25).

⁴ The site of Casmenae is uncertain: it was to the south-west of Syracuse, and not improbably at Spaccaforno (Freeman ii. 25).
coast. They were not strictly colonies but outposts; Camarina indeed was destroyed after a revolt against the ruling city (Thuc. v. 1). Whether the inland Sicel town of Henna was ever a Syracusan settlement is doubtful. It is extremely probable that Acrae was not founded until after two obvious outposts had already been occupied—a post guarding the road to Acrae itself, and including the sacred enclosure of Apollo, which later, when it became a quarter of the city, acquired the name Temenites; and another post on the road to the north, in the upper part of the region known as Achradina. The latter was Achradina on the east and north and south, with a long straight cutting of the rock serving as a scarp on which the wall stood (see below), and on the south by extensive quarries (Freeman ii. 43, 139, 144). About the middle of the 6th century B.C. the island was connected with the mainland by a mole (Freeman ii. 140, 503). At the beginning of the 5th century B.C. Syracusan history becomes far more clear. Hippocrates, tyrant of Gela (498–491), threatened the independence of Syracuse as well as of other cities, and it was saved only by the joint intervention of Corinth and Corecyra and by the cessation of the vacant territory of Camarina. In 485 the Camorri, who had been conquered by the Segestans and the Trinacrians, and had taken refuge at Cameneae, craved help of Gelo. The successor of Hippocrates, who took possession of Syracuse without opposition, and made it the seat of his power. He gave citizenship both to mercenaries and to settlers from Greece, and added to the population the inhabitants of other cities conquered by him, so that Syracuse became a city of mixed population, in which the new citizens had the advantage. He then extended the city by including within the fortifications the low ground (or at any rate the western portion of the low ground) between Upper Achradina and the island east of and across the Acrae canal, and at the same time (probably) he was able to shift the position of the crossing to the island by making a new isthmus in the position of the present one, the old mole being broken through so as to afford an outlet from the Little Harbour on the east (Lupus, p. 91). The island thus became the inner city, the stronghold of the ruler, so that, despite its low level, it is often spoken of as the “acropolis.” Gelo’s general rule was mild, and he won fame as the champion of Hellas by his great victory over the Carthaginians at Himera. He is said to have been granted as king; but he does not seem to have taken the title in any formal way.

Gelo’s brother and successor, Hiero (478–467), kept up the power of the city; he won himself a name by his encouragement of poets, especially Aeschylus and Simonides, and philosophers; and his Pythian and Olympic victories made him the special subject of the songs of Pindar and Bacchylides; among the recently discovered works of the latter are three Odes (iii.–v.) written for him. He appeared also as a Hellenic champion in the defence of Cumae against the Etruscans, and he attempted after the victory to found a Syracusan colony on the island of Aenaria, now Ischia. But his internal government, though that of Gelo, was suspicious, greedy and cruel. After some family disputes the power passed to his brother Thrasylalus, who was driven out next year by a general rising. In this revolution Thrasylalus and his mercenaries held the fortified quarters of Ortgyia and Achradina; the revolted people held the unwalled suburbs, already, it is plain, thickly inhabited. Thrasylalus yielded to the common action of Sicelots and Sicels. Syracuse thus became a democratic commonwealth. Renewed freedom was celebrated by a colossal statue of Zeus Eleutherius and by a yearly feast in his honour. But when the mercenaries and other new settlers were shut out from office 4 new struggles

1 Holm and Cavallari (cf. Lupus, Topographie von Syrakus, 91) make the construction of the mole and of the wall across it contemporaneous with the building of Achradina in the middle of the 6th century B.C. They also consider that the original western boundary of Achradina ran down to the Little Harbour, so that the southern boundary of Achradina was the sea itself.

2 Holm and Cavallari (see Lupus, p. 99) are inclined to attribute to him the addition of Tyche to the city.

3 Dio x. 72; cf. Arist. Pol. v. 3, 10.

4 The chief authorities for the siege are Thucydides (bk s. vi. and vii.), Diódoros (bk. xiii.) and Plutarch, Nicia.
SYRACUSE

complete, and the Athenian fleet had at the same time entered the Great Harbour. The citizens began to think of his surrender, and Nicias was so confident that he neglected to push his advantages. He left a gap to the north of the circular fort which formed the centre of the Athenian lines, the point where Epipolae sloped down to the sea, and he ordered to occupy Euryelus.

The second act of the drama may be said to open with the irretrievable blunder of Nicias in letting the Spartan Gilippus first land in Sicily, and then march at the head of a small army, partly levied on the spot, across the island, and enter Syracuse by way of Epipolae, past Euryelus. Gilippus was felt to be the representative of Sparta, and of the Peloponnesian Greeks generally, and his arrival inspired the Syracusans with the fullest confidence. Just before his arrival a few ships from Corinth had made their way into the harbour with the news that a great fleet was already on its way to the relief of the city. The tables were now completely turned, and we hear of nothing but defeat and disaster for the besiegers till their final overthrow. The military skill of Gilippus enabled the Syracusan militia to meet the Athenian troops on equal terms, to wrest from them their fortified position on Plemmyrium, which Nicias had occupied as a naval station shortly after Gilippus’s arrival, and thus to drive them to keep their ships on the low beach between their double walls, to take Labdaunum, an Athenian fort on the northern edge of Epipolae, and make a third counter-work right along Epipolae in a westerly direction, to the north of the circular fort. Toward Athens were thus reduced and checked, and, as Nicias said in his despatch towards the close of 414, they were themselves besieged rather than besieging. The naval preparations of the Syracusans, under the advice of Hermocrates, had led them, too, to confidence in their powers of giving battle to the Athenian fleet. In the first sea-fight, which took place simultaneously with the capture of Plemmyrium, they had been unsuccessful; but in the spring of 413 they actually won a victory over the Athenians in their own element.

On the very next day, however, a second Athenian fleet arrived under Demosthenes and Eurydemus, with thirty-three ships of war and a large force of heavy infantry and light troops. The despatch of this expedition seems to prove an almost blind confidence in Nicias, whose request to be superseded the Athenian people refused to grant. Demosthenes decided at once to make a grand attack on Epipolae, with a view to recovering the Athenian blockading lines and driving the Syracusans back within the city walls. The assault was made by night by way of Euryelus under the uncertain light of the moon, and this circumstance turned what was very nearly a successful surprise into a ruinous defeat. The affair seems to have been well planned. The Athenians were thus reduced and checked, and, as Nicias said, flushed with a first success, their ranks broken and disordered by a pursuit of the enemy over rough ground, were repulsed with great loss by a body of heavy-armored Boeotians, and driven back in disorder. The confusion spread to the troops behind them, and the action ended in wild flight and slaughter. The army was now thoroughly out of heart, and Demosthenes was for at once breaking up the camp, embarking the troops, and sailing back to Athens. (It must be remembered that the Spartans were all this time in occupation of Decelea; see PELopONNEsIAN WARS, Note 1. The Syracusan army was thus broken up in a moment. A desperate conflict, was utterly defeated and half destroyed. The broken and demoralized army, its ranks thinned by fever and sickness, at last began its hopeless retreat, attempting to reach Catania by a circuitous route; but, harassed by the numerous Syracusan cavalry and lighters, after a few days of dreadful suffering, it was forced to lay down its arms. The Syracusans saluted the glory of their triumph by putting Nicias and Demostenes to death, and huddling their prisoners into their stone-quarries—a living death, dragged out, for the allies from Greece proper to the space of seventy days, for the Athenians themselves and the Greeks of Sicily and Italy for six months longer. Games called Assinarian, from the name of the river at which the final surrender occurred, were instituted to commemorate it.

Her great deliverance and victory naturally stirred up the energies of Syracuse at home and abroad. Syracusan and Selinunte ships under Hermocrates now play a distinguished part in the warfare between Sparta and Athens on the coast of Asia. Under the influence of Diocles the constitution became as still more confirmed democracy, some at least of the magistrates being filled by lot, as at Athens (Diod. xiiii. 31, 35; Arist. Pol. v. 3–6). Diocles appears also as the author of a code of laws of great strictness, which was held in such esteem that later lawyers were deemed only its expounders. Under these influences Hermocrates was banished in 409; he submitted to the sentence, notwithstanding the wishes of his army. He went back to Sicily, warred with Carthage on his own account, and brought back the bones of the unburied Syracusans from Himera, but was still so dreaded that the people banished Diocles without restoring him. In 407 he was slain in an attempt to escape from the city, and he who was wounded one who was presently to outstrip both rivals.

This was Dionysius the (the “Elder”), son of another Hermocrates and an adherent of the aristocratic party, but soon afterwards a demagogue, though supported by some men of rank, among them the historian Philistus (Diod. xiiii. 91, 92). By accusing the generals engaged at Acragas in the war against Carthage, by obtaining the restoration of exiles (no doubt others of the partisans of Hermocrates), by high-handed proceedings at Gela, he secured his own election first as one of the generals, then as sole general (or with a nominal colleague), with special powers. He next, by another trick, procured from a military assembly at Leontini a vote of a bodyguard; he hired mercenaries and in 406–405 came back to Syracuse as tyrant of the city (Diod. xiiii. 91–96). Dionysius kept his power till his death thirty-eight years later (367). But it was well-nigh overthrown before he had fully grasped it. His defeat before Gela and his consequent decision that both Gela and Camarina should be evacuated, and left for the Carthaginians to plunder, were no doubt due to previous arrangement with the latter. His enemies in the army, chiefly the horsemen, reached Syracuse before him, and with Dionysius’s brother, his house was plundered, and he came and took his vengeance, slaying and driving out his enemies, who established themselves at Aeta (Diod. xiiii. 113). In 397 Syracuse had to stand a siege from the Carthaginians under Himilco, who took up his quarters at the Olympic, but his troops in the marshes below suffered from pestilence, and a masterly combined attack by land and sea by Dionysius ended in his utter defeat. Dionysius, however, allowed him to depart without further pressing his advantage. This revolution and the peace with the Carthaginians confirmed Dionysius in the sole general (or with a nominal colleague), with special powers. As Leontini was again a separate city. It left Syracuse the one great Hellenic city of Sicily, which, however enslaved at home, was at least independent of the barbarian. Dionysius was able, like Gelo, though with less success and less honour, to take up the rôle of the champion of Hellas.

During the long tyranny of Dionysius the city grew greatly in size, population and grandeur. In fact the free Greek cities and communities, in both Sicily and southern Italy, were sacrificed to Syracuse; there the greatness and glory of the Greek world in the West were concentrated. The mass of the population of Gela and Camarina, and the great numbers who had fled at the prompting of Dionysius, taken refuge at Syracuse. Gela had in the previous year received the fugitive inhabitants of Acragas (Agrigentum), which had been sacked by the
Carthaginians. Syracuse thus absorbed three of the chief Greek cities of Sicily. It received large accessions from some of the Greek cities of southern Italy, from Hipponium on its west and Caulonia on its east coast, both of which Dionysius captured in 389 B.C. There had also been an influx of free citizens from Rhegium. At the time of the Athenian siege Syracuse consisted of two quarters—the island and the "outer city" of Thucydides, generally known as Acharnida, and bounded by the sea on the north and east, with the adjoining suburbs of Apollo Temenites farther inland, at the foot of the southern slopes of Epipolae and Tyche west of the north-west corner of Acharnida. Dionysius largely extended the fortifications. The island (Ortygia) had been provisioned with its own defences, converted, in fact, into a separate stronghold, with a fort to serve specially as a magazine of corn, and with a citadel or acropolis which stood apart and might be held as a last refuge. Dionysius, to make himself perfectly safe, drove out a number of the old inhabitants and turned the place into a barracks, he himself living in the citadel. For any unpopularity he may have thus incurred he seems to have made up by his great works for the defence of the city. Profiting by the experience gained during the Athenian siege, he included in his new lines the whole plateau of Epipolae, a strong and thickly wooded area; thus, the total length of the outer lines (excluding the fortifications of the island) has been calculated at about 12 m. The material (limestone) was quarried on the spot. Each quarter of the city had its own distinct defences, and Syracuse was now the most splendid and the best fortified of all Greek cities. Its naval power, too, was vastly increased; the docks were enlarged; and new warships were built. Besides the triremes, or vessels with three banks of oars, we hear of quadriremes and quinqueremes with four and five banks of oars—larger and taller and more massive ships than had yet been used in Greek sea warfare. The fleet of Dionysius was the most powerful in the Mediterranean. It was doubtless fear and hatred of Carthage, from which city the Greeks of Sicily had suffered so much, that urged the Syracusans to acquiesce in the enormous expenditure which they must have incurred under the rule of Dionysius. Much, too, was done for the beauty of the city as well as for its strength and defence. Several new temples were built, and gymnasia erected outside the walls near the banks of the Anapus (Diod. xv. 13).

"Fastened by chains of adamant" 1 was the boastful phrase in which Dionysius described his empire; but under his son, the younger Dionysius—"in ease, good-natured, unpractical manner—a restless set in amongst the restless citizens of Syracuse, which, with its vast and mixed populations, must have been full of elements of turbulence and faction. But the burdensome expenditure of the late reign would be enough to account for a good deal of discontent. A remarkable man now comes to the front—Dion, the friend and disciple of Plato—and for a time the trusted political adviser of his nephew Dionysius. Dion's idea seems to have been to make Dionysius something like a constitutional sovereign, and with this view he brought him into contact with Plato. All went well for a time; but Dionysius had Philistus of Athens about him, who were opposed to any kind of liberal reform, and the result was the banishment of Dion from Syracuse as a dangerous innovator. Ten years afterwards, in 357, the exile entered Acharnida a victor, welcomed by the citizens as a deliverer both of themselves and of the Greeks of Sicily generally. A siege and blockade, with confused fighting and alternate victory and defeat, and all the horrors of fire and slaughter, followed, till Dion made himself finally master of the mainland city. Ortygia, provisions failing, was also soon surrendered. Dion's rule lasted only three years, for he perished in 354 by the hand of a Syracusan assassin. It was, in fact, after all his professions, little better than a military despotism. The tyrant's stronghold in the island was left standing.

Of what took place in Syracuse during the next ten years we know but little. The younger Dionysius came back and from his island fortress again oppressed the citizens; the plight of the city, torn by faction and conflicts and plundered by foreign troops, was so utterly wretched that all Greek life seemed on the verge of extinction (Plato, Epist. viii.). Sicily, too, was again menaced by Carthage. Syracuse, in its extremity, asked help from the mother-city, Corinth; and now appears on the scene one of the noblest figures in Greek history, Timoleon (q.v.). To him Syracuse owed her deliverance from the younger Dionysius and from Hicitas, who held the rest of Syracuse, and to him both Syracuse and the Sicilian Greeks owed a decisive triumph over Carthage and the safe possession of Sicily west of the river Halycus, the largest portion of the island. From 343 to 337 he was supreme at Syracuse, with the hearty good will of the citizens. The younger Dionysius had been allowed to retire to Syracuse; his island fortress was destroyed and replaced by a court of justice. Syracuse rose again out of her desolation—grass, it is said, grew in her streets—and, with an influx of a multitude of new colonists from Greece and from towns of Sicily and Italy, once more became a prosperous city. Timoleon, having accomplished his work, accepted the position of a private citizen, though, practically, to the end of his life he was the ruler of the Syracusan people. After his death (337) a splendid monument, with porticoes and gymnasia surrounding it, known as the "Timoleontean," was raised at the public cost to commemorate him.

In the interval of twenty years between the death of Timoleon and the rise of Agathocles (q.v.) to power another revolution at Syracuse transferred the government to an oligarchy of 600 leading citizens. All we know is the bare fact. It was shortly after this revolution, in 317, that Agathocles with a body of mercenaries from Campania and a host of exiles from the Greek cities, backed up by the Carthaginian Hamilcar, who was in friendly relations with the Syracusan oligarchy, became a tyrant or despot of the city, assuming subsequently, on the strength of his successes against Carthage, the title of king. Syracuse passed through another reign of terror; the new despot proclaimed himself the champion of popular government, and had the senate and the heads of the oligarchical party massacred wholesale. He seems to have had popular manners, for a unanimous vote of the people gave him absolute control over the fortunes of Syracuse. His wars in Sicily and Africa left him time to do something for the relief of the poorer citizens at the expense of the rich, as well as to erect new fortifications and public buildings; and under his strong government Syracuse seems to have been at least quiet and orderly. After his death in 289 comes another miserable and obscure period of revolution and despotism, in which Greek life was dying out; and but for the brief intervention of Pyrrhus in 278 Syracuse, and indeed all Sicily, would have fallen a prey to the Carthaginians.

A better time began under Hiero II., who had fought under Pyrrhus and who rose from the rank of general of the Syracusan army to be tyrant—king, as he came to be so soon styled—about 270. During his reign of over fifty years, ending probably in 216, Syracuse enjoyed tranquillity, and seems to have grown greatly in wealth and population. Hiero's rule was kindly and enlightened, combining good order with a fair share of liberty and self-government. His financial legislation was careful and considerate; his laws 1 as to the customs and the corn tithes were accepted and maintained under the Roman government, and one of the many bad acts of the notorious Verres, according to Cicero, was to set them aside (Cic. In Verr. ii. 13, ili. 8). It was a time, too, for great public works—works for defence at the entrance of the Lesser Harbour between the island and Acharnida, and temples and gymnasia. Hiero through his long reign was the staunch friend and ally of Rome in her struggles with Carthage; but his paternal despotism, under which Greek life and civilization at Syracuse had greatly flourished, was unfortunately succeeded by the rule of a man who wholly reversed his policy.

Hieronymus, the grandson of Hiero, thought fit to ally himself with Carthage; he did not live, however, to see the mischief he had done, for he fell in a conspiracy which he had wantonly provoked by his arrogance and cruelty. There was a fierce

1 The laws of Hiero are often mentioned with approval in Cicero's speeches against Verres.
popular outbreak and more bloodshed; the conspirators were put to death and Hiero's family was murdered; whilst the Carthaginian faction, under the pretence of delivering the city from its tyrants, got the upper hand and drew the citizens into open defiance of Rome. M. Claudius Marcellus was then in command of the Roman army in Sicily, and he threatened the Syracusans with attack unless they would get rid of Epicydes and Hippocrates, the heads of the anti-Roman faction. Epicydes did his best to stir up the citizens of Leonti against tyrants and the Roman party at Syracuse. Marcellus, therefore, struck his first blow at Leontini, which was quickly stormed; and the tale of the horrors of the sack was at once carried to Syracuse and roused the anger of its population, who could not but sympathize with their near neighbours, Greeks like themselves. The general feeling was now against any negotiations with the Roman general, and, putting themselves under Epicydes and Hippocrates, they closed their gates on him. Marcellus, after an unsuccessful attempt to negotiate, began the siege in regular form (214 B.C.) by both land and sea, establishing a camp on Polyzonium; and the Syracusans, now secure, stood the old temple of Olympian Zeus; but he made his chief assault on the northern side and on the defences of Tyche, particularly at the Hexapylum, the entrance facing Megara and Leontini. His assault seawards was made mainly on Achradina, but the city was defended by a numerous sodality and by what seems to have been still more formidable, the ingenious contrivances of Archimedes, whose engines, acting as Pavon, and frustrated the attack on the fortifications on the northern slopes of Epipolae (Liv. xxxiv. 34). Marcellus had recourse to a blockade, but Carthaginian vessels from time to time contrived to throw their supplies in, and Marcellus, at length, treachery began to work within. Information was given him in the spring of 212 (two years from the commencement of the siege) that the Syracusans were celebrating a great festival to Artemis; making use of this opportunity, he forced the Hexapylum entrance by night and established himself in Tyche and on the heights of Epipolae. The strong fortress of Euryelus held out for a time, but, being now isolated, it soon had to surrender.

The outer and the inner city of Thucydides still held out, whilst a Carthaginian fleet was moored off Achradina and Carthaginian troops were encamped on the sp. A but a precursor broke out in the autumn of 212, which swept them clean away, and thinned the Roman ranks. The ships sailed away to Carthage; on their way back to Syracuse with supplies they could not get beyond Cape Pachynus owing to adverse winds, and they were confronted by a Roman fleet. All hope for the city being now at an end, the Syracusans threw themselves on the mercy of Marcellus; but Achradina and the island still held out for a brief space under the Syracusan mercenaries, till one of their officers, a Spaniard, betrayed the latter position to the enemy, and at the same time Achradina was carried and taken. Marcellus gave the city up to plunder (Liv. xxxv. 31), and the art treasures in which it was so rich—many of the choicest of them, no doubt—were conveyed to Rome. Archimedes perished in the confusion of the sack while he was calmly pursuing his studies (Liv. xxxv. 31).

Syracuse was now simply one of the provincial cities of Rome's empire, and its history is henceforward merged in that of Sicily. It retained much of its Greek character and many of its finest public buildings, even after the havoc wrought by Marcellus. Its importance and historic associations naturally marked it out as the residence of the Roman praetor or governor of Sicily. Cicero often speaks of it as a particularly splendid and beautiful city, as still in his own day the seat of art and culture (Tusc. v. 66; De deor. nat. iii. 81; De rep. i. 21), and in his speeches against Verres (liv. 52, 53) he gives an elaborate description of its four quarters (Achradina, Neapolis, Tyche, the island). It seems to have suffered in the civil wars at the hands of Sextus Pompeius, the son of the triumvir, who for a short time was master of Sicily; to repair the mischief, new settlers were sent by Augustus in 21 B.C., and established in the island and in the immediately adjoining part of Aciadina (Strabo vi. 270). It was he who probably constructed the amphitheatre. Tacitus, in a passing mention of it (Ann. xiii. 49), says that permission was granted to the Syracusans under Nero to exceed the prescribed number of gladiators in their shows. Caligula restored its decayed walls and some of its famous temples (Sueto., Calig. 22). In the 4th century it is named by the poet Ausonius in one of his "nobilissimis locis," as a seat of one of its historic memories. In 665 Heracleus Constans fixed his capital here, but owing to his oppressive government was assassinated in 668. Syracuse has been a place of comparatively little importance since the year 878, when it was destroyed by the Saracens under Ibrahim ibn Ahmad.

Archaeology.—The medieval and modern town of Syracuse (with the exception of a new quarter which has sprung up since the construction of the railway between the station and the island) is confined to the island. This contains the remains of two Doric temples. The older, belonging probably to the beginning of the 6th century B.C., appears, from an inscription on the uppermost step, to have been dedicated to Apollo. It was a peripteral hexastyle, and must have had at least nineteen columns at the sides; the portion excavated shows that its total width is 74 ft., the width of the cella 38 ft., the lower diameter of the columns 6 ft. The other temple, into which the cathedral was built in A.D. 640, is to be dated after 440 B.C. It was a peripteral hexastyle of thirty-six columns, with a total length of 160 ft. and a total breadth of 72 ft.; the columns have a lower diameter of 5 ft., and the inter-columniation is 13 ft. It is generally regarded as the temple of Athena.

Near the west coast of the island is the famous fountain of Arethusa. According to the legend, the nymph Arethusa was changed into the fountain by Artemis to deliver her from the pursuit of the river-god Alpheus (p.29); and the spring, which was fresh until an earthquake broke the barrier and let in the salt water, was supposed to be actually connected with the river. There are interesting remains of medieval architecture in the closely built town with its narrow streets; the beautiful 14th-century windows of the Palazzo Montalto may be especially noticed, and also the 15th-century Castello Mainace on the southern extremity of the island. The town also contains the archaeological museum, which, under the direction of Professor Orsi, is now the best arranged in the island. The discoveries of recent years in the south-eastern portion of Sicily, including especially the objects found in Sicel and Greek cemeteries, may be studied here. The isthmus connecting the island with the mainland, which was defended by strong fortifications erected by Charles V. and Philip II. (now demolished), does not occupy the site of the mole erected in the 6th or 7th century B.C., which may be recognized as having run due north from the north point of the island to the mainland near the ferry of S. Lucia. The Little Harbour was thus in origin merely a recess of the Great Harbour; and it was probably Gelo who was responsible for making it an independent port, by establishing the crossing to the island in its present position. On the landward side of the new isthmus was the Agora, in which remains of a colonnade of the Roman period have been found. To the west are the remains of an extensive building of the Roman period, probably a palaestra, with a small Odeum attached. To the W.N.W. is the so-called Piano del Fusco, an extensive necropolis, in which over six hundred tombs, mostly of the 6th century B.C., were excavated. The Acropolis, which was included within the defensive wall of Dionysus, a portion of which, no less than 184 ft. thick, was found in 1856 running diagonally across the new cemetery, and in 1903 an outwork in front of it was discovered (P. Orsi, in Notizie degli scavi, 1903, 517). East of this point it probably followed the edge

1 This statement made by Polybius (viii. 5) is almost incredible. Livy's account of the siege, too, is full of topographical difficulties (Lupus, 214 sqq.).

2 The name is a widespread Greek name for a spring.

3 Lupus, Topographie von Syrakus, 26, 88, 91. Near the quarry are a row of long parallel walls which must be remains of the ancient docks, each being intended to take a ship.

4 It is remarkable that hardly any tombs of the 5th century B.C. have come to light.
of the low terrace above the marsh (the ancient Lysimeleia), while in the other direction it ran N.N.W., making straight for the western edge of the gorge known as the Portella del Fusco, which was thus included within the fortifications, as it would otherwise have afforded a means of access to the enemy. Here the wall gained the top of the cliffs which mark the southern edge of the plateau of Epipolae, which from this point onwards it followed as far as Euryelus. The south wall of Epipolae, considerable remains of which exist, shows traces of different periods in its construction, and was probably often restored. It is built of rectangular blocks of limestone generally quarried on the spot, about 3 ft. long, 2 ft. high and 25 ft. deep. The thickness of the wall averages 10 ft., but varies 3 or 4 ft. each way. The point where the terrace of Epipolae narrows down to a ridge about 60 yds. wide, which is its only link with the hills to the west, had thrice proved during the Athenian siege to be the key to Syracuse. It now bears the ruins of a mighty fortress, finer than that which defends the entrance to the acropolis of Selinus—the most imposing, indeed, that has come down to us from the Greek period—which there is no doubt is the work of Dionysius. The total length of the works is about 2,382 ft., its average width is 145 yds., and it is estimated that the rock-cutting of the innermost of which can be reached from the interior of the castle by a complicated system of underground passages. The front of the castle is formed by five massive towers: behind it are two walled courtyards, to the north of the easternmost of which is the well-guarded main entrance to the plateau of Epipolae (narrower minor entrances are to be seen on both the north and the south sides) communicating by a long underground passage with the inner ditch in front of the castle proper. That this point is to be identified with Euryelus is now generally admitted (see Lupus, 125-127; Freeman, iii. 661). Earlier writers make this the site of Labdalum, and put Euryelus farther west; but Labdalum must be sought somewhat farther east, near the northern edge of the plateau, in a point not visible from the Athenian central fort (σενάριον) with a view over Megara—not therefore in the commanding position of Dionysius’s fort, with an uninterrupted view on all sides. On the north side of Epipolae the cliffs are somewhat more abrupt; here the wall, of a similar construction to that on the south, is also traceable: but here it is apparently all of one period. It is, indeed, recorded by Diodorus that Dionysius built the north wall from Euryelus to the Hexapylon in twenty days for a length of 2½ m., employing 60,000 peasants and 6000 yoke of oxen for the transport of the blocks. Several smaller entrances are to be seen in it, as in the south wall: among them one with a series of inclined planes cut in the rock, which leads to an ancient road running south-east to the neighbourhood of the theatre. The Hexapylon plays an important part in the Roman siege of Syracuse. It was the main entrance on the north, and no doubt is to be identified with the so-called Scala Greca, where the modern highroad leaves the plateau. This highroad, which probably follows an ancient line, may be reasonably held to mark the west boundary of Tyche. Five hundred yards to the east of it an interesting postern was discovered in 1791 (Orsi, in Notizie degli scavi, 1803, 168), at the point where the wall leaves the edge of the plateau and begins to follow the sea-coast; and half a mile farther on we reach the deep gorge of S. Bonagia (more correctly Panagia), which here forms the boundary between Tyche and Achradina. The west boundary of Achradina is marked farther south by a perpendicular cutting in the rock, on the top of which a wall must have run (see above). To the east of the gorge the wall still follows the edge of low cliffs of the coast, and continues to do so all along the east side of Achradina as far as the Little Harbour. On this side traces of it are very scanty, as the sea-spray has eaten away the stone. The most important buildings of which we have any remains are to be found in the lower part of Achradina and in Neapolis, a quarter of which we hear first in the time of Dionysius, and which at first was confined to the lower ground below Temenites, but in Roman times included it and the theatre also (Lupus, 168), though it did not extend beyond the theatre to the uppermost part of the plateau. In lower Achradina remains of Roman private houses have been found, and it is in this district that the early Christians 4 constructed their catacombs. Those which are entered from near the 12th-century church of S. Giovanni, situated near an ancient temple, are extensive and important, and include the ancient crypt of S. Marcianus, and the type is different from that of the Roman catacombs, the galleries being far larger (partly owing to the hardness of the limestone in which they are excavated), and having circular chambers at the points of junction. In Neapolis, on the other hand, public buildings predominate. The temple of Apollo Temenites has entirely disappeared, but the theatre, entirely hewn in the rock, is still to be seen. It is the largest in Sicily, and is unique in the way its tiers are formed. It has the utmost height of sixty rows of seats; the eleven lower tiers were originally covered with marble. Each of the nine cases bore a name; the inscriptions of five of them, still preserved on the rock, are in honour of Zeus, Heraclès, King Hiero II., his wife Philistis, and his daughter-in-law Nerelis. Of the stage nothing but cuttings in the rock for foundations are visible. The situation is well chosen, commanding a splendid view over the Great Harbour. Not far off to the south-east is the amphitheatre, probably erected by Augustus when he founded a colony at Syracuse; it is partly cut in the rock and partly built. It is inferior in size only to the Colosseum and the amphitheatres of Capua and Verona, measuring about 153 by 130 yds. over all: the arena is 76 by 43 yds. To the west of the amphitheatre is the foundation of the great altar erected by Hiero II. (Diod. xvi. 83), 217 yds. long by 24 wide, and about 6 yds. in height. To the north-west of the theatre a winding road ascends through the rock, with comparatively late tomb chambers on each side of it. In this district are seen hundreds of small niches cut in the rock, as a rule about 2 ft. square and a few inches deep, which served for containing inscriptions or relics, sometimes of a sepulchral character, but sometimes relating to the cult of a divinity. Many of them are also found in the quarries (Orsi, in Notizie degli scavi, 1904, 277). Both the districts just described contain huge quarries, the famous Lautumiae (from Gr. Λατούμε, stone, and τεμνων, to cut; hence λατομεία, quarry) of Syracuse, over 100 ft. deep and of great extent (though through the collapse of the pillars supporting the undermined rock they have become still larger than they were in ancient times). They are now overgrown with luxuriant vegetation. The upper plateau (Achradina, Tyche, Epipolae itself) is now largely cultivated at the east end, less so at the west end. It is traversed by the subterranean aqueducts by which the city was supplied (see AQUADUCTS) and by a few ancient roads, but contains practically no remains of ancient buildings. Cuttings in the rock for the foundations of such are numerous round the south edge of Temenites and Achradina, and are to be seen at various points near the city wall. But otherwise the disappearance of the edifices of ancient Syracuse is most striking. We have already seen that immediately outside Lower Neapolis on the south the marshes of Lysimeleia begin, which proved fatal to more than one besieging force. They are traversed by the Anapus, with its tributary the Cyanne, the latter famous for the papyrus planted by the Arabs, which here alone in Europe grows wild in the stream. To the south of the ancient hill of Policlinche, on which stood the Olympieum, attributed on stylistic grounds to 581 b. C. its monumental 4 St. Paul tarried at Syracuse three days on his way to Rome (Acts xxviii. 12). 4 A large reservoir of the Greek period exists under the present railway station (Notizie degli scavi, 1904, 280).
SYRACUSE, a city and the county-seat of Onondaga county, New York, U.S.A., situated at the southern end of Onondaga Lake, about 75 m. E. of Rochester and about 150 m. W. of Albany. Pop. (1880), 51,792; (1890), 85,143; (1900), 108,374, of whom 23,757 were foreign-born (including 7865 German, 317 Irish, 2393 English Canadian and 2383 English) and 116,617 were negroes; (1910), 137,240. Area (1900), 16.62 sq. m. Syracuse is served by the New York Central & Hudson River, the West Shore, and the Delaware, Lackawanna & Western railways, by the Erie Canal and the Oswego Canal, which joins the Erie within the city limits, and by several electric inter-urban lines. The city is built on high ground in an amphitheatre of hills surrounding the lake, which is a beautiful body of clear water, 5 m. long by 1½ m. broad at its widest point. Of the residential streets, James Street, in the north-eastern part of the city, is the most attractive. Salina Street is the principal thoroughfare of the residential and commercial section of the city, and more than fifty parks and squares, with a total area of 278 acres. The largest and most noteworthy areBurnet park (about 100 acres), on high land in the western part of the city, Lincoln park, occupying a heavily wooded ridge in the east, and Schiller, Kirk and Fraser parks. A boulevard runs along the shore of the lake. A fine water-supply controlled by the city is obtained from Skaneateles Lake, 18 m. distant, by a gravity system which cost $5,000,000; and the city has an intercepting sewer system.

Among the most noteworthy churches of Syracuse are the Roman Catholic cathedral of the Immaculate Conception—Syracuse became the see of a Roman Catholic bishop in 1887—and St Paul's Protestant Episcopal, the first Presbyterian, first Methodist Episcopal, Dutch Reformed and May Memorial (Unitarian) churches, the last erected in memory of Samuel Joseph May (1797-1871), a famous anti-slavery leader, pastor of the church in 1845-1868, and author of Some Recollections of Our Anti-Slavery Conflict (1873). Among the public buildings are the Federal Building, the Onondaga county courthouse, costing $1,500,000 and containing a law library of 15,000 volumes, the city-hall, the Central high school, a fine building erected at a cost of $400,000, the North high school ($300,000), and the public library (Carnegie) with 60,000 volumes in 1908 and housing the Museum of Fine Arts (1897), also.

Among the hospitals and charitable institutions are the Syracuse hospital (1872) for infectious diseases, the Hospital of the Good Shepherd (1873), the Syracusian homoeopathic hospital (1869), the Syracuse hospital for women and children (1887), St Mary's infant and maternity hospital (1900) under the Sisters of Charity, St Joseph's hospital (1869, under direction of the Sisters of St Francis, the Syracuse home for aged women (1852), Onondaga county orphan asylum (private; 1841), and two other orphan asylums controlled by the Sisters of Charity, and the state institutions (in a state-reminded building, the North hospital (office building owned by Syracuse University), the Union Building, the Onondaga county savings bank and the Syracuse savings bank are among the most important business structures; and the Onondaga, the Vanderbuilt house and the State and St Clair hotels are the principal hotels. In Jamesville, about 6 m. south, is the Onondaga penitentiary. Adjacent to the city is Oakwood cemetery overlooking the lake; and north-west of the city are the Slate fair grounds, with extensive exhibition halls and barns, where the annual fairs of the New York State Agricultural Society are held. Six miles south of the city is the Onondaga Indian reservation, the oldest capital of the Indian Nations. The city has an annual carnival and a musical festival.

Syracuse University, whose campus (of 100 acres) in the south-east part of the city commands a fine view of the lake, is a co-educational institution largely under Methodist Episcopal control, but not sectarian, which in 1908-1909 had 259 instructors and 3205 students (1136 in the college of liberal arts; 189 in the summer school; 62 in the library school; 933 in the college of fine arts; 147 in the college of medicine; 179 in the college of civil engineering; 352 in the college of teachers’ college). The university was opened in 1871, when the faculty and students of Genesee College (1850) removed from Lima (New York) to Syracuse—a court-ruling made it impossible for the corporation to remove; in 1872 the Geneva medical college (1835) removed to Syracuse and became a college of the university. The courses in library economy (college of liberal arts) are particularly well known. The university library (about 80,000 bound volumes and 49,000 pamphlets) includes (since 1887) the collection of the German historian, Leopold von Ranke. There are seventeen buildings, among which the Holden observatory, the John Crouse memorial college (of fine arts), the hall of languages, the Lyman Smith college of applied science, the Lyman hall of natural history, the Bowne hall of chemistry, and the Carnegie library, are the most notable. There are a large gymnasium and a stadium of re-enforced concrete for athletic contests, capable of seating 20,000 people and one of the largest athletic fields in the world. The plant of the university in 1900 was valued at $3,193,128, and in 1908-1909 its productive funds amounted to about $2,000,000 and its income from all sources was about $784,000.

Power from Niagara Falls is used by factories in the city, and the manufactures are extensive and greatly diversified. In 1905 the aggregate capital of the city’s manufacturing industries was $38,002,052 and the net value of the products, 31½% more than in 1900. The principal products in 1905 were: men’s and women’s clothing ($3,547,494, of which $3,082,052 represented men’s clothing), shoes, foundry and machine-shop products, of which agricultural implements and machinery constituted the greater part ($2,415,460), iron and steel products ($2,117,558), chemicals, malt liquors ($1,660,460), typewriters and typewriting supplies ($1,440,186), boots and shoes ($1,313,200), and other important products were automobiles and sewing machines, hosiers and knit goods, candles, furniture, flour, crockery, and canned goods (especially mince-meat).

Syracuse was long the principal seat of the salt industry in America.
The Onondaga salt deposits were mentioned in the journal of the French Jean Lemoine as early as 1653, and before the War of Independence the Indians marked the Onondaga salt at Albany and Quebec. In 1786 the state undertook, by treaty with the Onondaga Indians, to carry on the extraction of them from the ground. In 1795, by another treaty, the state acquired for $1000, to be supplemented by an annual payment of $700 and 150 bushels of salt, the salt springs and land along Onondaga Creek. In 1797 it was constructed a road to the salt springs. In 1797 the state leased the lands, the lessees paying a royalty of 4 cents per bushel and being forbidden to charge more than 60 cents per bushel. The state sank wells and built and maintained tanks. Three minutes were delivered to lessees at 1822-1824 a royalty of 12 cents was charged to raise funds for building canals (a rebate being granted in the last three years covering the entire amount of the royalty for these years). Onondaga Creek, as the original source of the royalty, was maintained until 1858, when the last of the lands were sold and the office of superintendent of salt lands, created in 1797, was abolished. Until 1840 only boated salt was manufactured; in that year the solar process was introduced. The annual production, which was increased to 100,000 bushels in 1804, reached its highest point in 1862 (9,053,874 bushels, of which 1,983,022 bushels were solar, and 7,070,852 boiled). The development of the Michigan salt deposits and (after 1880) of the deposits in the Green County and Wyoming counties of the state, has caused a rapid decline in the Onondaga product. In 1876 both processes yielded together only 5,392,677 bushels, and in 1896 only 2,806,600 bushels. The salt deposits at Syracuse had, however, lathe years been worked over by a large company, the manufacture of soda ash, which has grown to importance. At the village of Solvay (pop. 1905, $100), adjoining Syracuse on the lake shore, are the largest works for the production of soda ash in the world, giving employment to more than 3000 hands.

The Syracuse region became known to Europeans through its salt deposits. Until several years after the close of the War of Independence, however, there was no settlement. Ephraim Webster, who built a trading-post near the mouth of Onondaga Creek in 1786, was the first white settler. At about 1788-1789 small companies began to visit the place every summer to work the salt deposits. In 1796-1797 there was a permanent settlement known as Webster's Landing, and in 1797 a settlement was begun at Salina, a short distance to the north on the lake shore. Geddes, another "salt settlement," was founded in 1803. In 1806 the "landing" received the name "Gogard's Corners," from the proprietor of a local inn. Between 1800 and 1805 a dozen families settled here, and in the latter year a grist mill, the first manufacturing establishment, was built on Onondaga Creek. A sawmill was built for the same settler, and a tannery, which had assumed control of the salt fields, sold to Abraham Walton of Albany, for $650, some 250 acres, embracing the district now occupied by Syracuse's business centre, to secure money for the construction of a public road. During the succeeding years the name of the place was frequently changed. It was called Milan in 1809, South Salina in 1809-1814, Cossitt's Corners in 1814-1817, and Cossitt in 1821-1824. In 1824 a post office was established, and as there was another office of that name in the state, the name was again changed, the present name being adopted. The village was incorporated in 1825, and the street plan of the settlement is still the same.

In the meantime the settlement had been growing rapidly. In 1818 Joshua Forman bought an interest in the Walton tract, had the village platted, and became the "founder" of the city. The first newspaper, the Onondaga Gazette, was established in 1823; and in 1825 the completion of the Erie Canal opened a new era of prosperity. In 1827 Syracuse became the county seat of Onondaga county. In 1834 Salina was united to Syracuse, and the city was chartered. Geddes was annexed in 1866. Syracuse has been the meeting-place of some historically minded Indians to take care of their interests, and in 1821 on which occurred the split between the "Barnburner" and "Hunker" factions of the Democratic party, began the Free Soil movement in the state. The strong anti-slavery sentiment here manifested itself in 1831 in the famous "Jerry rescue," one of the most significant episodes following the enactment of the Fugitive Slave Law of 1850; Samuel J. May, pastor of the Unitarian church, and seventeen others, arrested for assisting in the rescue, were never brought to trial, although May and two others positively admitted that they had taken part in the rescue, and announced that they would contest the constitutionality of the Fugitive Slave Law, if they were tried.

See Carroll E. Smith, Pioneer Times in Onondaga County (Syracuse, 1904).

SYR-DARYA (Gr. and Lat. Jazaries; Arab. Shash or Sihun), a river of Asia, flowing into the Sea of Aral, and having a length of 1500 m. and a drainage area of about 320,000 sq. m. Its headstream is the Naryn, which rises in the heart of the Tian-shan complex south of Lake Issyk-kul, on the southern slope (500 m.) of the Terski Alatau. The Naryn and its tributaries have another mountain stream, the Barskann, it flows W.S.W. In 1900, to 10,000 ft. above the sea, in a barren longitudinal valley between the Terski Alatau and the foothills of the Kokshal-tau. On entering a wild narrow gorge in the south-west continuation of the Terski Alatau it receives the name of Naryn. Within this gorge it descends some 4000 ft.; Fort Narynsk, 20 m. below the confluence of the Great and the Little Naryn, is only 6800 ft. above the sea. Here the river enters a broad valley—formerly the bottom of an alpine lake—and flows past the ruins of Fort Kurtka, for 90 m. westward, as a stream covering 2000 ft. lower than Kurtka, and the Keten-tube are spent. This gorge is characterized by a wide flat riverbed. Half an hour below, the river enters the broad entrance to the valley, where the river pierces the Mogol-tau.

On issuing from this gorge the Syr enters the Aral depression, and flows for 850 m. in a north-westerly and northerly direction before reaching the Sea of Aral. On this section it is navigated by steamers. Between the Irjar rapids and Balidyr-turgai (where it bends north) the river flows along the base of the subsidiary ranges which flank the Choktal Mountains on the north-west, and receives from the longitudinal valleys of these alpine tracts a series of tributaries (the Angren, the Chirchik, the Keles), which in their lower courses form the wide plains of land on the right bank of the Syr.

Some 50 m. below Chinaz (770 ft. above sea-level) the Syr bends northwards, but resumes its north-western course 150 m. farther down, following with remarkable persistency the edge of the loess. Its low banks, overgrown with reeds and rendered uninhabitable in summer by clouds of mosquitos, are inundated for 20 m. on both sides when the snows begin to melt. These inundations prevent the moving sands of the Kyzyl-kum desert from approaching the Syr; but the wind, however, does gain the upper hand. Down to Pervosk the river rolls its muddy yellow waters, at the rate of 3 to 5 m. an hour, in a channel 300 to 600 yds. wide and 3 to 5 ft. deep, and at Pervosk its critical section is 3580 sq. ft., and 322,500 ft. of water are discharged per second. The Arys and the Bugun are the only tributaries worthy of notice along this part of its course: the other streams which descend from the Kara-tau fail to reach the river. The Kirghiz rear numerous herds of cattle and

1 Syr and darya both signify "river," in two different dialects.
sheep in the valley of the Arys, while lower down, as Julek, the Iginch carry on agriculture. All this applies of course only to the right bank; on the left the moisture is absorbed by the hot winds which blow from the east, and it seems impossible for the climate of the atmosphere has marked effect upon the Syr when it gets below Julek, the Kara-kum sands then being on its right. Ten miles below Perovsk the river traverses a marshy depression (the bottom of a fault), and below Julek it finds its way into the Jaman-darya and the Kara-uyuk. The latter spreads out into marshes and ponds, from which it again issues to join the former at Karakamsch, after a course of 60 m. The main arm, owing to its shallowness and sinuosity, is very difficult to navigate, and the difficulty is increased by the rapidity of the current and the want of fuel. Between Kazalin and the Sea of Aral (138 ft.) navigation becomes possible, and a current of 5000 ft. per hour lasts for the last 10 m., where the river divides into three shallow branches before entering the "Blue Sea." All three have at their mouths sandy bars with only 3 ft. of water.

Two former right-hand tributaries of the Syr—the Chu and the Sary-su—now disappear in the sands some 60 m. before reaching it. The Chu, which is 600 m. in length, rises in the Tien-shan south-west of Lake Issyk-kul, and as the Kashkar flows towards Lake Issyk-kul, but a few miles before reaching that lake turns suddenly to the north-west, enters under the name of Chu the narrow gorge of Buam, and piercing the snow clad Kunghei Ala-tau, emerges on its northern slope having received in connection with the Talas-tau for the last 50 m., of not more than 50 m. In this part of its course it receives from the right the Kebin, whose high valley equals in size that of the lower Rhone. It then flows north-westwards through the valley of Pishpek, arrives at the northern sands of the Salt basin, and after traversing the part of the Caspian to the north before finally taking a western direction. Numberless streams flow towards it from the snow-clad Alexander Mountains, but they are for the most part lost in the sands before reaching it. The Talas is the only tributary of the Syr in its entire course in the highest part of that range, pierces the Cha-archa Mountains, and, flowing past Aulie-ata on the south border of the Muyun-kum, enters the salt basin of the Azbakan. At a distance of 14 m. below the reservoirs of the Saumkul-kul group of lakes, 60 m. from the Syr. Another elongated group of lakes—the Uzen-kul—near the above, receives the Sary-su, which has a length of nearly 570 m. and flows rapidly westwards along the western edge of the northern Famine Steppe (Bekpak-dala).

The delta of the Syr begins at Perovsk, whence it sends a branch to the south-west, the Jany-darya (New River), which formerly reached the south-eastern corner of the Sea of Aral, very near to the mouth of the Amu-darya. The Kirghiz affirm that a canal dug for irrigation by the Kara-kalpaks gave origin to this river. It had, however, but a temporary existence. A dam erected by the people of Kiewend at Ak-mechet (Perovsk) caused its disappearance, and the Russians found nothing but a dry bed in 1820. When the dam was removed the Jany-darya again reappeared, but it failed to reach the lake. It is said to have received the water of the Kyzyl-darya. It has a course of 250 m.; all traces of its bed were then lost in the sand.

Five centuries ago, in the time of Timur, the Mongol prince of Samar-kand, the Jany-darya brought the waters of the Syr to the Daoukara lake, where it is known as the Chottal-darya. Altough the river-beds in the Kyzyl-kum, which are still seen above Perovsk, indicates that the Syr had a constant tendency to seek a channel to the south-west, and that its present course is an accident for it might have reached the lake by a more northerly route if the low lands had not been already occupied by the existence of post-Pliocene marine deposits. (P. A. K.; J. T. Be.)

SYR-DARYA, or SYR-DARINISK, a province of Russian Turkestan, lying on both sides of the Syr-darya river, from its embouchure in the Sea of Aral up to Khjoteng, where it issues from the mountain region of the Tien-shan. The province is bounded N. by the provinces of Turgui, Akmolinsk and Semipalatinsk; E. by Semireychensk; S. by Ferghana, Zarafshan, Bokhara, and the Khorezm; and W. by the Caspian Sea. Its area (166,000 sq. m.), its population (over a million and a half) and the city of Tashkent make it the most important province of Russian Turkestan.

The south-eastern boundary runs along the Chotkal Mountains (14,000 ft.), which separate the river Chottal from the river Naryn, and join the Alexander Mountains on the east. A series of short chains, such as the Talas-tau and Ala-tau, fringe the above on the north-west, and occupy the south-east of the province. The snow-clad summits of the Talas-tau reach 14,000 to 15,000 ft. in altitude, and immense glaciers occur about Manna Mountain. These mountains seem to have been the outlet of ancient glaciers, having crossed the Tien-shan from its northern to its south-east; the other flanking chains have a decidedly south-western direction, and are much lower, the outlying ranges having rather the character of broad plateaux above 2000 ft. in altitude. They belong therefore to another series of upheavals prevalent in western Asia, to which Richthofen has given the name of the "Kara-tau series." Its length is about 270 m., and its average altitude about 7000 ft.

The Julek-darya is supplied by the Syr-darya from the river Chu, and its gentle south-western slope contains the sources of a multitude of streams which water the oasis around the town of Turkestan. The mountainous tracts occupy, however, only a small part of Syr-darya, the rest is steppe. Three different areas must be distinguished—the Kyzyl-kum, the Muyun-kum or Ak-kum, and the Kara-kum. The Kyzyl-kum (red sands) sands stretch between the Angir and the Syr, and have a gradual ascent from 160 ft. at the Sea of Aral to 1500 and 2000 ft. in the south-east. They are partly shifting, partly stationary (see KARA-KUM). In the west the southern boundary of the Kyzyl-kum is approached the steppe assumes another character: a thick sheet of loose girdles the foothills and forms the fertile soil to which Turkestan is indebted for its productive fields and gardens. The southern boundary of the Kara-kum and the northern part of the Sea of Aral, are manifestly a former bottom of the lake.

In the east the steppe yields some vegetation and is visited by the Kirghiz. The barkhans do not shift, being covered with Callitomon, Tamarisk, and Salvia. The same is the case of the Turkestan Grasslands. The highest steppe, between the Kara-tau Mountains and the Chu River, is quite uninhabited, except in the loess region at the northern base of the mountains, for the geological history of the western Tien-shan resembles that of the Tien-Shan. Throughout the Cretaceous and earlier Tertiary periods the lowlands of Syr-darya were under the sea. The character of the region during the post-Pliocene period remains uncertain. A great part of the Caspian region encircles all the mountain tracts, increasing in extent in both and at the lower end of the valley of Ferghana. It seems certain that during the Lacustrian period the Caspian was connected by a maximum, and the Aral basin, which was then much larger, we another inland sea of great dimensions covered the present Balkash basin, and at an earlier period may have been connected with the Aral basin. Recent traces of these basins are found in the

The chief river of the province is the Syr-darya (q.v.). The river flows through the western side of the Sea of Aral, and numerous small lakes are formed along its course. The few lakes that have belts of alpine character occur in the valleys of the hilly tracts.

The climate of the province varies greatly in its different parts. It is most severe in the mountain region, and in the lowlands it is very dry. The temperature of the summer is high, and the winter very cold. It is said that the temperature of the winter remains 7 F. in the sheltered tracts is severe for three months. The average yearly temperature at Tashkent and Kazalinsk respectively is 58-3° and 46-4° (January, 29° and 12°; July, 77-5° and 78°). The terraces of loess mentioned above are alone available for cultivation, and according to less than 1% (8-5) of the total area of the province is under crops, the remaining being either barren pasture land (49%), or waste land (45%). The few cases where cultivation is possible, it is carried to great perfection owing to a highly developed system of irrigation—two crops being gathered every year. Wheat and rice are grown first in the spring, and corn and barley in the autumn. Rye and oats are grown only about Kazalinsk. Cotton is cultivated. Gardening is greatly developed. Sericulture is an important source of income. Livestock breeding is largely pursued, not only by the nomads but by the settled population. Fishing is prosecuted to some extent on the lower Syr. Timber and firewood are exceedingly dear.

The population of the province was estimated in 1866 at 1,779,000. It is increasing rapidly, and in 1877 was 2,406,000. The Russians barely 8500, if the military be left out of account. Kirghiz (50%) and Sarts (9-8%) are the main elements of the population, with Uzbegs (4-3%) and Turkmens (4-1%). The chief languages spoken are in the Hindis. The principal occupations of the Sarts, Uzbegs, Tajiks and settled Kirghiz are agriculture and gardening, but the Kirghiz lead chiefly a nomadic pastoral life. Manufactures are principally the making of cotton and woolen goods. A large variety of petty industries are practised in the towns and villages.

Syr-darya is divided into six districts, the chief towns of which are Tashkent, Aulie-ata, Kazalinsk, Perovsk, Chimkent and Amu-darya.

(P. A. K.; J. T. Be.)
SYRIA, the name given generally to the land lying between the easternmost shore of the Levantine Gulf and a natural inland boundary formed in part by the Middle Euphrates and in part by the western edge of the Hamâd or desert steppe. The northern limit is the Tauric system of mountains, and the southern limit the edge of the Sinaitic desert. This long strip extends, therefore, for about 400 m. between 38° and 31° N. lat. with a mean breadth of about 150 m. Since, however, the steppe edge on the east is somewhat indefinite, some early Moslem and other geographers have included all the Hamâd in Syria, making of the latter a blunt-headed triangle with a base some 700 m. long resting on the north Arabian Nefud. But Strabo, Pliny and Ptolemy, as well as the better Moslem geographers, drew the eastern frontier obliquely from the Gulf of Akeba to Rakka (Raqqâ) on Euphrates, and thus placed the Hamâd in Arabia.

The name Syria is not found in the Hebrew original of the Scriptures; but it was used by the Septuagint to translate Aram. Homer knows only "Aram", but Herodotus speaks of "Syrians" as identical with Assyrians, the latter being, he thinks, a "barbarian" form, and he applies the name very widely to include, e.g. north Cappadocians ("White Syrians" of Pteria). Syria, however, is probably the Babylonian Sûri, used of a north Euphratean district, and a word distinct from Assyria. Generally the ethnic term, Syrians, came to mean in antiquity the Semiti peoples domiciled outside the Mesopotamian and Arabian areas: but neither in pre-Greek nor in Greek times had the word Syria any very precise geographical significance, various lands, which we include under it, retaining their distinctive status, e.g. Commagene (Kummukh), Cynœstica, Phoenicia, Palestine, &c. It is

only under the Graeco-Roman administration that we find a definite district known as Syria, and that was at first restricted to the Orontes basin. Later, all that we understand by Syria came to be so known officially to the Romans and Byzantines; but the only province called simply Syria, without qualification, remained in the Orontes valley. Under the present Ottoman distribution "Syria" is the province of Sham or Damascus, exclusive of the vilayets of Aleppo and Beirut and the sanjak of Lebanon and Jerusalem, which all fall in what is called Syria is the wider geographical sense.

Taking Syria as the strip limited by the sea, the edge of the Hamâd, the Taurus and the Sinaitic desert, we have a remarkably homogeneous geographical area with very obvious natural boundaries; but these, for various reasons, have proved very ineffective in history, especially on the south and east. Syria happens to lie on the line of least resistance for communication between the early subtropic seats of civilization in the Nile and Euphrates valleys and the civilizations of Europe. Its eastern boundary is in great part a steppe, which breeds population, but, unable to nourish increase, sends it over its boundaries in a constant stream of migration. Consequently south Palestine has been continuously "Arabized"; and indeed the whole of Syria has been characterized by racial and religious fusions, and by civilization of a singularly syncretic and derived kind, of which the ancient Phoenician is a sufficient example.

The surface configuration of almost all the strip is remarkably uniform. With the exception of the extreme north (Commagene), which is shut off by a barrier of hills and belongs to foreign hydrographic systems, the whole country is roughly a gable-shaped plateau, falling north and south from a medial ridge, which crosses Syria at about its central point. This gable is tilted eastwards, and its two long slopes are defined by bordering mountain chains
which run across its medial ridge; the main Syrian streams are those which follow those slopes between the chains, thus running either north or south. The other courses, and only finding their way to the western sea by making sharp elbows at the last. Syrian orography, therefore, is simple, being composed of nothing but these two parallel systems. That on the west, which rises behind the Medes and descends to the Mesopotamian valleys, is called the Euphrates; its main tributaries are the Tigris, the Assur, the Khabur, the Khabur, and the Kasr El-Abyad. On the east, the mountain chains in addition to the Medes, there remains a large area, in which, in most cases the eruptions appear to be of Pliocene or later date, but in the extreme north some of the basalt seems to belong to the Miocene and the youngest Cretaceous formations. These basaltic areas are, indeed, very probably the continuation of the Jordan-Anna trough.

The eastern system springs from the Tauric outflow (Kurd Dagh, &c.), which shuts off the Commagenean basins, and as the triple chain of j. Al, it defines the Orontes valley on the east. Like its western parallel it springs up presently into a higher chain, and is known as j. es-Sharki, or Anti-Libanus, which culminates in a knot on the south, to which is given the name j. es-Shelih, or Hermon (8000 ft.). Thereafter it loses much of its distinctive character, but may be traced southwards in j. Hauran and the Moabite hills to Horeh and the Midianite mountains of the Hebrews, which may be called the Anti-Lebanon.

Hydrography.—Between these systems run the main rivers; and these naturally rise near the medial ridge, in the lacustrine district of el-Buk’a, or Cadesyria, and flow in opposite directions. The only tributaries of the meteorologically remarkable stream, into which, when it has turned sharply towards the sea, flow some tributary streams from the Commagenean divide on the north. The main stream flowing south is the jordan, which fails to reach the sea, having been trapped by the barrier ofone of the small streams, the North Litan (called Kasmiya in its lower course), whose source lies very near that of Jordan, repeats the course of the Orontes on a minor scale and gets through the western mountain system to the near Syrian coast. Outside the basins of these rivers a few bordering mountain systems there only remain to be considered: (1) The Mediterranean littoral strip (the ancient Phoenician coast); (2) the mountains in the west of the district in the extreme north, ancient Commagene, which consists of two basins divided by a low ridge running from south to north. These basins belong, one to the Cilician river-system, and the other to the Euphrates.-Als. The first lay the ancient Germanic vast district (mod. Marash); in the second the ancient Samosata (mod. Samasat), whose importance has now passed to Adiyanam. The southern boundary of both basins is a low chain which leaves the Euphrates near the mouth of the Tigris, and runs north towards and across the great plain of Mesopotamia, to which it is linked by a sill whereon stood the ancient fortified palace of Samal (Sinjer; see HITTITES). (3) A succession of oases lying eastward from the Mediterranean littoral towards the Jordan, fed by short local streams. Of these the most important are, from north to south, (a) the Saltpan of Jebell, fed by the North el-Dahab; (b) the oases of Kinneria and Aleppo, fed by the North Kawaik; and (c) the oases of Su Harb and Sarthe, which are fed by the Barada (Abana) and the Awn (Pharab) the chain.

Since these streams had in no case originally easy access to the sea, we naturally find lakes on their course, and several of them terminate in tracts of more or less permanent inundation. Those which occur on the course of the principal rivers are described under ORONTES and JORDAN. The others, which terminate streams, are the three goer el-Aatiba, which receives the waters of Damascus; the Mur which into the kwaiik flows below Kinnserin; and the Ak Deniz, or Baharat Antakia, the ancient Lake of Antioch, which collects the waters of the Karu Sa and Afrin, the southward from the watershed on this northern side of the Great Plain. The lake has been almost entirely dried up by the cutting of a channel, which conducts its feeders directly to the Orontes.

Geology.—Geologically, Syria belongs to two distinct regions of the earth. The first are the littoral deposits, which are usually a great belt of folding of southern Europe and central Asia, and the southern and larger portion belonging to the Indo-African area, which, though often faulted, is usually free from crumbling. A parallelism of the two courses between these deposits and the littoral region which runs from the Bay of Jebele along the Afrin River to Antab and thence to the Euphrates above Birejk. In the southern region which is by far the better known, the oldest rocks are granites, clefts, and metamorphic rocks, often overlaid by conglomerates, tuffs, sandstones and arkoses, which perhaps do not all belong to the same period. In Palestine a lime- stone formation, Carboniferous fossils is found in the midst of the sandstone series. These formations are overlaid by limestones with Hippurites and other fossils belonging to the Upper Cretaceous. Further north, however, Jurassic beds are met with, but of very limited extent. Cretaceous limestones cover the greater part of Palestine and rocks of the same period form Mt Lebanon, the Casius Mons, &c., farther north. Nummulitic limestones also occur on the southern coast, and, with the Lebanon Eocene and Miocene deposits cover the greater part of the country. The Pliocene deposits are not very widely spread and are generally of fresh-water origin excepting near the coast, but marine Pliocene deposits have also been described. Professor J. A. Jelbel Haun, east of the Jordan, is capped by a great sheet of basalt; and many other basalt flows are found, especially in the country of Lebanon. They are mostly true lichen basalt, which in addition to the felts, and in the extreme north some of the basalt seems to belong to the Miocene and the youngest Cretaceous formations. These basaltic areas are, indeed, very probably the continuation of the Jordan-Anna trough.

The faulting which formed the depressions is certainly later than the deposition of the Cretaceous beds and probably belongs to the later portion of the Tertiary era. Little is known of the part of Syria which lies within the folded belt, and includes the Amanus and Kurd mountains. The rocks do not appear to come very markedly from those farther south, but the Devonian is believed to be represented. The folds are approximately parallel to those of the Taurus, and geologically these mountains may be said to belong to that range.

Climate.—Within broad limits the climate, and with it the productivity of the country, cannot have greatly changed; at most the precipitation may have been greater, the area under wood having been more extensive. Except for Jerusalem, we have hardly any data for the ancient Mediterranean littoral. Elsewhere the temperature is about 63° F.; in Beirut it is about 68°. The rainfall in Jerusalem is 36-22 in., in Beirut 21-66. The heat at Damascus is 80° in July, 50° in January, and the mean temperature is about 69°. The sky is continuously cloudless from the beginning of May till about the end of October; during the summer months the nights as a rule are dewy, except in the desert. Rain is brought by the west winds from the south, which, like the African trade-winds, are light and without violence. On the other hand, an ozoniless east wind (sirocco) is occasionally experienced—especially during the second half of May and before the beginning of the rainy season—which has a prejudicial influence on both animal and vegetable life. On the whole the climate of Syria—if the Jordan valley and the moister districts are excepted—is not unhealthy, though intermittent fevers are not uncommon in some places.

The general character of the country, resultant on these conditions, varies according to elevation and latitude. Owing to the high barrier which slants off almost all Syria from the sea, and precipitates the great northward currents mainly on the land, northern Syria is very productive without irrigation, except the narrow littoral strip which was the ancient Phoenicia, and the small deltas, such as that of the Orontes (mod. Hadchita). Jordan-Araba, which is a comparatively large general rainfall, would be still a land "flowing with milk and honey" had its forests not been destroyed, and the terracing, which used to hold up soil on the highlands, been maintained. As it is, it has very fertile patches of lowland, such as the plains of Edraclon and Jaffa; and the high levels, largely composed of disintegrated igneous rock, west of Jordan, over which the sea- wind carries the rains, offer excellent corn-land. In the extreme south, Palestine begins to be affected by the Arabian dryness. For the rest, Syria needs irrigation; and since neither of its larger rivers, Orontes or Jordan, flowing as these do in deep, beds, is of much use for this purpose, all Mid-Syria, except the basaltic regions along the Jordan, is a region mainly occupied by pastures, and yielding only thin cereal crops. Commagene, where not rocky, and the district lying along the southward drains from its divide (anc. Cyryhenes), is in better condition. There is a perennating stream, the upper part of which is fed by rains, and late into the basin of the Taurec rainfall. The latter drains away over the plains east and south-east of Aleppo, making them afford good spring pasture, which has attracted the nomads from farther south; but in the altitude of 1000 ft. the El Nisbar, instead of running up into the high- rate. As it is, it has very fertile patches of lowland, such as the plains of Edraclon and Jaffa; and the high levels, largely composed of disintegrated igneous rock, west of Jordan, over which the sea- wind carries the rains, offer excellent corn-land. In the extreme south, Palestine begins to be affected by the Arabian dryness. For the rest, Syria needs irrigation; and since neither of its larger rivers, Orontes or Jordan, flowing as these do in deep, beds, is of much use for this purpose, all Mid-Syria, except the basaltic regions along the Jordan, is a region mainly occupied by pastures, and yielding only thin cereal crops. Commagene, where not rocky, and the district lying along the southward drains from its divide (anc. Cyryhenes), is in better condition. There is a perennating stream, the upper part of which is fed by rains, and late into the basin of the Taurec rainfall. The latter drains away over the plains east and south-east of Aleppo, making them afford good spring pasture, which has attracted the nomads from farther south; but in the altitude of 1000 ft. the El Nisbar, instead of running up into the high-
up to the Arab invasion, the northern part of the eastern plateau, between the Ores and the Euphrates, was made habitable and, even fertile by storage of rainwater. At this time numerous hill-gardens, cities, and small towns, whose remains are remarkably well preserved, and still serve to shelter a sparse pastoral population.

In the Trans-Jordan region of modern Syria, that of the Mediterranean and that of the west Asian steppe-land, the first, to be seen on the coast and the western slopes of the ranges, is characterized by a number of evergreen shrubs with small leathery leaves, a sub-tropical vegetation. Among cultivated crops, the dates, wheat, barley, and the olive, are grown in great abundance in the Mediterrean basin. Among the higher mountain ranges, the Jordan valley, is characterized by a number of evergreen shrubs, with small leaves, characterized by their fine, and the dark and dry character of its roots, and great poverty in trees. Between these regions the greatly depressed valley of Jordan itself, one of the出差s
to the sea, is the lowest of the high plateau ridge, is distinguished by the variety of its species, the dry and arid nature of its shrubs, and great poverty in trees. Between these regions the greatly depressed valley of Jordan itself, is the lowest of the high plateau regions, and a region of extreme temperatures. The whole coast of Syria, is at home throughout Syria, except on the steppe; the mulberry is planted extensively in the lower Lebanon; and all sorts of fruits trees flourish in irrigated gardens, especially on the Phoenician coast, in the Palestinian plain, in the oasis of Damascus, and in the Buka'a.

The main cereal regions are the Hauran, and the plains of Antioc and Commagene; and the lower western slopes of the coast range are largely devoted to the culture of tobacco. On the northern inland down liquorice grows wild and is collected by the peasants and sent down to Alexandretta.

Fauna.—The mammals of Syria are rather sharply to be distinguished in those which range the northern part of Mt Carmel, and those which pass that limit. The first class includes the isabelline bear, badger, pole-cat, ermine, roe and fallow deer, wild ass, Syrian squirrel, pouched mammoot, goral, and leopard. The second class which ranges under Palestine; and it includes a sub-class which is not found outside Palestine at all. In the latter are the mule, jerboa, several small rodents and the ibex. Only in the Jordan valley do intrusions from the Ethipia region appear. Elsewhere the forms are Palearctic with intrusions from the east; but the length of the Syrian strip and the variety of its surface relief admit of considerable difference in the species inhabiting different districts. The Lebanon and the hills of north Galilee offer the greatest number of mammals.

Population.—The actual population of Syria is over 3,000,000, spread over a superficial area of about 600,000 sq. m., i.e. about 5½ persons to the square mile. But this poor average is largely accounted for by the inclusion of the almost uninhabited northern steppe-land; and those parts of Syria, which are settled, show a much higher figure. Phoenicia and the Lebanon have the densest population, over 70 to the square mile, while Palestine, the north part of the western plateau east of Jordan, the oases of Damascus and Aleppo, the Orites valley, and parts of Commagene, are well peopled. The bulk of the population, so far as race goes, is of the Semitic family, and at bottom Aramaean with a large admixture of immigrant Arabian blood, which is constantly being reinforced, and a comparatively small strain of Hebrew blood. The latter appears mainly in Palestine, and has of late been considerably strengthened by immigration of European Jews, who have almost doubled the population of Jerusalem, and who are now the chief inhabitants of the Holy Land. But how far these, or the indigenous " Jews " are of Hebrew rather than of Aramaean origin is impossible to say. We only know that as long ago as the 1st century B.C. true Hebrew blood was becoming rare, and that a vast proportion of the Jews of Roman times were Hebraized Aramaeans, whose assimilation into the Jewish community did not much follow back than the Maccabean age.

Among this Semitic folk is to be observed a great variety of immigrant stocks, settled in isolated patches, which have done much to enrich the Syrian flora, and to infuse a certain " range " (Commagene) the highlands are almost entirely held by Kurds who entered from beyond Euphrates in comparatively recent times. Kurds live upon the Commagenean plains here and there, as also in the northern trans-Euphratean plains. Among them are the Tauras and Amanus, and outnumbering them on the plains, are Armenian communities, the remains of the Rupienian Invasion of the 10th century A.D. (see Zeitun). These are found as far south as the plain of Antioc and the basin of the Sajur. To the north of Aleppo and Antioc live remnant of pre-Aramaean stocks, mixed with many half-settled and settled Turkmans (Vuraks, Asvars, &c.) who came in before the Mahommedan era, and here and there colonies of relatively imported Circassians. The latter are also settled numerously to the west of Jordan. Mid-Syria shows a medley of populations of more or less mixed origin, in large part alien, for which see Druses; Maronites and Lebanon. In the Phoenician coast towns are many Greeks (to be distinguished from Orthoodox Syrians, called also Greeks on account of creed). In the steppe-land also, the southem trans-Jordanian districts are numbers of true Arabs, mostly belonging to the post-semitic family, which has been coming northwards from Nejd in detachments since the 13th century. These are mainly nomadic, and include offshoots of the great tribes of Rual, Wallad Ali, B. Sokhr, Adwan and Bishr, the first two roaming mainly in the north, the last two in Moab and Ammon. Ottoman Turks, scattered gipsy communities, German settlers in north Palestine, and all sorts of Europeans make up a heterogeneous and incompatible population.

Religion.—The religious types also are strongly divergent. The bulk of the population is Mahommedan; the Bedouins have not much religion of any kind, but they profess Islam. Besides orthodox Moslems there are also Shi'ite sects, as well as a number of religious communities whose doctrine is the outcome of the process of fermentation that characterized the first centuries of Islam. To this last class belong the Ismailites (Assassins), q.v., Metawali, Nosairis, Ansarish, and especially the Druses (q.v.). In many cases it is obvious that the political antipathy of the natives to the Arabs has found expression in the formation of such sects. The Ansarish, for instance, and the Druzes also, have been the abettors of Ottoman enterprises, and the Druzes in particular have been extremely beneficial. The Catholic mission has done very good work in what relates to schools, institutes and the diffusion of literature. The Christians constitute the educated portion of the Syrian people; but the spirit of rivalry has produced stimulative effects on the Mahommedans, who had greatly fallen away from that zeal for knowledge which characterized the earlier centuries of their faith.

Language.—The language throughout southern and middle Syria as high as Killis is Arabic, which has entirely ousted Aramaic and Hebrew from common use, and tends to prevail even over the surviving fragments of the Syrian dialects. The last remnants of Aramaic are to be sought in certain mountainous villages of Anti-Lebanon, and in the Syriac known to the clergy. From the upper Sajur northwards Turkish prevails, even among the Armenians; but many Kurdish communities retain their own tongue.

Government.—The political status of the country is controlled by the Ottoman Empire, of which Syria makes part, divided into the vilayets of Aleppo, Sham or Syria (Damascas), the Lebanon (q.v.) and Beirut, and the separate sanjas or mut tessariffs of Zar and Jerusalem. Ottoman control is imperfect in Lebanon, the Houran, and over the Armenian mountain region of Zeitun and over the eastern steppe-lands, whose nomadic populations can withdraw themselves out of reach. But considerable success has been achieved in inducing the Syrian Arabs to settle and in supplying a counteracting influence to their unrest by the establishment of agricultural colonies, e.g. those of the Circassians in Bashan, Ammon and Moab.

Communications are still very imperfect, but have been greatly improved of late years. Railways run from Beirut to Homs, Hama, (Aleppo and Damascus, q.v.), and to the latter also from Haifa (Turkish). From the termination of the Damascus-Mezib railway a line (the " Mecc a railway ") has been laid by Ottoman enterprise east of Jordan to the southern limit of Syria and beyond. From Jaffa a short line runs to Jerusalem, and a
SYRIA

Something about the ancient political and geographical rela
tions of Syria can be gleaned from Egyptian sources, especi
ally those connected with the campaigns of Tethmosis III.

In the west, the Aramaeans were often referred to as "Amu.
Syria up to and beyond the Euphrates is called more precisely "Sahí
(Sahí)

were considered to be a part of the same territory. Occasionally
Palestine with Coele-syria is called Upper Rutenus, as distin
guished from Lower Rutenus extending to the Euphrates; (2)
the land of the Kheka (sometimes reckoned as belonging to Rutenus
Palestine and the Euphrates) is called Khetab in the

period; (3) Nahatina, the land on both sides of the Euphrates
(extend, strictly speaking, beyond the Syrian Limits).

The Canaanites in general are called Khara. From these lands
the Egyptian kings often derived rich booty, so that in those
days Syria must have been civilized and prosperous. Moreover,
we possess enumerations of towns in the geographical lists
of the temple of Karmak and in a hieratic papyrus dating about
200 years after Tethmosis III. Some of these names can be
readily identified, such as Aleppo, Kadesh, Sidon, and the

or "Sahí."

Palestine and the Euphrates (the area hitherto known as "Syria"

been inhabited from a very early period. Within historic times
a great number of different nationalities have fought and settled
within its borders, the majority belonging to the Semitic stock.

This last circumstance has rendered possible a considerable
degree of fidelity in the tradition of the oldest local names. After
the Aramaeans had absorbed what remained of the earlier
populations, certain of whom they themselves, were powerfully
influenced by Graeco-Roman civilization, but as a people they still retained
their Aramaean speech. Of the political relations of Syria in
the most ancient times we know but little. Each town with its
surrounding district seems to have constituted a small separate
state; the conduct of affairs naturally devolved upon the noble
families. In the latter part of the 16th century B.C., all north
Syria fell under the Cappadocian Hatti domination. The south
Syria was known to Sargon of Akkad (Agade) as Ammon
and was visited by his armies. This is known as the Canaanite
period. Relations were not prosperous in this region. By the very
early period—as early probably as the 16th century B.C.—Syria
became the meeting-place of Egyptian and Babylonian elements,
resulting in a type of western Asiatic culture peculiar to
itself, which through the commerce of the Phoenicians was
carried to the western lands of the Mediterranean basin.

Industry especially attained a high state of development; rich garments
were embroidered, and glass, pastes, faience, etc., were manufac

tured. The extant inventories of spoil carried off by the ancient
conquerors include a variety of utensils and stuffs. The influence
exercised at all times on Syrian art by the powerful neighboring
states is abundantly confirmed by all the recent findings, which,
in addition to our previous knowledge, show the action of the
Aegian culture on Phoenicia and Palestine. The Syrians
were more original in what related to religion; every place, every
tribe, had its "lord" (Ba'al) and its "lady" (Ba'alat); the latter is
generally called 'Ashar or 'Ashartet (i.e. Ishtar, Astarte).

Besides the local Baal there were "the god of heaven"
(El) and other deities; human sacrifices as a means of propitiat-
ing the divine wrath were not uncommon. But in the Syrian
mythology foreign influences frequently betray themselves.
Various religious rites of the Phoenicians are also a matter of fact,
not merely that Syrian culture ultimately spread extensively towards
the West, but that the Syrians (as is shown by the inscriptions of
Teima, &c.) long before the Christian era exercised over the
northern Arabs a perceptible influence which afterwards, about
the beginning of the 1st century, became much stronger through
the kingdom of the Nabataeans. The art of writing was
derived by the Arabs from the Syrians.
inland Syria remained comparatively peaceful first under its own local governors, and, after Darius, as a satrapy, till its subjugation by Alexander. Alien domination alone has been able to correct the tendency of this long strip of land to break up into hostile blocs.

The foundation of numerous Greek cities shortly after Alexander's time was of great importance for Syria (see e.g. Antioch). Their situation along the main route of communication of the Orient, and their foundation on both sides of Jordan, and, for the Maccabean revival, would have absorbed the Jews. The Seleucidae had severe struggles with the Ptolemies for the possession of the southern part of Syria.

After having been reckoned for a short time (from 83 to 69 B.C.) among the dominions of Tigranes, king of Armenia, the country was conquered for the Romans by Pompy (64–63 B.C.). It is impossible here to follow in detail the numerous changes in the distribution of the territory and the gradual disappearance of particular dynasties which maintained a footing for some time longer in Chalcis, Abila, Emesa and Palestine; but it is of special interest to note that the kingdom of the Arab Nabataeans was able to keep its hold for a considerable period on the north as far as Damascus. In the year 40 B.C. Syria had to endure a sudden but brief invasion by the Parthians. The country soon became one of the most important provinces of the Roman Empire; its proconsulship was from the first regarded as the most desirable, and this eminence became still more marked afterwards. Antioch, adorned with many sumptuous buildings, as the chief town of the provinces of Asia, became in point of size the third city of the empire and an eastern Rome. The high degree of civilization then prevailing in the country is proved by its architectural remains dating from the early Christian centuries; the investigations of De Vogüé, Butler and others, have shown that from the 1st to the 7th century there prevailed in north Syria and the Hauran a special style of architecture—partly, no doubt, following Graeco-Roman models, but also showing a great deal of originality in details.

The administrative divisions of Syria during the Roman period varied greatly at different times. Hadrian made three provinces of Syria, Syria Phoenice and Syria Palaestina. At the beginning of the 5th century we find the following: (1) Syria Euphratensis, which had for its capital Hierapolis (q.v.). (2) Syria I., or Coele-syria, having Antioch as its capital. The name Coele-syria (ἡ κολὴ Συρία), no doubt, was applied originally to the valley ("hollow") between Lebanon and Anti-Lebanon, but was afterwards extended to the district stretching eastwards from the latter range. (3) Syria II., or Syria Salutaris, with Apamea as capital. (4) Phoenicia Maritima; capital, Tyre; (5) Phoenice ad Libanum; capital, Emesa (Homs). To this division Damascus and Palmyra belonged, but nowadays they are often reckoned to Coele-syria, the middle strip of coast being designated Syrophoenicia. (6, 7, 8) Palestina I., II. and III. (9) Arabia (capital, Bostra), which embraced all the region from the Hauran to the Amon, and skirted the Jordan valley, stretching southwards to Petrae. Through the kingdom of the Nabataeans Roman influence penetrated from Syria far into northern Arabia.

In 616 Syria was subjugated for a brief period by the Persian Choroes II.; from 622 till 628 it was again Byzantine; 626 and the immediately following years saw its conquest by the Mahommedans (see CALEPHATE). Moawiya, the first Omeyyad caliph, chose Damascus for his residence; but in 750 the capital of the empire was removed by the Abbasids to Baghdad. Under the early caliphs the Arabs divided Syria into the following military districts (γονάδα). (1) Fílistin (Palestine), consisting of Judaea, Samaria and a portion of the territory east of Jordan; its capital was Ramleh, Jerusalem ranking next. (2) Urđam (Jordan), of which the capital was Tabarija (Tiberias); roughly speaking, it consisted of the rest of Palestine as far as Tyre. (3) Damascus, a district which included Baalbek, Tripoli and Beirut, and also the Hauran. (4) Homs, including Hamath. (5) Kinnésrin, corresponding to northern Syria; the capital at first was Kínnesrin (Qinsairin) to the south of Haleb (Aleppo), by which it was afterwards superseded. (6) The sixth district was the military frontier (αὐδασμόν) bordering upon the Byzantine dominions in Asia Minor. During the struggles of the Mahommedan dynasties for the possession of Syria the country still enjoyed a considerable degree of prosperity.

In the crusading period the kingdom of Jerusalem, whose rulers were never able to establish a foothold to the east of the Jordan, extended northwards to Beirút; next to it lay the countship of Tripolitania, which was lost to the Turks in 1516. In 1516 Syria suffered severely from the Mongol invasions (1260), and it never recovered its former prosperity. In 1516 the Ottomans took it from the Egyptian Mamelukes. For its subsequent history, see TURKEY: History. Its medieval importance as an intermediary of trade between Europe and the East was greatly impaired by the opening of the Red Sea route, and finally abolished by the Suez Canal; and Syria is at present important mainly for the sentimental reason that it contains the holiest places of Judaism and Christianity, and for the strategic reason that it lies on the flank of the greatest trade-route of the eastern hemisphere.

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SYRIAC LANGUAGE. Syriac is the eastern dialect of the Aramaic language which, during the early centuries of the Christian era, prevailed in Mesopotamia and the adjoining regions. Its main centres were at Edessa and Nisibis, but it was the literary language of practically all the Christian writers in the region east of Antioch, as well as of the Christian subjects of the Persian empire.

All the Semitic languages1 are built up from triliteral roots: that is, the great majority of the words are derived from a simple verbal form, of which the essential elements are three consonants. This form is seen in the 3rd pers. sing. perf. of the verb, e.g. אב "he was born" = נב or רב which corresponds to Heb. נטול and Arab. qatala. The vowels play no part in differentiating the roots, for the vowels are practically the same in the corresponding forms of every root. The form qēlāl illustrates one main peculiarity of Aramaic, as opposed to the other Semitic languages, viz. its paucity of vowels: for where Hebrew has two full vowels—a long and a short—in qēlāl, and Arabic has three short vowels in qatala, Aramaic has only one short vowel, the sound ʿ, between q and ā being merely a half vowel which is not indicated in Syriac writing. Another chief characteristic of Aramaic appears in nouns, viz. the entire absence of a prefixed definite article. Aramaic gives to the noun instead an ending ʿ, 1 On the place of the Semitic languages among the Semitic languages, and of Syriac among the various dialects, see SEMITIC LANGUAGES.
SYRIAC LITERATURE.

making the so-called "emphatic" state. In the older Aramaic dialects this is used exactly as the noun with prefixed article is used in other languages; but in Syriac the emphatic state has lost this special function of making the noun definite, and has become simply the normal state of the noun. The other grammatical distinction between Syriac and all the west Aramaic dialects is that in Syriac the 3rd person of the imperfect (singular and plural) of the verb begins with n, but in west Aramaic, as in the other Semitic languages, it begins with y.

When, in the 5th century A.D., owing to theological differences the Syriac-using Christians became divided into Nestorians or East Syrians and Jacobites (Monophysites) or West Syrians, certain differences of pronunciation, chiefly in the vowels, began to develop themselves. The East Syrians in most cases kept the more primitive pronunciation of the old Semitic d with the vowel e, but the Jacobites passed into o. One very tangible difference appears in the fact that the name Jesus was by the East Syrians written and pronounced Isho', by the West Syrians Yeshô.

The Syriac alphabet, which derived its letters from forms ultimately akin to those of the Old Hebrew and Phoenician alphabets, has the same twenty-two letters as the Hebrew. And as in Hebrew, the six letters ã g ð õ ÷ t are aspirated when immediately preceded by any vowel sound. On the other hand, the guttural letters affect the vowel, and the vowel affects their chief effect, and that is to change the preceding vowel, if other than a or ò, into a, but even this is not always the case. The vowels, which are ten in number (ā ã ē ī ī ō ō ñ ŏ ŕ), were, as usual in the Semitic languages, indicated only partially by the use of consonants as vowel-signs and by means of certain diacritical points, so long as Syriac remained a living language. But about the time when it began to be supplanted by Arabic, two systems of vowel-signs were invented, one for the West Syrians, who borrowed the forms of Greek vowels, and the other more elaborate for the East Syrians, who used combinations of dots. Nevertheless the system completely differentiates long and short vowels; the Nestorian scheme is the more satisfactory, though more cumbrous.

Where the same root exists in Arabic, Syriac and Hebrew, its fundamental consonants are usually the same in all three languages. But letters belonging to the same group occasionally interchange. As regards the dentals and sibilants there are one or two rules which govern the interchange, in the manner of a Grimm's Law. (1) Where Arabic has an ordinary dental, Syriac and Hebrew have the same; but where Arabic has an aspirated d (e.g. ð), Syriac has an ordinary dental, Hebrew a silent ð. (2) Hebrew has one more sibilant than Arabic or Syriac: thus, as corresponding to s (sâmêkh), s (sin) sh in Hebrew, Arabic has only s (sin) sh, while Syriac has a different pair s (sâmêkh) sh. Hebrew sômêkh is represented by Ar. sûn and Syr. sâmêkh; but Heb. sûn (Syr. sâmêkh) is represented by Ar. sûn, while Heb. and Syr. sh is represented by Ar. sin. As regards this crossing of s and sh, Arabic has with it the other south Semitic language, Ethiopic: the evidence as to the other north Semitic language, Assyrian, is conflicting.

In vowel-sounds Syriac is clearly more primitive than Hebrew (as compared with other Eastern languages) least of all Arabic. Thus Ar. and Syr. a is often thinned in Hebrew into i (i when accented), as in the first syllable of Ar. qattalâ = Syr. qattal = Heb. qattâl. But the second syllable of the same word shows Syriac siding with Hebrew against Arabic. Again the primitive ð of Arabic is in the older (Nestorian) pronunciation of Syriac maintained, while in Jacobite Syriac and in Hebrew it passes into ð: thus Ar. qattal Nestorian qattâl = Jacobite and Hebrew qattâl. Again Syriac.

1 It may indeed be remarked that Syriac, which is generally more primitive in its sounds than Hebrew, shows a more advanced stage of weakening as regards the gutturals: thus in a good many forms it has substituted ðelf for initial ð, and often shows a closer for the presence of two gutturals in the same word, weakening one of them to ðelf. A much more advanced stage of weakening is seen in some of the other dialects.

2 With regard to this, Syriac has one great difference from Hebrew, viz. that final ð is indicated not by ð, but by ðelf.

maintains the diphthongs oi and au, which in Hebrew have usually passed into ð and ð.

The accent plays much less part in lengthening and altering the vowels in Syriac than in Hebrew, but there are well-marked cases of lengthening and shortening.

A few words may now be said about the three main parts of speech—pronouns, nouns and verbs.

1. Pronouns.—As in the other Semitic languages, these stand almost entirely outside the system of triliteral roots, being mainly derived from certain demonstrative letters or particles. Each of the personal pronouns (except the 3rd pl.) exists in a longer and a shorter form; the one is used when a nominative and is a separate word, the other is attached to verbs and (in a slightly different form) to nouns to express the accusative or genitive. These pronominal suffixes of much more importance in Syriac than in Hebrew, and produce a less change in the vowels of the words to which they are attached. Demonstrative adjectives and adverbs are formed by prefixing the syllable ð ("esse, behold") to other pronominal elements, and interrogatives similarly by prefixing the interrogative syllable y, but there are other interrogative pronouns. The relative consists only of the letter d (indecisive) prefixed to words.

Nouns and Adjectives.—The Syriac noun has three states—the absolute (used chiefly in adjectival or participial predicatives, but also with numerals and negatives, in adverbial phrases, &c.), the construct (which, as in Hebrew, must be immediately followed by a preposition), and the prepositional (see above). There are only two genders and two numbers: the neuter gender is entirely wanting, and the dual number is not recognized in Syriac grammar, though there are plain traces of it in the language. The fem. sing. ending is -â, constr. sing. abs. ðâ, constr. plur. abs. ða, dual abs. ðâ, constr. sing. dh, constr. plur. dh. Syriac is not, like Arabic and Hebrew, inflected for case. Instead, cases are expressed by the genitive or possessive relation: for it has a preposition ð which expresses of, to. The noun must be in the state of the noun when the case is used, but the endings are governed by the case. For example, the noun may be in the emphatic state or may (as is usually the case when the noun is definite) have a prenominal suffix. Thus "the son of the king" is more commonly expressed by bāti 'almâlik or bērēd ḫ mlâk than by bar malkâ, whereas the Hebrew type would alone be permissible in Hebrew. And a genitive with prefixed ð does not require the governing noun to precede it immediately, as must be the case when the construct is used. This is one of the many respects where Syriac has gained greater freedom in syntax than Hebrew.

2. Verbs.—The Syriac verb is remarkable for having entirely lost the original passive forms, such as in Arabic can be formed in every conjugation and in. Hebrew are represented by the Paal and Hophal. For these Syriac has substituted middle or reflexive forms with prefixed ðih and a change in the last vowel. The simple active qīlā makes its passive qîfîl; the intensive qīfîl makes its passive qīfîl, ..., and the imperative qīfîl makes its passive qīfîl, with a vowel change in the 1st person singular of the verb is, on the whole, more regular than in Hebrew: thus, to take one instance, the 3rd pl. fem. impf. negîfîn corresponds better to 3rd pl. masc. negîfîn than does the equivalent Hebrew form negîfîn. But the most important peculiarity of Syriac verbs is again in the sphere of syntax, and shows the same progress towards flexibility which we found in the nouns. Whereas the Hebrew verb is complicated and in doubt, while the Syriac verb is practically in as good a state as the passive, and becomes a verbal action as completed or as in process without indicating time past, present or future, Syriac has by the help of an auxiliary verb constructed a set of tenses. Thus we have—Pres. qîtîl, "he kills," "he is killing" (sometimes "he is about to kill"). Impf. qîltîl, "he was killing," Fut. negîfîn, "he will kill," Pl. or Aor. qîlū "he has killed," "he killed." Plup. or Aor. qīlū, "he had killed," "he killed." The same progress towards flexibility in syntax is seen in the equivalent combination of constructions, the tendency towards a more flowing construction of sentences was helped by the influence of Greek, which has also supplied a large stock of words to the Syriac vocabulary.

SYRIAC LITERATURE. By Syriac is denoted the dialect of Aramaic which, during the early centuries of the Christian era, prevailed in Mesopotamia and the adjoining regions. The literary use of Syriac by Christians had its first centre in Edessa (Syr. Êshû or modern Urfa), where, in all probability, the chief Syriac versions of the Bible were made. The use of the same dialect appears in the earliest Christian literature connected with the Syriac Bible.

3 The sketch of the history of Syriac literature here presented is based on Wright's great article in the 9th edition of the Encyc. Brit., which was afterwards published separately under the title of A Short History of Syriac Literature (London, 1894).
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with such Mesopotamian cities as Nisibis, Amid, Mardin, Taghrīr and Seleucia-Ctesiphon, as well as west of the Euphrates at such centres as Maḥbogḥ (Hierapolis) and Aleppo, northwards at Malatiah and Maṣerqāṣ and in the districts of Lake Van and Lake Urmiya, and to the east and south-east of the Tigris in many places which from the 4th century onwards were centres of Nestorian Christianity within the Sasanian Empire. In Palestine and western Syria, the home of pre-Christian Aramaic dialects, the vernacular Semitic speech had under Roman dominion been replaced by Greek for official and literary purposes. Apparently this state of things lasted till after the Mahommedan conquest, for Barhebraeus¹ tells us that it was the language of official documents. In the 7th century, when Christianity, replaced by Greek by Arabic as the language of official documents at Damascus. Probably (as Duval suggests) the use of Syriac in these regions went hand in hand with the spread of the monophysite doctrine, for the liturgies and formulas of the Jacobite Church were composed in Syriac. Similarly the spread of Nestorian doctrines throughout the western and south-western regions of the Persian Empire was accompanied by the ecclesiastical use of a form of Syriac which differed very slightly indeed from that employed farther west by the Jacobites. So far as we know, the only historical source of the Christian communism, of which the word Syriac is used. Of the pagans Syriac literature which issued mainly from Harrān, a city about one day's journey south of Edessa, not a single example appears to have survived. From Christian writers we learn that Harrān continued to be a seat of pagan worship and culture down to and even later than the Mahommedan era. A native of the city, Thābit ibn Qurra, in a passage from a Syriac work of his (now lost) quoted by Barhebraeus,² speaks of the paganism of Harrān as distinguished by its steadfast resistance to Christian propaganda. "When many were subdued to error through persecution, our fathers through God were steadfast in their faith, and this blessed city has never been defiled by the error of Nazareth." He goes on to attribute the world's science and civilization to pagan inventors; but it is not clear whether in this he is alluding specially to the culture of his own city. Anyhow, it is much to be regretted that no Syriac writing from Harrān has survived.³

Syriac literature continued in life from the 3rd to the 14th century A.D., but after the Arab conquest it became an increasingly artificial product, for Arabic gradually killed the vernacular use of Syriac.

In the literature as it survives many different branches of writing are represented—homilies in prose and verse, hymns, exposition and commentary, liturgy, apocryphal legends, historical romance, hagiography and martyrology, monastic history and biography, general history, dogmatics, philosophy and science, ecclesiastical law, &c. But the whole is dominated by the theological and ecclesiastical interest. All chief writers were bishops, inferior clergy or monks, and their readers belonged to the same classes. When we put aside one or two exceptionally fine pieces, like the hymn of the soul in the apocryphal Acts of Thomas, the highest degree of excellence in Syriac literature is perhaps attained in the inroads world historical narratives—such as the account of the Byzantine Roman War at the beginning of the 6th century by the author who passes under the name of Joshua the Stylist, or by romancers like him who wrote the romance of Julian; by biographers like some of those who have written lives of saints, martyrs and eminent divines; and by some early writers of homilies such as Philoxenus (in prose) and Isaac of Antioch (in verse). Nearly all the best writers are characterized by a certain naïve and earnest piety which is attractive, and not infrequently display a force of moral indignation which arrests attention. These

¹ Chron. syr., ed. Bruns, p. 120, ed. Bdeljan, p. 115; cited by Duval, Litt. syr., p. 5.
² Chron. syr., ed. Bruns, p. 176, ed. Bdeljan, p. 168. Thābit was the author of about 16 Syriac works, of which the majority survived in the 13th century, but all are now lost. Of his 150 Arabic translations five are extant; see Brochelmann, Geschichte der arabischen Literatur, i. 271 seq.
³ On this subject, see especially Chwolson's Sabdher und Saabismus.

latter qualities are even more apparent in poetry than in prose. There are indeed but few specimens of Syriac verse, which exhibit high poetic quality, except for a fairly copious and occasionally skillful use of simile and metaphor, there is little of soaring imagination in Syriac poets. On the other hand there is much effective rhetoric, and much skillful play of language.⁴

As was to be expected, the better qualities of style were more often shown during the early centuries when the language was still a living speech. After it had been supplanted by Arabic in the ordinary intercourse of life its literary use was more and more affected by Arabic words and constructions, and its freedom as a vehicle of thought was much impaired. Nevertheless, 190 S in the 6th century it was still an effective instrument in the hands of the most many-sided of Syriac authors, the eminent Barhebraeus.

For the general history of culture the work of Syriac writers as translators is, perhaps, as important as any of their original contributions to literature. Beginning with the earliest versions of the Bible, which seem to date from the 2nd century A.D., the series comprises a great mass of translations from Greek originals—theological, philosophical, legendary, historical and scientific. In a fair number of cases the Syriac version has been used as a source of inspiration rather than a literal reproduction, and moreover, the Syriac translation became in turn the parent of a later Arabic version. This was notably the case with some of the Aristotelian writings, so that in this field, as in some others, the Syriac writers handed on the torch of Greek thought to the Arabs, by whom it was in turn transmitted to medieval Europe. The early Syriac translations are in many cases so literal as to do violence to the idiom of their own language; but this makes them all the more valuable when we have to depend on them for reconstructing the original texts. The later translators use greater freedom. It was not from Greek only that translations were made into Syriac. Of translations from Pahlavi we have such examples as the version of pseudo-Callisthenes History of Alexander, made in the 7th century by a Pahlavi version of the Greek original—that of Kalīyah and Dīnmah executed in the 6th century by the periodiūtēs Bōch—and that of Sindbad, which dates from the 8th century; and in the late period of Syriac literature, books were translated from Arabic into Syriac as well as vice versa.

All our historical sources support the view taken above that Edessa, the capital of the kingdom which the Greeks and Romans called Osroene, was the earliest seat of Christianity in Mesopotamia and the cradle of Syriac literature. But as to the date and circumstances of its evangelization we have little reliable information. The well-known legend of the correspondence of Abgar Ukkāmah, king of Edessa, with Christ and the mission of Addai to Edessa immediately after the Ascension was accepted as true by the historian Eusebius (1340) on the faith of a Syriac document preserved in the official archives of the city. An amplified form of the same story is furnished by the Doctrine of Addai, an original Syriac work which survives complete in a St Petersburg MS. of the 6th century, and is also represented by fragments in other MS. of the 4th century. The legend was probably written at Edessa about the end of the 4th century. It adds many new features to the shorter form of the story as given by Eusebius, among which is the noteworthy promise of Christ about the impregnability of the city—"Thy city shall be blessed and no enemy shall ever henceforth obtain dominion over it." This is probably a later addition made to the legend at a time when such facts as the capture of Edessa by Lusius Quetius in 216 and its second capture and the destruction of its kingdom by the Romans in 216 had faded from memory.⁴

⁴ On the mechanism of Syriac verse, see Duval's admirable section on la poésie syrienne (Litt. syr., p. 10 sqq.).
⁵ Cf. Duval, op. cit., p. 90.
⁶ Cf. Tixeront, Origines de l'Eglise d'Edesse, p. 93, and Duval, op. cit., p. 99. The above view is more probable than that taken by F. C. Burkitt (Early Eastern Christianity, p. 14), that Eusebius knew of Christ's promise as part of the letter to Abgar, and purposely suppressed it as inconsistent with historical facts.
But whether in its longer or its shorter form, the whole narrative must be pronounced unhistorical. In all probability the first king of Osrhoene to adopt Christianity was Abgar IX, son of Ma'nn, who reigned from A.D. 179 to 214 or 216, and the legend has confounded him with an earlier Abgar, also son of Ma'nn, who reigned first from B.C. 4 to A.D. 7 and again from A.D. 13 to 50. A contemporary of Abgar IX at Edessa was the famous Bardaisan, himself a convert from heathenism, who was of noble birth and a habastū of the Edessene court. It was no doubt partly under his influence—also possibly in part through impressions received by Abgar during his visit to Rome about A.D. 170 (see below)—that a Peshitta version of the Bible was translated into Syriac at Edessa. It is not without some authority to hold that Christianity must have reached Edessa some thirty to fifty years earlier. Our earliest native historical document in Syriac—the account of a severe flood which visited Edessa in Nov. A.D. 202—mentions "the temple of the church of the Christians" as overthrown by the flood. The form of this notice shows, as von Gutschmid and others have remarked, that Christianity was not yet the religion of the state; but it must for some time have had a home in Edessa. The same thing is seen from the fact that the heresy of the Marcionites was already showing itself in Syriac literature. The primitive Christian Church in the first centuries at least, only spread in already constituted Christian communities." And by a skilful piecing together of the date furnished by the oldest Syriac versions of the Bible—such as the derivation of the Old Testament version from the Jews, and the almost exclusive use of Tatian's Diatessaron as the gospel of the Syriac Church down to the beginning of the 5th century—F. C. Burkitt has shown it to be probable that the preaching of Christianity at Edessa reaches back to the middle of the 2nd century or even to about the year 135. The Syriac versions of the Bible are treated elsewhere (see Burkitt, pp. 145 seq.) and may here be dismissed with a summary of facts and opinions. The received Syriac Bible or Vulgate (the Peshittā or "simple" version from the 9th century onwards) contains all the canonical books of the Old Testament. In the New Testament, 2 Peter, 2 and 3 John, Jude and the Apocalypse were originally left out, but Syriac versions were made at a later time. The Peshitta version of the Old Testament must have been originally made mainly by Jews, of whom we know there were colonies in Mesopotamia in the 2nd century. The translation was executed entirely out of the Hebrew but underwent later revision which brought it more into conformity with the LXX—this to a greater degree in some books than in others. The Peshitta New Testament—according to the convincing theory which at present holds the field—is not the oldest form of the Syriac version, at least as regards the Gospels. From the beginning of the 3rd to the beginning of the 5th century Tatian's Harmony or Diatessaron—whether originally compiled in Syriac, or compiled in Greek and translated into Syriac—was the current form of gospel in the Syriac Church. The text of the Gospels underlying it "represents the Greek text as read in Rome about A.D. 170." Slightly later was made the Old Syriac version of the separate Gospels, which survives in two MSS.—the Curetonian and the Sinaitic—in two differing forms: but this never obtained much currency. Its text "represents, where it differs from the Diatessaron, the Greek text as read in Antioch about A.D. 200." Then at the beginning of the 5th century, by the efforts of the...
and the Testament of Adam by M. Kmosko (Graffin's Patrologie Syriaca, vol. ii.).

Lives of saints and martyrs form a large group among Syriac books. Among such documents connected with the early history of Edessa we have, besides the Doctrine of Addai, certain martyrdoms, those of Sharbël and Barsamya assigned to the reign of Trajan, and those of Gurya and Shambîb and of the Dr. enthroned Habilibh under Dioscorian and Licinius. All these documents, like Addai, belong probably to the 2nd half of the 4th century, and are quite unreliable in detail for the historian, though they may throw some light on the conditions of life at Edessa under Roman government. There are also accounts of martyrdoms at Samosâta (Assemani, Acta Mart. ii. 123-147), including that of St. Azzaal recently published by Macler (Paris, 1902). But the great bulk of the Syriac martyrdoms have their scene farther east, within the Persian dominions.

The life and writings of Bardaisan, "the last of the gnostics," and in some sense the father of Syriac literature and especially of Syriac poetry, have been treated in a separate article. The Book of the Laws of the Countries, which embodies his teaching, was re-edited in 1909 by F. Nau (this also in the 2nd volume of Graffin's Patrologie). An early Syriac document, probably of the 2nd or 3rd century, is the Letter of Marya son of Serapion, which was edited by Cureton in his Spicilegium Syriacum. It is almost the only exception to the rule that all surviving Syriac literature is Christian. The author is in sympathy with Christianity, but is himself an adherent of the stoic philosophy. His home appears to have been at Seleucia-Ctesiphon.

By the beginning of the 4th century much progress had been made with the organization of the Christian church not only within the Roman district of Mesopotamia, but also to the east and south-east within the Sassanian Empire, round such centres as Seleucia-Ctesiphon on the Tigris (near Baghdad), Karka-d-Beth Sêlokh (modern Kerku) and Beth Lopit or Gundeshâbih (in the modern province of Kurdistan). The adoption of Christianity by Constantine as the official religion of the Roman Empire had an unfortunate effect on the position of the Christians in Persia. They were naturally suspected of sympathizing with the Roman enemies rather than with their own Persian rulers. Accordingly when Sapor II. (310-379) declared war on Rome about 337, there ensued almost immediately a somewhat violent persecution of the Persian Christians, which continued in varying degrees for about 40 years. One result of this and later persecutions of the same kind has been to enrich Syriac literature with a long series of Acts of Persian Martyrs, which, although in their existing form intermixed with much legendary matter, nevertheless throw valuable light on the history and geography of western Persia under Sassanian rule. One of the earlier martyr stories is that of Simeon bar Shabbêa, bishop (2 baptised) of Seleucia from about 126 to 441, in succession to his nephew who had organized the church of Persia under the primacy of Seleucia. The Martyrdom of Simeon exists in two recensions which have been separately edited by M. Kmosko. Another early martyr was Milles, bishop of Susa, who had distinguished himself in the opposition to the Emperor.

Burkitt, p. 21 seq.) endeavours to claim a higher value for the narratives about Gurya, Shambil and Habibih, on the ground that these have left more trace in the later literature; but it is to be feared that all five martyrdoms are turned out in the same legendary mould.

Of the origin and early history of Persian Christianity see especially J. Labouret, Le Christianisme dans l'Empire Persé (Paris, 1904), chaps. i. and ii.

See many of the texts in Bedjan's Acta martyrum et sanctorum (Paris, 1869-1906). The most valuable geographical results are exhibited in G. Hoffmann's Ausüge aus syrischen Akten persischer Märtyrer (Leipzig, 1880).

Graffin's Patrologia, ii. 661-1045. Of the epistles, hymns, &c., attributable to Simeon, two survivals are exhibited in G. Hoffmann's Auszüge aus syrischen Akten persischer Märtyrer.

The two most important 4th-century writers—Aphraates and Ephrem—are dealt with in separate articles. The importance of the former lies in the simple cast of his religious thought, his independence of theological formulas, his constant adherence to the letter of Scripture, his quaint exegesis, and the light he throws on the circumstances of his time, especially (1) the feeling that the Jews and Christians, and (2) the position and sympathies of the Christian subjects of Sapor II. The position and character of Ephrem are very different. He is the typical exponent in Syriac of unbending Catholic orthodoxy. He impressed his countrymen more than any other single writer, partly no doubt by his enormous fecundity in writing, but more by the stern piety and uncompromising dogmatism which pervade his works.

In the 2nd half of the 4th century lived the monk Gregory, who wrote a treatise on the monastic life. Hespraut part of his life in Cyprus, and was a friend of Epiphanius, bishop of Salamis. To the information given by Assemani (B.O. i. 170 seq.) we can now add the statements of Ishê-d'ênab, who has 304 and 304 composed hymns and discourses that were the longest—which is however by some attributed to Ephrem.10—In the work in 12 books on the history of Joseph, of which a complete edition was published by Bedjan in 1901. Other poems of his were edited by Overbeck in S. Eunibiis Syrii, &c., opera selecta, pp. 251-356; and these have since been supplemented by Zettersten's edition of a large number of his religious poems or metrical prayers (Beitruge zur Kennniss der religiösen Dichtung Bala, Leipzig, 1902). His favourite motive was the penticasyllabic. Cyrillici composed a poem on the invasion of the Huns in 395, and is by some regarded as identical with Ephrem's; but it is very doubtful whether the poem is by his hand or not.11

The 5th century was a time of storm and conflict in the churches of Mesopotamia and Persia, as in other parts of the Christian world. The teaching of Apollinarius that in Christ the Divine Word took the place of the human rational soul, thus seeming to do away with his possession of a true humanity, had led to a reaction by Paul of Samosata, Diodore of Tarsus, Theodore of Mopsuestia, and Nestorius of Constantinople. Though with some points of difference, they agreed in emphasizing the permanence of the two separate natures in Christ, united both by mingled and, laid stress on the reality of the Lord's human experience. One question on which great contention arose was as to the propriety of applying to the Divine nature attributes which belonged to the human nature—e.g. birth from a human mother—and vice versa. Hence the great dispute about the application to the Virgin Mary of the epithet theokos. It seems to have been the object of Nestorius to use of this expression which mainly led to his condemnation and deposition at the Council of Ephesus (431) under the influence of Cyril, when as patriarch of Constantinople (428-431) he had distinguished himself by his zeal for Nicene orthodoxy. At Edessa the result of the conflict between the Nestorians and their opponents was long doubtful. When Rabbedel, the fiercest anti-Nestorian and friend of Cyril, died in 435, he was succeeded in the bishopric by Ibas, who as head of the famous Persian

\[1\] Book of Chastity, p. 12.

\[2\] It is in Ephrem's favourite metre, the heptasyllabic, and all the MSS. but one attribute it to him.

\[3\] Chron. Edessa, p. 40.

\[4\] In Bedjan, p. 47.

\[5\] New light on the theological position of Nestorius is to be obtained from the lost work Book of Hesed, a work of his which has turned up in a Syriac version and has just been published by Bedjan.
school " in the city had done much to inculcate on his pupils the doctrines of Theodore of Mopsuestia. But the feeling against the Nestorian party grew in strength, till on the death of Ibas in 457 the leading Nestorian teachers were driven out of Edessa. The Pope in 459, on the success of his writings in 457 was sent, but was finally closed and destroyed by order of the emperor Zenon in 489. The Nestorian teachers then started a great school at Nisibis (which had been under Persian rule since Jovian's humiliating treaty of 363). By the energetic efforts of Barṣûmâ, bishop of that city, practically the whole church of Persia was won over to the Nestorian creed. Western Syria, on the contrary, had partaken with Alexandria in the reaction from Nestorianism which finally crystallized in the Monophysite doctrine, that spread so widely through Egypt and Western Asia towards the end of the 5th century. 

At the beginning of this century one of the most able and influential men in the Syriac-speaking church was Mārūthā, bishop of Maiperkāt or Martyropolis. Without entering on the details of his ecclesiastical activity, we may note that he was twice associated with embassies from the Roman emperor to Yazgeder I. (399-420); that along with Isaac, patriarch of Seleucia (390-410), he obtained from the Persian monarch a concordat which secured a period of religious toleration; and that he arranged for and precedent at the Council of Seleucia in 410, which added to the full Nicene creed and organized the hierarchy of the Persian Church. As a writer he is chiefly known as the reputed author of a collection of martyrologies which cover the reigns of Sapor II, Yazgeder I. and Bahram V. By his history of the Council of Nicaea he made a great contribution to the education of the Persian Church in the development of Christian doctrine. Rabbūša, the powerful and energetic bishop of Edessa who withstood the beginnings of Nestorianism, and who gave currency to the Peshitta text of the four Gospels, abolishing the use of the Diatessaron, is dealt with in a separate article. The next bishop of Edessa, Ibas, who succeeded in 435 at the death of Rabûša, proved himself a follower of the Nestorian doctrine (see above). As a teacher in the Persian school of Edessa he had translated, probably with the help of his pupils, certain works of "the Interpreter," i.e. Theodore of Mopsuestia. Among these may have been the commentary on St John of which the complete Syriac version was published by Chatob in 1897. He may possibly have translated a work of Aristotle. To the Nestorian movement in Persia he rendered useful service by his letter to Mār of Bēth Hardâsh, in which he maintained the tenets of Dionysius and Theodore, while allowing that Nestorius had erred. It was the young Rabûša of Edessa who in 435, after the "rober synod" of Ephesus (449), was restored by the Council of Chalcedon (451), after he had anathematized Nestorius. His death in 457 was followed by a strong anti-Nestorian reaction at Edessa, which led to the expulsion of many of the leading teachers. 

On Isaac of Antioch, "one of the stars of Syriac literature," see the special article. In spite of his over-diffuseness, he is one of the most readable of Syriac authors.

A Nestorian contemporary of Isaac, Dādhiša, who was catholicus of Seleucia from 451 to 456, composed commentaries on Daniel, Kings and Ecclesiasticus. His chief importance in the history of the Persian Church lies in his having induced a synod of bishops to declare that church independent of the see of Antioch and of the "Western Fathers" (Labourt, p. 122 seq.).

The most powerful missionary of Nestorianism during the 2nd half of the 5th century was Barṣûmâ of Nisibis, whom his opponents called "the swimmer among the reeds," i.e. the wild boar. Born probably between 415 and 420 he imbied Nestorian doctrine from Ibas at the Persian school of Edessa, but was driven out in 457 on the death of his master, and went to be bishop of Nisibis. In a succession of missionary journeys he succeeded, partly by persuasion and partly (if his enemies are to be believed) by violence, in attaching to Nestorianism nearly all the Christian communities of Persia, with the exception of Taghir, which was always strongly Monophysite. He had many quarrels with his ecclesiastical superiors the catholicus of Seleucia, but finally reconciled with Aemilius after the death of the latter in 484. Among other severities towards the Monophysites, he persuaded the Persian king Pērō (457-484) to banish many of them into the Roman dominions. One of his great aims was to secure for the Nestorian clergy freedom to marry, and this was finally sanctioned by a council at Seleucia in 486 (Labourt, op. cit., chap. vi.). Barṣûmâ must have been bishop of Nisibis for nearly 40 years, but was dead by 496. His writings seem to have been chiefly liturgical: he gave the first set of statutes to the school of Nisibis, which was founded during his bishopric.

His fellow-worker Narsai, whom the Jacobite called "the leper," but the Nestorians "the harb of the Holy Spirit," apparently accompanied Barṣûmâ from Edessa to Nisibis, where according to Barhebræus he lived for 50 years. Barṣûmâ appointed him head of the new school, where he taught rigidly Nestorian doctrine. He was a copious writer, especially in verse. Many of his poems have now been published. His theological position is clearly defined in a homily on the three doctrines—Diodore, Theodore and Nestorius—published by the Abbé Martin in the Journal asiatise for July 1900.

Another early Monophysites was Simeon of Beth Aršām, who by a series of journeys and disputations within the Persian empire did all he could to prevent the triumph of Nestorianism among the Persian Christians. He had considerable success at the time, but the ground he had won was soon reconquered by his opponents, except at Taghir and the surrounding district. It was after a successful disputation in presence of the Nestorian catholicus Bābālī (497-502/3) that Simeon was made bishop of Bēth Aršām, a town near Seleucia. He made several journeys to Constantinople, where he enjoyed the favour of the empress Theodora. His life was written by John of Asia in the collection of the lives of eastern saints which has been edited by Land (Anecd. syr. vol. ii.). His literary productions consist only of a liturgy and two exceedingly interesting letters. The one has for its subject Barṣûmâ and the other Nestorian leaders in Persia, and gives a highly malicious account of their proceedings. The other, which has been often edited, is an account of a severe persecution which the Himyarite Christians of Najrān in south-west Arabia underwent in 513, at the hands of the king of Yemen. Simeon had repeatedly visited al-Hirah and was in touch with the Arab kingdom which centred there, his letter is a document of first-rate historical importance.

Mention should be made of two other early Monophysites leaders who suffered persecution at the hands of the emperor Justin I. (518-527). The one is John of Tellār, author of 538 canons, answers to questions by the priest Sergio, a creed and an exposition of the Trisagion. His life was written by his disciple Elias, and also by John of Asia. The other, John bar Aplōntyā, was the founder of the famous monastery of Kenneshēr, opposite Sīrāq, held by Feldmann, Syrische Wechseltden von Nurses (Leipzig, 1896); Mingana, Nurses, homonian et carmina (2 vols., Mosul, 1908); and other editions of which a list is given by Duval, p. 344 seq. Four of the homilies which deal with liturgical matters have been translated into English, accompanied with valuable notes, by R. H. Connolly (Cambridge, 1906).
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Jerábis on the Euphrates, and wrote a commentary on the Song of Songs, a number of hymns and a biography of Severus, the Monophysite patriarch of Antioch (512–519).

The life of the great missionary bishop Jacob Burđená1 or Baradaeus, from whom the Monophysite Church took its name of Jacobite, belongs rather to ecclesiastical than to literary history. A native of Tellá in Mesopotamia, he obtained the favour of the empress Theodora while on a mission to Constantinople, and resided in that city for fifteen years (528–543). At the request of the Arab king of Ghassán he was sent on a mission to the East after being consecrated bishop of Edessa; and the rest of his life was spent among the early monasteries of the Churches of eastern Syria. We possess two lives of him—one by John of Asia in his collection of biographies, and another which may have been written by a priest of Jacob’s original monastery of Pésílata. Both are to be found in the 2nd volume of Land’s Anaedota syriaca. An excellent modern biography and estimate of Jacob has been written by Kley.2 A Syriac account of the removal of his remains from Alexandria, where he died in 578, to his old monastery of Pésílata has been edited by Kugener in the Bibliothèque hagiographique orientale, pp. 1–26 (Paris, 1903). The authenticity and the little life of Pésáti (published in 1896) was by the author of “an anaphora, sundry letters, a creed or confession of faith, preserved in Arabic and a secondary Ethiopic translation, and a homily for the Feast of the Annunciation, also extant only in an Arabic translation” (Wright). A very different character from Jacob’s was that of Sergius of Rás’ain, one of the best Greek scholars and ablest translators whom Syria has produced. Of his life little is known, and that little not wholly creditable. He wandered curiously in his ecclesiastical views, and ended by helping the persecutors of the Monophysite Church, to which he himself had belonged. He served as a priest at Rás’ain in Mesopotamia most of his life. About 535 he travelled on various ecclesiastical missions, and finally made a journey to Rome and thence to Constantinople (in this latter accompanied by the pope Agapetus). The result was to bring about the deposition and banishment of the Monophysites from the latter city. Sergius died almost immediately afterwards, in 536. Among the works which he translated into Syriac and of which his versions survive are treatises of Aristotle, Porphyry and Galen, the Ars grammatica of Dionysius Thrax, the works of Dionysius the Areopagite, and last but not least a treatise by the author of “An ars grammatica, sundry letters, a creed or confession of faith, preserved in Arabic and a secondary Ethiopic translation, and a homily for the Feast of the Annunciation, also extant only in an Arabic translation” (Wright). The last 6th-century author to be mentioned here is Abúdâm-mêlê, who was Jacobite metropolitan of Taghríth from 559 till he was martyred by Khosrau Anásharwân in 575. He wrote various philosophical works, also a treatise on grammar which is quoted by the later grammarian, John bar Zoîbi. A Syriac life of him has been published by F. Nau, who appends to it the surviving fragment of his treatise on the composition of man consisting of soul and body.

We may here take note of three important anonymous works, of which the first probably and the other two certainly belong to the 6th century.

The Me’arrath gázqê or Cave of Treasures, translated and edited by C. Bezold (Leipzig, 1883–1888), is akin (as Duval remarks) to the Book of Jubilees. It is an imaginary history of the patriarchs and their descendants. The work derives its name from the picturesque story of the cave where Adam deposited the treasure of gold, myrrh and incense which he had brought away from paradise: the cave was used as a burying-place by him and his descendants until the deluge. After the precious relics together with the bones of Adam had been saved in the ark, they fell into the hands of Baradaeus, whose disciple Melchizedek took them to the guidance of an angel.

The tripartite narrative which is known as the Romance of Julian (the Apostle) has no claim to be regarded as an historical document. Its hero is Jovian, one of the feeblest of Roman emperors, and Julian is everywhere exhibited in flaming colours as the villain of the story. But as an example of Syriac prose style it is of the best, and the author at times shows considerable dramatic power.

A valuable historical source, though of small dimensions, is the Chronicle of Edessa, which gives a record of events from 132 to A.D. 540—at first exceedingly brief, but becoming somewhat fuller for the later years. It appears to be thoroughly reliable wherever it can be tested. It has been three times edited—first by Assemani in the Bibliotheca orientalis (i. 388–417), secondly by L. Hallier (Leipzig, 1892) with a translation, introduction and abundant notes, and thirdly by Guidi with a Latin version in Chronica minora, Paris, 1903).

On John of Asia or Ephesus, the eminent Monophysite bishop and earliest Syriac church historian, see the separate article.

An historical work of somewhat similar character to John’s is the Bibliotheca historica which is generally known by the name of Zacharias Rhetor, because the anonymous Syriac compiler has incorporated the Syriac version or epitome of a lost

1 See the details in Wright, pp. 90 sqq.; and cf. especially A. Baumstark, Aristoteles bei den Syrern vom VI. –VIII. Jahrhundert (Leipzig, 1900); and V. Rynzel, Uber den syrischen Buchstabensatz im syrischen historischen Quellenwerk (Leipzig, 1880–1881). The latter singles out the version of the pseudo-Aristotelian Hexaplurom as a model of excellence in translation.

2 On these last see Baumstark, Lucubrationes syro-graecae pp. 405 sqq. (Leipzig, 1894); and Duval, Litt. syr. i pp. 266 sqq.

3 Land, Anecd. syr. iii. 289.

4 Since Brooks and Hamilton’s translation of the latter, p. 234.

5 Patrologia orientalis, iii. 1 (Paris, 1906).

6 Bezold’s edition contains also an Arabic version.

7 This author has hitherto been identified by Zacharias Scholas- ticus, who afterwards became bishop of Mitylene, but according to M. A. Kugener, La Compilation historique de pseudo-Zacharie le Rhétour (Paris, 1900), this identification is a mistake.
Greek history written by that author. The Syriac work exists (not quite complete) in a British Museum MS, of about the begin-
ning of the 7th century; this can be in part supplemented by an
8th-century MS, at the Vatican. From the latter Guidi published
the interesting chapter (X. 16) which contains the description
of Rome. The entire text of the London MS was published by
Land in the third volume of his Anecdota syriaca; and there is now
an English translation by Hamilton and Brooks (London, 1889),
and a German one by Ahrens and Krüger (Leipzig, 1889).

Of the 6th-century Jacobite writers we must mention only Moses
of Agel (c. 550–570), who translated into Syriac some of the
writings of Cyril, and Peter of Callinicus, Jacobite
patriarch of Antioch 578–591, who wrote a huge controversial
work in 4 books, each of 25 chapters, against Damian, patri-
arch of Alexandria, as well as other less important works.
The Nestorian writers of the 6th century were numerous,
but as yet we know little of their works, beyond what 'Abhdi-
sho' tells us in his Catalogue. It will be sufficient to mention
one or two. Joseph Hāṣaū (i.e. of al-Ahwāz or Khūzistān),
who came third in succession to Narsai as head of the school
of Rome, was the first Syriac grammarian and linguist, and
the author of an important work on signs of interpolation. Mārthā, who was Nestorian
catholicus of Seleucia from about 540 to 552, and a man of exceptional
energy, made the only known attempt, which was, however,
unsuccessful, to provide the Nestorians with a Bible version of
their own. He was the author of many commentaries, homilies,
epistles, canons and hymns. Paul the Persian, a courtier of
Khosrau Anšāšwān, dedicated to the king a treatise on logic
which has been published from a London MS. by Land
in the 4th volume of his Anecdota. Bōdh the periodist's
work has been published; it is best known as the author of the old Syriac version of the
collection of Indian tales called Kalīlah and Dimnah. He made
it doubtless from a Pahlavi version. His translation, which was
edited by Bickell with an introduction by Beney, must
be distinguished from the much later Syriac translation made
from the secondary Arabic version and edited by Wright in
1884. Hannānā of Hādhāyab, who nearly produced a dis-
ruption of the Nestorian Church by his attempt to bridge over the
interval which separated the Nestorians from Catholic ortho-
doxy, was the author of many commentaries and other writings—
besides the teaching of Theodore of Mopsuestia. An account of his theological position, derived from the
treatise of Bābhai De unione, will be found in Laboutr, op. cit., pp. 279 sqq. One of his followers, Joseph Ḥażānaya, was
also a prolific writer.

With the 7th century," as Wright remarks, "begins the slow decay of the native literature of the Syriacs, to which the
frigntful sufferings of the people during the great war with the
Persians in its first quarter largely contributed. The same
process of decay was greatly promoted by the Arab conquest
of Persia, achieved through the victory of Kādīsīya in 636–637.
The final replacement of Syriac by Arabic as the vernacular
language of Mesopotamia by degrees transformed the Syriac
from a living to a dead language. Apart from a few leading
writers—such as Jacob of Edessa, the anonymous historian
who whose work has passed under the name of Dionysius of Tell-
Mahīr, Thomas of Margā, Dionysius Bar Șalībi, and Barhe-
bræus—there are not enough names of interest to make it
worth while to continue our chronological catalogue. It will
be sufficient to group the more important contributors to each
of the chief branches of literature.

1. Theology—Here we may first mention George, Bishop of
the Arabs (712–), who wrote commentaries on Scripture, and
tracts and homilies on church sacraments, and finished the
Hexa-
meron of Jacob of Edessa.1 Bābhai the Elder, a leading Nestor-
ian in the beginning of the 7th century and a prolific author, wrote
many commentaries and theological discourses. Ishō'yaḥ I.1
Nestorian catholicus from 647 to 657, wrote controversial treatises
discussing points of law. He was succeeded by Bābhai Sabr Sīrāh
(657/8), who belongs to the 2nd half of the 7th century, compiled a Catena patrum on the Gospels and wrote many commentaries.

Thomas I., of his work, but he died in 691, and then appears a
man who belongs to the 9th century: a great Nestorian scholar 'Abhdišo' (1138).

2. History.—Besides the important writers treated in separate
articles, mention only four. Λ. de Excid. Cordub., a history of al-
Mas'ūda (1127), one of the most

fertile of 9th-century authors, wrote commentaries, theological
treatises and many liturgical works. Other important contributors to
3. Literature.—The value of the Nestorian literature, by 'Abhdišo' of

Nestorians, is that of Michael 1., who was Jacobite patriarch from 1166
1190. Its range extends from the Creation to the author's own day,
and it was largely used by Barhebraeus in compiling his own
Chronicle. Till recently it was known only in an abridged Armenian
version, which has been published by the late Professor de Kir-ka in
1884, and there is, as early as in 1884. Another important Chronicle
is that of Michael 1., who was Jacobite patriarch from 1166
1190. Its range extends from the Creation to the author's own day,
and it was largely used by Barhebraeus in compiling his own
Chronicle. Till recently it was known only in an abridged Armenian
version, which has been published by the late Professor de Kir-
ka in

3. Biography, Monastic History, etc.—Besides the important
works of Thomas of Margā, Ishō'yaḥ II. (628–644) on the history of
Nestorian bishops, who wrote ecclesiastical biographies and other theological works was Sabhirīsh
Rūštām, who lived at Mount Ḥabān and other monasteries.

In the beginning of the 8th century David of Bēth Rabban, also a Nestorian
abbot, wrote a historical work called the Little Paradise, which is frequently cited by
Thomas of Margā. A more important work is The Book of Chastity, by
Ishō'dnāb, who according to the Syriac writers, and even to the
most learned among the Nestorians, wrote a treatise called The Little Paradise, which is frequently cited by
Thomas of Margā. A more important work is The Book of Chastity, by
Ishō'dnāb, who according to the Syriac writers, and even to the
most learned among the Nestorians, wrote a treatise called

4. Philosophy and Science.—Special mention may be made of
Abû Ma'sūda al-Hādhāyab, who wrote an extensive commentary
on the Greek philosophy of Plato and Aristotle, and in the latter
he was the author of a new recension of the Paradise of Plato, and
also the author of a volume on philosophical divisions and
definitions; Românus the physician (860), who wrote a medical compendium.

In a work on the Islamic philosophy, he mentions translations of
some gnostic maxims and other works; Moses Bar Șābūn, the
philosopher who wrote a work often referred to; the famous physician Ḥanān ibn Iṣḥāq

5. See O. Braun's article in Oriens christianus, i. 138–152; and
7. See H. Goussen, Martyrius-Sakandrar Life and Works (Leipzig,
1879).
8. Le Livre de la chasteté (ed. Chabot, pp. 67 sqq.).
9. A fresh edition by Bedjan forms an appendix to his edition
of Thomas of Margā (Paris, 1904, 1905). It has been twice edited by Bedjan (Paris, 1888 and
1905), and there is a French translation, with copious notes, by
Chabot (Paris, 1895); cf. also Journ. As. (1888), pp. 313 sqq., and
SYRIANUS—SYZYGY

(1873), who wrote chiefly in Arabic, but deserves mention here by his services to Syriac grammar and lexicography, and still more by his translations of Greek philosophical and scientific works upon a very large number of subjects. Syriac, becoming in a sense the founder of a school of translators; and Jacob bar Shakkâ, whose work called the Dialogues treats of grammar, rhetoric, poetry, logic, philosophy and science.

So the philosopher, as several of the authors in this department have already been mentioned. The more important, besides Jacob of Edessa and Barhebræus, are ‘Anâšīq of ‘Iṣâb (early 10th century), Bar Ali, Bar Sarœshbâ (early 10th century), Bar Bahâlî (middle of 10th century), Elias of Tîrîn (1049), Elias bar Shínâyâ (above), John Bar Zo’bî (beginning of 13th century) and Jacob bar Shakkâ.

Apart from the numerous editions of Syriac texts by M. Paul Bedjan, most of which have been cited above, nearly all the texts recently edited are included in one or other of three comprehensive series now running—viz. (1) Patrologia syriaca (Paris, 1893); (2) Corpus scriptorum orientalium—scriptores syriaci (Paris, 1907); (3) Patrologia orientalis (Paris, 1907).

SYRIANUS, a Greek Neoplatonist philosopher, and head of the school at Athens in succession to Plutarch. He is important as the teacher of Proclus, and, like Plutarch and Proclus, as a commentator on Plato and Aristotle. His best-known extant work is a commentary on the Metaphysics of Aristotle. He is said to have written also on the De coelo et the De intend, in the latter, Aristotle and on Plato’s Timaeus. A treatise on the Stases of Raymonde’s under the name of Ali, the name given to a thick, viscid liquid, containing much dissolved (generally crystalline) matter, but showing little tendency to deposit crystals. The “syrup” employed for medicinal purposes consists of a concentrated or saturated solution of refined sugar in distilled water. The simple “syrup” of the British Pharmacopoeia is prepared by adding 1000 grams (or 5 lb) of refined sugar to 500 cubic centimetres (or two pints) of boiling distilled water, heating until it is dissolved and sucked from the boiling distilled water until the weight of the whole is 150 grams. The specific gravity of the syrup should be 1.33. Flavoured syrups are prepared by adding flavouring matter to a simple syrup. For instance, syrupus aromaticus is prepared by adding certain quantities of orange and cinnamon water to simple syrup. Similarly, medicated syrups are prepared by adding medicaments to, or dissolving them in, the simple syrup. Golden syrup is the uncrystallizable fluid drained off in the process of obtaining refined crystallized sugar. Trecule and molasses are syrups obtained in the earlier stages of refining. Technically and scientifically the term syrup is also employed to denote a viscid, generally residual, liquids, containing substances other than sugar in solution.

SYRJENIANS (also Sirian, Syrijenian, Zyrenian, Zirianian, Zyrinian and Zirjan), a tribe belonging to the Permian division of the eastern Finns. They are said to number about 85,000 on the west side of the Urals in the governments of Perm, Vologda and Archangel, and there are also about 1000 on the Siberian side of the lower Ob. Their headquarters are at Ust-Ishma, at the junction of the Ishma and Pechora. Formerly they spread farther to the west. They are of moderate stature, blond, and grey-eyed, and more energetic and inclined to trade than those on the east side of the Urals. They were converted to Christianity about 1350 and their language was forced in writing. They call themselves Komis and are not sharply distinguished from the tribes known as Permian, the languages being mutually intelligible. The archaeological remains in the governments of Perm and Vatyka called Chudish by Russians are probably Syryenian. A grammar of the language was published by Castren, and linguistic and other notices of the tribe are contained in the Journal de la société finno-ougrienne, especially for 1903. (See Finno-Ugrian.)

SYSTYLE (Gr. στῦλος, together with, and σωτός, a column), in architecture, a term meaning bearing columns rather thickly set—an intercolumniation to which two diameters are assigned.

SYZRA, a town of Russia, in the government of Simbirsk, 156 m. E. of the town of Penza, and a short distance from the Volga. Pop. (1882), 24,500; (1900), 33,046. Syzra originated in a fort, erected in 1683, to protect the district from the Tartars and Circassians. Most of its inhabitants are engaged in gardening and tillage. In the large villages of the surrounding district various petty trades are carried on. The town has long been in repute for its tanneries and its manufactures of leather. Several flour-mills and other factories have recently sprung up. Much grain is exported; timber is brought from the upper Volga and manufactured wares from Nizhny Novgorod.

SYZGY (Gr. σύγγυρα, a yoking together, from σύν, together, and root γυρ-, yoke), in astronomy, either of the points at which the moon is most nearly in a line with the sun. The moon passes her syzygies, or is in a syzygy, at new and full moon.

1 See Serv. ad Virgil, Eclogi, ii. 31; and Ovid, Metam. i. 691, &c.

2 The Syriac versions made by him and his successors have unfortunately perished (see Wright, p. 213).

3 The Syriac translations made by him and his successors have unfortunately perished (see Wright, p. 213).

The Idylla figlura, in which the legend is repeated. The pan-
SZABADKA—SZE-CH'UEN

SZABADKA (Ger. Mariu-Theresiopel), a town of Hungary, in the county of Bacs-Bodrog, 109 m. S.S.E. of Budapest by rail. Pop. (1900), 81,464. It is situated in the great Hungarian plain between the Danube and the Theiss, and is the centre of an immense agricultural district. To the town belongs a large territory (369 sq. m.) of the adjoining Pusztza Telecska, where large herds of cattle are reared. In this territory is situated Lake Palics, a favourite watering-place and summer resort.

SZALAY, Volodar (1828—1864), Hungarian geologist, was born at Kalocsa, on the 14th of March 1822. His first contribution to science was an essay on metallurgy, in which subject he had received special training. Afterwards he settled at Budapest and investigated the geology of the district, the results of which were published in a geological map (1858). In 1859 he joined the staff of the Austrian Geological Survey, as a volunteer member, and paid attention to the economic as well as to the purely scientific aspects of the work. He also arranged for surveys having special reference to agricultural geology to be undertaken by the Hungarian Geological Institute. In 1863 he became professor of geology and mineralogy in the university of Budapest. In later years he devoted himself largely to petrology, and published memoirs on the trachytes of Hungary and Transylvania; on a new method of determining the species of felspars in rocks, depending on fusibility and flame-coloration; on the geology and petrology of the district of Schemnitz; and on Santorin Island. He died at Budapest on the 11th of April 1894.

He was author of Geologie mit besonderer Rücksicht auf die Petrographie, den Vulcanismus u. die Hydrographie (1853).

SZALAY, LADISLÁS (1813—1864), Hungarian statesman and historian, was born at Buda on the 18th of April 1813. After the completion of his studies, he became a member of the Hungarian parliament, and in 1848 he represented Hungary in the German national parliament at Frankfort. He took part in the revolution of 1848—49, and was obliged to seek refuge in Switzerland, where he wrote his History of Hungary. This important work, published at Budapest (1856—1860), extends to 1707. Szalay also wrote remarkable studies on Pitt, Fox, Mirabeau and other statesmen, and contributed very considerably to the codification of Magyar law. In later life he returned to Hungary, but he died at Salzburg on the 17th of July 1864.

See Alexander Flegler, L. von Szalay (Leipzig, 1866).

SZÉCHÉNYI, ISTVÁN, COUNT (1791—1860), Hungarian statesman, the son of Ferencz Széchenyi and the countess Juliana Festetics, was born at Vienna on the 21st of September 1791. Very carefully educated at home till his seventeenth year, when he entered the army, he fought with distinction at the battle of Raab (June 14, 1809), and on the 19th of July brought about the subsequent junction of the two Austrian armies by conveying a message across the Danube to General J. G. Chasteler at the risk of his life. Equally memorable was his famous ride, through the enemy's lines on the night of the 16th—17th of October 1813, to convey to Blücher and Bernadotte the wishes of the two emperors that they should participate in the battle of Leipzig on the following day, at a given time and place. In May 1815 he was transferred to Italy, and at the battle of Tolentino scattered Murat's bodyguard by a dashing cavalry charge. From September 1815 to 1821 he visited France, England, Italy, Greece and the Levant, carefully studying the institutions of the countries through which he passed, and everywhere winning admirers and friends. A gifted scientific writer, with his brother Miklos Wesselenyi, taught him much about trade and industry, which knowledge he subsequently applied to his country's needs. In 1825, when he went to France in the suite of Prince Pál Esterházy, to attend the coronation of Charles X., the canal du Midi especially attracted his attention and suggested to him the idea of regulating the rivers Danube and Theiss. At the Diet of 1825, when the motion for founding a Hungarian academy was made by Pál Nagy, who bitterly reproached the Magyar nobles for so long neglecting their mother-tongue, Széchenyi offered to contribute a whole year's income (60,000 florins) towards it. His example was followed by three other magnates who contributed between them 58,000 florins more. A commission was thereupon appointed to settle the details, and on the 18th of August the project received the royal assent. Another of his great projects was the opening up of the Danube for trade from Buda to the Black Sea. He satisfied himself of the practicability of the scheme by a personally conducted naval expedition from Pest to Constantinople. The basis of Joseph I. reform the nation was already divided into two parties, though only the minority held with Széchenyi. But neither this fact nor the gradual loss of his popularity restrained Széchenyi, both in the Diet and at county meetings, from fulminating conscientiously against the extreme demands of Kossuth. His views at this period are expounded in the pamphlet Politikai program töredékek ("Fragments of a Political Programme"). He held the portfolio of ways and communications in the first responsible Magyar administration (March 23, 1848) under Báthory, but his increasing apprehension of a revolution, with its inevitable corollaries of civil war and a rupture with the dynasty, finally affected his mind, and on the 5th of September he was removed to an asylum. Here he remained for many years, but recovered sufficiently to correspond with his friends and even to meditate writing fresh books. In 1859 he published the pamphlet Ein Blick in which he implored his countrymen to accept the Bach system as the best constitution attainable in the circumstances. The sudden death of his old friend Baron Samuel Jósvika and the once more darkening political horizon led him, in a moment of despair, to take his own life (April 8, 1866). He richly deserved the epithet "the greatest of the Magyars" bestowed upon him by his political antagonist Kossuth.

Most of his numerous works on political and economical subjects have been translated into German. The best complete edition of his writings has been published, in nine volumes, by the Hungarian Academy of Arts, 1884—1898, by J. Milich, J. Szechenyi, by Zagdond Kemény (Hung.; Pest, 1870); Aurel Kecskeméthy, The Last Years and Death of Count Széchenyi. (Hung.; Pest, 1866); Menhyert Lowyai, Count Széchenyi and his Posthumous Writings (Hung.; Budapest, 1875); Max Falk, "Der Graf Stephen Széchenyi und seine Zeit" (in the Oesterreichische Revue, Vienna, 1867); Antal Zichy, Count Széchenyi as a Pedagogue (Hung.; Budapest, 1876); Pál Gyulai, Széchenyi as a Writer (Hung.; Budapest, 1892); Antal Zichy, Count Stephen Széchenyi (1791—1860) (2 vols., Budapest, 1896—1897).

SZE-CH'UEN (Four Rivers), a western province of China, bounded N. by Kokonor, Kan-suh and Shen-shi, E. by Hu-pei and Hu-nan, S. by Kwei-chow and Yun-nan, and W. by Tibet. Estimates of its population vary from 45,000,000 to 68,000,000; estimates of its area from 185,500 to 218,000 sq. m. It is considerably larger than any other province of China, Yun-nan, which comes next in size, covering less than 150,000 sq. m. Sze-ch'uen contains twelve prefectural cities, inclusive of Ch'êng-tu Fu, the provincial capital. The western portion forms part
of the mountain-lands of Central Asia and much of it is over 10,000 ft. high, while heights of 16,000 to 19,000 ft. occur. The northern portion is also mountainous, but the east central part of Beyond-ruen consists of a red sandstone table-land (see Cittiva, § 1). Toward the north-east end of this plateau, commonly known as "the red basin," is Ch'eng-tu Fu (pop. 450,000–
500,000), the provincial capital. The plain in which the city stands is about 70 m. long and 30 wide, and is noted for the density of its population (about 5,000,000), its wealth, and its splendid irrigation works.

The fauna includes bears, yaks, various kinds of antelope, monkeys and parrots. The flora includes magnificent yews, a great variety of bamboos, tallow, varnish, soap, and wax trees, rhododendrons and giant azaleas. The ethnological and commercial features are shared by the physical features. The mountain districts are poorly cultivated, and are inhabited by Ijin or barbarians, who are distinguished under the tribal names of Si-fan, Lo-lo and Man-tse, and who maintain a semi-independence. Tibetans are also scattered over the western region and are numerous in the districts of Pa-tang. The table-land is inhabited by Chinese, and is one of the most thriving and populous regions in the empire. These Chinese exhibit great diversity of type, due in part to immigration from other provinces in the 17th century—


The province of Kiangsu, in the north-eastern part of the empire, is one of the richest and most densely populated in the world. It is bounded on the north by the Huai-hai plain, on the west by the Yangtsze-kiang, and on the south by the Hizen Sea. It is divided into two districts, one on the north-west and one on the south-east.

The north-west district is more fertile and produces a larger variety of crops. It is also more densely populated. The capital of the province is Hankow (pop. 250,000), a commercial centre and a port of call for the Chinese junks. The city is renowned for its beautiful gardens and parks, and for its fine temples and pagodas. The north-west district is also noted for its minerals, particularly coal and iron. The south-east district, on the other hand, is more thinly populated and is mainly agricultural. The capital of the south-east district is Nanking (pop. 300,000), a centre of trade and culture. It is also the seat of the university.

The Yangtsze-kiang, the chief river of the empire, flows through the province of Kiangsu. It is one of the longest rivers in the world, and is navigable for a distance of 1,500 miles. The river is also of great importance for irrigation, and is used to irrigate a large area of the plain. The province is also noted for its salt production, which is carried out on the shores of the sea. The salt is produced by boiling the seawater in large pans, which are then left to dry in the sun. The resulting salt is collected and transported to market in large jars.

The province is also famous for its porcelain, which is produced in the city of Ching-chow (pop. 100,000). The porcelain is highly regarded for its fine quality and delicate designs. It is exported to many countries, and is much prized by collectors. The province is also noted for its silk production, which is carried out in the city of Peking (pop. 1,500,000), the capital of the empire. The silk is produced by feeding silkworms with mulberry leaves, and the cocoons are then boiled to extract the silk. The silk is then woven into fine fabrics, which are exported to many countries.

The province is also noted for its tea production, which is carried out in the city of Ch'ing-chow (pop. 500,000), the second largest city of the empire. The tea is grown on the hillsides, and is harvested in the late summer. The tea leaves are then dried in the sun, and are then shipped to market.

The province is also noted for its rice production, which is carried out in the city of Peking (pop. 1,500,000), the capital of the empire. The rice is grown in the paddy fields, and is harvested in the late summer. The rice is then dried in the sun, and is then shipped to market.

The province is also noted for its cotton production, which is carried out in the city of Peking (pop. 1,500,000), the capital of the empire. The cotton is grown on the plains, and is harvested in the late summer. The cotton is then ginned, and is then shipped to market.

The province is also noted for its tobacco production, which is carried out in the city of Peking (pop. 1,500,000), the capital of the empire. The tobacco is grown on the hillsides, and is harvested in the late summer. The tobacco is then dried in the sun, and is then shipped to market.

The province is also noted for its brick production, which is carried out in the city of Peking (pop. 1,500,000), the capital of the empire. The bricks are made from clay, which is dug from the hillsides, and is then mixed with water to form a paste. The paste is then rolled into balls, which are then dried in the sun. The bricks are then used to build houses and other structures.
red pepper largely used in Hungary, and of a pastry called tarkonya; and has factories of soap, leather, boots, saw-mills and distilleries. Szeged is the centre of the commerce and industry of the great Hungarian Alföld, being an important railway junction and the principal port on the Theiss.

Since the 15th century Szeged has been one of the most prominent cities in Hungary. From 1541 till 1686 it was in possession of the Turks, who fortified it. It is also notorious for its many witchcraft trials. In 1848 it sent strong detachments to the national Hungarian army. In July 1849 the seat of the government was transferred hither for a short time.

SZÉKESFEHÉRVÁR (Ger., Stuhlwiessebn, Lat., Alba Regalis or Alba Regio), a town of Hungary, capital of the county of Székesfehérvár in Pusztaújváros Hagymás Pop. (1900), 30,451.

It is situated in a marshy plain and is a well-built and prosperous town. Székesfehérvár is the seat of a Roman Catholic bishopric, one of the oldest in the country, and was formerly a town of great importance, being the coronation and burial place of the Hungarian kings from the 10th to the 16th century. Amongst its principal buildings are the cathedral, the episcopal palace, several convents, of which the most noteworthy is the Jesuit convent, now a Cistercian secondary school with a handsome church, and the county hall. The town carries on a brisk trade in wine, fruit and tobacco, and is one of the chief centres of Hungarian distilleries.

SZÉKELERS, or Székels (Szeke, Lat. Siculi), a Finno-Ugrian people of Transylvania, akin to the Magyars. They form a compact mass of rather more than 450,000, extending from near Kronstadt on the south to Maros-Vásárhely and Gyergyó St Miklós on the north. Their origin is unknown and has been the subject of much learned debate. Their own ancient tradition affirms their descent from Attila's Huns. According to Procopius (De bello gothic. iv. 18) 3000 Huns entered Transylvania (Erdelem, i.e. the Magyar Erdély) after their defeat, calling themselves, not Hungarians, but Zekei, and the Székelys (or descendants of the Hun, as they were styled by the Hungarians) remained in Transylvania till the return of their kinsmen under Árpád; the anonymous scribe of King Béla speaks of them as "formerly Attila's folk." Von Rethy (Ung. Rev. vii. 812) suggests that they were originally a band of Black Ugrics who sought refuge in Transylvania after their defeat by the Pechenegs. Timon, however (Magyar Alkotmány és Jogtörténete, p. 73), points out that their language proves that their separation from the main Magyar stock must have taken place after the Magyar tongue had been fully developed (see also Hunfalvy, Magyarság Étnographiája, 1900). According to another theory they were Magyars transplanted by St Ladislaus to Transylvania in order to form a permanent frontier guard. Some such origin would, indeed, seem to be implied by the name Székeli, if this be derived, as Czetseni surmises ("Die Szeklerfrage," Ung. Rev. i. 411-438), from zek, seat, i.e. an administrative district (cf. the Stuhl of the Transylvanian Saxons); Székely would thus mean simply "frontier-guards."

SZIGILGETI, EDE (1614-1679), Hungarian dramatist, whose original name was Jászfalyc Szathmáry, was born at Nagyvárad-Olaszi, on the 8th of March 1614. His parents would have made him a priest; he wanted to be a great doctor; finally he entered the office of an engineer. But his heart was already devoted to the drama and, on the 15th of August 1634, despite the prohibition of his tyrannical father, he actually appeared upon the stage at Budapest. His father thereupon forbade him to bear his name in future, and the younger Szathmáry henceforth adopted instead the name of Edé Szigilgeti, the hero of one of Sandor Kisfaludy's romances. He supported himself for the next few years precariously enough, earning as he did little more than twelve florins a month, but at the same time he sedulously devoted himself to the theatre and sketched several plays, which differed so completely from the "original" plays then in vogue (The Played-out Trick actually appeared upon the boards) that they attracted the attention of such connoisseurs as Vörösmarty and Bajza, who warmly encouraged the young writer. In 1640 the newly founded Hungarian Academy crowned his five-act drama Rosa, the title-role of which was played by the brilliant actress Barbara Rakodczay, who was afterwards (1858) elected a member of the Academy. In 1645 he was a member of the Kisfaludy Society. He was now the leading Hungarian dramatist. Three of his plays were pronounced by the National Theatre and sixteen by the Academy. His verdict on all dramatic subjects was for years regarded as final, and he was the mentor of all the rising young dramatists of the 'sixties. During the half-century of his dramatic career Szigilgeti wrote no fewer than a hundred original pieces, all of them remarkable for the inexhaustible ingenuity of their plots, the technical perfection of their construction, and the humourous and satirical vein of their style. To the last he was an incisive and unscrupulous author used striking and unexpected effects to produce his dÉnouement. He wrote, perhaps, no work of genius, but he amused and enthralled the Magyar playgoing public for a generation and a half. Szigilgeti's most successful tragedies were Gritti (1844), Paul Bélki (1856), Light's Shadows (1865), Strange (1871), Velia and The Pretender (1868). His tragedies, as a rule, lack pathos and sublimity. Much more remarkable are his comedies. He is a perfect master of the art of weaving complications, and he prefers to select his subjects from the daily life of the upper and upper-middle classes. The best of his comedies are The Three Commandments of Matrimony (1850), Sweet Sweeney (1855), Momma (1857), The Reign of Woman (1862), and especially the farce Young Lilly (1869). He also translated Goethe's Egmont and Shakespeare's Richard III., and wrote a dramatical work entitled The Drama and its Varieties. A few of his plays have appeared in German.

See P. Rakodczay, Edward Szigilgeti's Life and Works (Hung.; Pressburg, 1901); F. Gyulai, Memorial Speeches (Hung.; Budapest, 1869).

SZOMBATHELY (Ger., Steinemseren), the capital of the Hungarian county of Vas, 162 m. W. of Budapest by rail. Pop. (1900), 23,309. It is the seat of a Roman Catholic bishop, and possesses a beautiful cathedral (1797-1821) with two towers, 180 ft. high. Other buildings are the episcopal palace, to which is attached a museum of Roman antiquities, the county hall, the convent of the Dominicans and the seminary for Roman Catholic priests. Szombathely is an important railway and industrial centre, and has a state railway workshop, manufactory for agricultural machinery, foundries and steam mills. About 5 m. south of Szombathely lies the small village of Ják, with a Dominican convent from the 11th century, which has a remarkably beautiful chancel and some of the best specimens of Romanesque architecture in the country. About 16 m. by rail south of the town is Körmend (pop. 6173), with a beautiful castle belonging to Count Bathynyi. About 16 m. by rail, west of Körmend is the small town of Szent Gotthard (pop., 2055, mostly Germans), with a Cistercian abbey, founded by King Béla III. in 1183, where General Montecucculi gained a decisive victory over the Turks in 1664.

Szombathely occupies the site of the Roman town Sabaria Savaria, which was the capital of Pannonia. Here in A.D. 193 Septimius Severus was proclaimed emperor by his legions. Many remains from the Roman period have been excavated, such as traces of an amphitheatre, a triumphal arch, the old fortifications, an aqueduct, &c. The remains are preserved partly in the museum at Budapest, and partly in the municipal museum. The bishopric was created in 1777.
the last letter in the Semitic alphabet, where, however, its form in the earliest inscriptions is that of a St. Andrew's Cross X. In both Greek and Latin, however, although the upright and cross stroke are frequently not exactly at right angles and the upright often projects beyond the cross stroke, the forms approach more nearly to the modern than to the Semitic shape. The name Taaffe was taken over in the Greek Ῥαθ. The sound was that of the unvoiced dental stop. The English t, however, is not dental but alveolar, being pronounced, as ð also, not by putting the tongue against the teeth but against their sockets. This difference is marked in the phonetic differentiation of the dental and the alveolar t by writing them respectively t and ð. The alveolar sound is frequent also in the languages of India, which possess both this and the dental sound. The Indian ḯ, however, is probably produced still farther from the teeth than is the English sound. In the middle of words when t precedes a palatal sound like ʃ (y) which is not syllabic, it would lie with it into the sound of ʃ as in position, nation, &c. The change to a sibilant in these cases took place in late Latin, but in Middle English the ḱ following the t was still pronounced as a separate syllable. A later change is that which is seen in the pronunciation of nature as nelts’. This arises from the pronunciation of u as ʌ, and does not affect the English dialects which have not thus modified the u sound. Similar changes had taken place in some of the local dialects of Italy before the Christian era. At the end of words the English t is really aspirated, a breath being audible after the t in words like bit, kit, pit. This is the sound that in ancient Greek was represented by ð. In medieval and modern Greek, however, this has become the unvoiced sound represented in English by th in thin, thick, pitch. Though represented in English by two symbols this is a single sound, which may be either interdental or, as frequently in English, produced “by keeping the tongue loosely behind the upper front teeth, so that the breath escapes partly between the tongue and the teeth, and partly, if the teeth are not very closely set, through the interstices between them” (Jespersen). In English ð represents both the unvoiced sound ð as in thin, ð, and the voiced sound ɹ which is found initially only in nominal words like this, that, there, then, those, is commonest medi ally as in father, bother, smoker, either, and is found also finally in words like with (the preposition), both. Early English used ð and ð indiscriminately for both voiced and unvoiced sounds, in Middle English ð disappeared and þ was gradually assimilated in form to y, which is often found for it in early printing. It is, however, to be regretted that English has not kept the old symbols for sounds which are very characteristic of the language. In modern Greek the ancient ð (d) has become the voiced spirant (ð), though it is still written ð. Hence to represent ð, Greek has now to resort to the clumsy device of writing NT instead.

(P. Gl.)

TAAFFE, EDUARD FRANZ JOSEPH VON, COUNT [11th Viscount Taaffe and Baron of Ballymote, in the peerage of Ireland] (1833–1895), Austrian statesman, was born at Vienna on 24th February 1833. He was the second son of Count Ludwig Patrick Taaffe (1791–1855), a distinguished public man who was minister of justice in 1848 and president of the court of appeal. As a child Taaffe was one of the chosen companions of the young archduke, afterwards emperor, Francis Joseph. In 1852 he entered the public service; in 1865 he was Statthalter of Upper Austria, and the emperor offered him the post of minister of the interior in Beust’s administration. In June he became vice-president of the ministry, and at the end of the year he entered the first ministry of the newly organized Austrian portion of the monarchy. For the next three years he took a very important part in the confused political changes, and probably more than any other politician represented the wishes of the emperor. He had entered the ministry as a German Liberal, but he soon took an intermediate position between the Liberal majority of the Berger ministry and the party which desired a federalistic amendment of the constitution and which was strongly supported at court. From September 1868 to January 1870, after the retirement of Auersperg, he was president of the cabinet. In 1870 the government broke up on the question of the revision of the constitution: Taaffe with Potocki and Taaffe wished to make some compromises to the Federalists; the Liberal majority wished to preserve undiminished the authority of the Reichsrath. The two parties presented memoranda to the emperor, each defending their view, and offering their resignation: after some hesitation the emperor accepted the policy of the majoriy, and Taaffe with his friends resigned. The Liberals, however, failed to carry on the government, as the representatives of most of the territories refused to appear in the Reichsrath: they resigned, and in the month of April Potocki and Taaffe returned to office. The latter failed, however, in the attempt to come to an understanding with the Liberals, standing with the Czechs, and in their turn had to make way for the Clerical and Federalist cabinet of Hohenwart. Taaffe now became Statthalter of Tirol, but once more on the breakdown of the Liberal government in 1879 he was called to office. At first he attempted to carry on the government without change of principles, but he soon found it necessary to come to an understanding with the Feudal and Federal parties, and he was responsible for the conduct of the negotiations which in the elections of this year gave a majority to the different groups of the National and Clerical opposition. In July he became minister-president: at first he was completely at loggerhead with the Liberals, but this was soon made impossible, and he was obliged to turn for support to the Conservatives. It was his great achievement that he persuaded the Czechs to abandon the policy of abstention and to take part in the parliament. It was on the support of them, the Poles, and the Clericals that his majority depended. His avowed intention was to unite the nationalities of Austria: Germans and Slavs were, as he said, equally integral parts of Austria; neither must be oppressed; both must unite to form an Austrian parliament. Notwithstanding the growing opposition of the German Liberals, who refused to accept the equality of the nationalities, he kept his position for thirteen years. Not a great creative statesman, he had singular capacity for managing men; a very poor orator, he had in private intercourse an urbanity and quickness of humour which showed his Irish ancestry. For the history of his administration see AUSTRIA-HUNGARY, History (Sec. II. “Austria Proper”). Beneath an apparent cynicism and frivolity Taaffe hid a strong feeling of patriotism to his country and loyalty to the emperor. It was no small service to both that for so long, during very critical years in European history, he maintained harmony between the two parts of the monarchy and preserved constitutional government in Austria. The necessities of the parliamentary situation compelled him sometimes to go farther in meeting the demands of the Conservatives and Czechs than he would probably have wished, but he was essentially an opportunist: in no way a party man, he recognized that the government must be carried on, and he cared little by the aid of what party the necessary majority was maintained. In 1863 he was defeated on a proposal for the revision of the franchise, and resigned. He retired into private life, and died two years later at his country residence, Ellerschau, in Bohemia, on 29th November 1895.

By the death of his elder brother Charles (1825–1873), a colonel in the Austrian army, Taaffe succeeded to the Austrian and Irish titles. He married in 1862 Countess Irma Tásky, by whom he left four daughters and one son, Henry. The family history presents points of unusual interest. From the 13th century the Taaffes had been one of the leading families in the north of Ireland. In 1628 Sir John Taaffe was raised to the peerage as Baron Ballymote and Viscount Taaffe of Corven. He left fifteen children, of
whom the eldest, Theobald, took a prominent part in the Civil War, accompanied Charles II. in exile, and on the Restoration was created earl of Carlisle. He was sent on missions to the duke of Lorraine and to the emperor, by which he was established the friendship of the house of Habsburg and Lorraine, which has continued to this day. His eldest son was killed in the Turkish wars. He was succeeded in the title by his second son, who had served in the Spanish wars and was killed at the Boyne. The next brother, Francis, the third earl, was one of the most celebrated men of his time: he was brought up at Olmizzt, at the imperial court, and in the service of the Elector of Saxony. He had many diplomatic commissions, and at the end of his life was chancellor and chief minister to the duke of Lorraine. Notwithstanding the Jacobite connexions of his family, the title of Lord of Lorraine was surrendered to William III., and the attainder and forfeiture of the estates incurred by his brother was repealed. This favour he owed to his position at the court of the emperor, William's most important ally. On his death the title and estates went to his nephew Theobald, whose father had fallen during the siege of Derry, and who himself had served with distinction in the Austrian army. On his death the title of earl of Carlisle became extinct; both the Austrian and Irish titles were continued in the Irish line by the marriage of Nicholas (1677–1706). Like so many of his family, he was brought up in Lorraine and passed into the Austrian army; he fought in the War of the Austrian Succession, and was in command of the forces in the Hanoverian army. His Irish estates were, however, claimed under the Act of 1703 by a Protestant heir: a lawsuit followed, which was ended by a compromise embodied in a private act of parliament, 961 Geo. II., Feb. 22, 1731. The paper was sent to him with the money he acquired the castle of Ellerschau, in Bohemia; he had also inherited other property in the Austrian dominions. He was naturalized in Bohemia, and left on record that the reason for this step was that he could not expect to be exposed to the temptation of becoming Prot- estants so as to avoid the operation of the penal laws. His great-grandson Nicholas (1777–1836), the last of the line who served in the British army, was a member of the Privy Council of the House of Lords in 1856, and the right of his family to hold the Irish title continued. See Wurzbach, Biographisches Lexicon Oesterreichs, Memoirs of the Times (1810–30), vol. 1, p. 466; (1838–61), vol. 1, p. 439, by E. B. Lanige. The Prague Politik published in December 1904 contains some interesting correspondence collected from Taaffe's papers. (J. W. Hc.)

TAAL, a town of the province of Batangas, Luzon, Philippine Islands, on the Pansipit river, opposite Lemery, with which it is connected by a bridge, and about 50 m. S. of Manila. Pop. of the municipality (1900) 17,525. Taal is built, chiefly of stone, on the shores of a lake, or lake-island, lying in the Gulf of Balayan into which the Pansipit river flows. It has a cool and healthy climate, is an important military station, and a port for coastwise vessels. Extensive agricultural lands in the vicinity produce rice, Indian corn, sugar-cane, pepper, cocoa, and cotton, but the great coffee plantations which were formerly to be seen in its vicinity have been destroyed by insects. The inhabitants are also engaged in raising horses and cattle, in fishing, and in carrying on a considerable trade in cotton goods, sugar, coffee, &c. Taal is the only town in the Philippines where effective efforts have been made to exclude the mosquito. The hospitality of the inhabitants, as of the rest of the island, was such that none succeeded in establishing a residence here until the latter days of the revolution against the American government. The town was founded in 1754 after the destruction by Taal volcano of an old town of the same name on Lake Taal. The language is Tagalog.

TABACO, a town and port of entry of the province of Albay, Luzon, Philippine Islands, on Tabaco bay, about 20 m. N. of the town of Albay. Pop. (1903) 21,046. The men of Tabaco are largely engaged in the cultivation of hemp; the women in weaving, spinning, and basket-making. The town has a deep and well-protected harbour, and its shipping is extensive. The language is Bicol.

TABARD, a short coat, either sleeveless, or with short sleeves or shoulder pieces, emblazoned on the front and back with the arms of the sovereign, and worn, as their distinctive gar- ment, by heralds and pursuivants. A similar garment with short sleeves or without sleeves was worn in the middle ages by knights on their armour, and was also emblazoned with their arms or worn plain. The name was also given in earlier days to a much smaller similar garment, a stuff frieze worn by peasants; the ploughman wears a "tabard" in the same manner to the Canterbury Tales. Similarly at Queen's College, Oxford, the scholars on the foundation were called "tabarders," from the tabard, obviously not an emblazoned garment, which they wore. The word itself appears in Fr. tabard or tabart, &c., Ital. tabarro, Ger. taschert, Med. Lat. tabardus, tabardium, &c. It is of doubtful origin, but has usually been connected with "tippet," "tapestry," from Lat. tæpetus, hangings, painted cloths; Gr. τάπητας, carpet.

Mohammad ibn Jarir ut-Tabarî (838–923), Arabian historian and theologian, was born at Amol in Tabaristan (south of the Caspian), and studied at Rei (Rai), Tabaristan and in Syria and Egypt. Cast upon his own resources after his father's death, he was reduced to great poverty until he was appointed tutor to the son of the vizier 'Ubaidallah ibn Yabây. He afterwards journeyed to Egypt, but soon returned to Bagdad, where he remained as a teacher of tradition and law until his death. His life was simple and dignified, and characterized by extreme diligence. He is said to have often refused valuable gifts. A Sha'â'ite in law, he claimed the right of the 'ulama' over all schools, and ended by establishing a school of his own, in which, however, he incurred the violent wrath of the Hanbalites.

His works are not numerous, but two of them are very extensive. The one is the Tabârî ur-Rusul wal-Muluki (History of the Prophets and Kings), generally known as the Annals (cf. ARABIA, Literature, "History"). This is a history from the Creation to A.D. 931, and is renowned for its detail and accuracy. It has been published under the editorship of M. J. de Goeje in three series, comprising thirteen volumes, with two extra volumes containing Indexes, introduction and glossary. A convenient digest of this work, made in 1963 by the Sâmanid vizier al-Bal'ami, has been translated into French by H. Zotenberg (vols. i.–iv., Paris, 1867–1874). A Turkish translation of this was published at Con- stantinople (1844). His second great work was the commentary on the Koran, which was marked by the same fullness of detail as the Annals. The size of the work and the independence of judgment in it seem to have prevented it from having a large circulation, but scholars such as Baghari and Suyuti used it largely. It has been published in thirty vols. (with extra index volume) at Cairo, 1902–1903. An account of it, with brief extracts, has been given in F. Zotenberg, Die Geschichtsdrucke des Deutschen Mittelalters, vol. xxv. (1881), pp. 588–628. Persian and Turkish translations of the commentary exist in manuscript. A third great work was projected by Tabari. This was to be on the traditions of the prophets, the apostles, and the ancestors. (Leiden, 1857, not published.) Other smaller works are mentioned in the Fikrist, pp. 234–235. (G. W. T.)

TABARIN (Fr. tabard, Ital. tabarrine, a small cloak), the name assumed by Jean Salomon (c. 1584–1633), a Parisian street charlatan, who amused his audiences in the Place Dauphine by farcical dialogue with his partner Mondor (Philippe Girard), with whom he reaped a golden harvest by the sale of quack medicines. A contemporary portrait shows him in the dress of a clown, but with a moustache and pointed beard, carrying a wooden sword and wearing a soft grey felt hat capable of assuming countless amusing shapes in his deft fingers. His regular evening antics were varied by more elaborate weekly performances in which others appeared, notably his wife. In these he took the part of a fat old fool, but his jokes, while usually coarse, were frequently clever, and his extemporized speeches were full of originality. He is said to have influ- enced both Molière and La Fontaine. The latter praises him, and he is also well spoken of by Boileau and Voltaire. He retired about 1628, and died on the 16th of August 1633.

The farces and pantomimes in which he performed, and whose répertoire, were credited to him, and long series of cheap leaflets purporting to be his complete works began to appear as early as 1622. Two rival editions, in two volumes and one volume respectively, were published as late as 1838. The word Tabarin, spell with a t, has been adopted into the French language to designate the comic performer of a street booth.
The Tabernacle

Tabasco, a state of Mexico, bounded N. by the Gulf of Mexico, E. by the state of Campeche and Guatemala, S. by Guatemala and Chiapas, and W. by Vera Cruz. Area 10,672 sq. m. Pop. (1900) 155,834. The surface is generally low and flat, largely covered with lagoons, watercourses and swamps. In the S. and S.E. there is an area belonging to the rough higher formation of Chiapas. Dense forests cover the whole region, and there are valuable fine woods and dyes-woods. There are several large lagoons on the coast, two of which are called Sant' Ana and Tupilco bays. Two large rivers, the Grijalva and Usumacinta, traverse its territory. The Grijalva, also called Tabasco, the upper course of which is known as the Chiapas, has its most distant sources in western Guatemala and flows N.W. up the river that stood the altar of burnt offering, thence to the frontier of Tabasco, and thence N.E. to the coast; it is navigable for 93 m. The Usumacinta likewise has its sources in western Guatemala. It forms the boundary between Guatemala and Chiapas until the frontier of Tabasco is reached, where its N.W. course turns to the N. and then N.W. to a junction with the Grijalva—the two rivers having a common outlet. The Usumacinta, including its head streams, is about 500 m. long; excluding them about 330 m. long; for about 270 m. it is navigable, for about 180 m. for large steamers. There are no railways and no good roads, and these rivers and the navigable channel of the San Juan, called its portiere, are the principal practical thoroughfares in the state. The capital is San Juan Bautista (pop., 1900, 10,548), formerly called Villa Hermosa, on the Grijalva river, about 70 m. above its mouth. The next most important town is Frontona (pop., 1895, 6794), a port 3 m. within the mouth of the Grijalva.

Tabernacle

Tabernaculum, a hut, tent, specifically the name given in the English Bible to the portable sanctuary which, according to the priestly sources of the Pentateuch, was erected by Moses in the wilderness as the place of worship of the community of Israel. The word is derived from the Arabic tabana, to huddle, crowd together, and thus it may be derived from the Hebrew tebenu, to huddle. From the Latin tabernaculum, the term was applied to the portable structure erected by Moses in the wilderness as the place of worship of the Israelites. The word has been used to refer to the portable temple erected by Moses in the wilderness, as well as to the various structures that were built in later periods, such as the tabernacle of the Israelites in the wilderness, and the tabernacle of the people of Israel in the Promised Land.

The Tabernacle and its Furniture

The Tabernacle proper is represented as standing within a rectangular area, measuring 100 cubits by 50, approximately 150 feet by 75, which formed the centre of the camp in the wilderness. This area, termed the "court of the tabernacle," was fenced off from the rest of the encampment by a series of curtains suspended from 100 pillars standing at intervals of 5 cubits, and lay east and west with its entrance on the eastern side. Of the two squares, each measuring 50 cubits by 50, into which the court may be divided, the more easterly was that in which the worshippers assembled. In the centre of this square stood the altar of burnt offering, a hollow chest of acacia wood overlaid with bronze. The tabernacle itself also stood east and west, with its entrance towards the east, on the edge of the second square. The essential part of the structure, to which everything else was subsidiary, was that termed in the original the mishkan, i.e. dwelling (Eng. Vers. tabernacle, but see Exod. xxv. 9, Rev. Vers. margin). It was formed of ten curtains, in two sets of five, of the finest linen with inwoven coloured figures of cherubim, the whole making an artistic covering measuring 40 cubits by 28. Instead of being suspended on poles after the manner of an ordinary tent, the curtains were made to form a wall of open frames of acacia wood overlaid with gold, each 10 cubits in height by 1½ in breadth. These frames, 48 in all, were so arranged as to form the southern, western and northern sides of a rectangular structure, 30 cubits in length and 10 cubits in breadth and height. Over the frames, as has been said, were thrown the two sets of tapestry curtains above described, while the eastern end, forming the entrance, was closed by a special portiere suspended from five pillars. The dwelling was divided into two parts by a second hanging, the "veil," 10 cubits from the western end. These two parts were termed respectively

1 For the philological and other arguments in favour of open frames in place of the traditional solid beams—the "boards" of the English version—as supports of the curtains, see the writer's article "Tabernacle" in Hastings's Dict. of the Bible, iv. 659 f., with illustrative diagrams.
TABERNACLE, as a general term in architecture, a species of niche or recess in which an image may be placed. In Norman work there are but few remains, and these generally over doorways. They are shallow and comparatively plain, and the figures are often only in low relief, and not detached statues. In Early English work they are deeper, and instead of simple arches there is often a canopy over the figure, which was placed on a small, low pedestal. Later in the style the heads of the tabernacles became cusped, either as trefoils or cinquefoils, and they are often placed in pairs side by side, or in ranges, as at Wells. In the late Decorated Period and in the Perpendicular, more ornamental, the heads are sometimes richly cusped and surmounted with crocketed gables, as at York, or with projecting canopies, very much like the arcade at Lincoln. In this case the under side of the canopy is carved to imitate groined ribs, and the figures stand either on high pedestals, or on corbels. Perpendicular tabernacles possess much the same features, but the work is generally more elaborate (see Corneli, Canopy, Niches, &c.). The word tabernacle is also often used for the receptacle for relics, which was often made in the form of a small house or chapel (see Canopy). The term "tabernacle work," or to be observed "to have tabernacles," i.e. to have the exteriors ornamented, similar to that employed on the upper part of a tabernacle, decorated with canopied niches which contain statues. The Eleanor crosses in England are enriched with tabernacle work on the sides, as also the chapels of Bishops Nicholas West (1461-1533), and John Aloeck (1430-1500) in Ely cathedral, both dating from the beginning of the 16th century.

TABERNACLES, FEAST OF, the autumn festival of the Israelites, beginning on the 15th of Tishri and celebrated by residing for the seven succeeding days in rustic booths (Heb. Sukkah, in the Vulgate Tabernaculis, whence the English name of the feast). Among the Hebrews it was the third and chief of the three annual pilgrimage festivals connected respectively with the harvesting of the barley (Passover), of wheat (Pentecost), and of the vine (Tabernacles). Hence it is referred to as "the Feast for excellence" (Heb. Hebag, cf. Arab. Hajj) even as late as 2 Chron. vii. 9. Being of the nature of a pilgrimage feast the booths were temporary erections for the accommodation of the pilgrims. But in early Jewish tradition, in both Yahvist and Elohist sources of the Pentateuch (Exod. xxxiv. 22, xxiii. 16) it is called simply the Harvest Feast (A.V. "Feast of Ingathering") and is to be observed "at the end of the year," i.e. of the agricultural year. In Deut. xvi. 13 seq., it is termed the Feast of Tabernacles and is to be kept seven days after the produce of the threshing-floor and winepress has been gathered in. In the Holiness Code (Lev. xxiii. 39) it is to be kept for seven days after the first, the first of which is to be "a sabbath," and the eighth "a sabbath" (possibly originally a lunar quarterly-day): branches of four trees are to be taken. In the Priestly Code (Lev. xxiii. 33 seq.; Num. xxix. 12-38) the first and eighth day are to be days of holy assembly, and in the latter passage elaborate details are given of the sacrifices to be presented, including a series of bullocks, thirteen on the first day, twelve on the next, and so on down to seven on the seventh day. Only one is to be sacrificed on the concluding feast (Heb. &p;eroh) of the eighth day.

The higher criticism sees, in these successive enactments of the various codes included in the Pentateuch (q.v.), a development in the character of the festival. At first held at any of the local shrines, such as Gilgal, Bethel, Shiloh, as well as Jerusalem, it was held at an indefinite date during the harvest in the fall of the year. Then with the concentration of the cultus at Jerusalem represented by Deuteronomy, the celebration was restricted to the Judæan capital, and its duration fixed at seven days, though its date was still left indeterminate. This was fixed in the Priestly Code at the 15th of the seventh month, and an eighth day of solemn assembly added after the return from the exile.

Against this hypothetical reconstruction is the fact that Solomon appears to have selected the occasion of the feast for the dedication of the temple, and that it lasted, even in his time, seven days (1 Kings viii. 2, 65). Jeroboam arranged for a similar feast in the northern kingdom on the 15th day of the eighth month, "like unto the feast in Judah" (ibid. xii. 32). The determination of a fixed date must therefore have been much earlier than Deuteronomy or the alleged period of the Priestly Code. A pilgrimage feast must be fixed in date to ensure the simultaneous presence of the pilgrims. There are, besides, seeming references to the feast in the early prophets, as Hosea xii. 9, Amos v. 21, as well as in Isaiah ix. 2 (Heb.).

The concluding feast does not seem to refer to tabernacles properly so called, but to the worship offered under the tabernacles in the descending series of the sacrifices of bullocks as given in Numbers. In Jewish practice the concluding feast is not held in booths, and Maimonides (Morch, iii. 42) suggests that its object was to give opportunity for final proceedings in assembly halls.

The existence, therefore, of much variation in the practice of the festival in historic times is scarcely proved by the seeming variations of the enactments concerning it in the Pentateuch. It is possible, however, that there may have been differences of custom in the carrying out of the feast. In Neh. xii. 15 the trees whose branches were used for making the booths appear to differ from those mentioned in Lev. xxiii. 40, though in Jewish tradition the latter passage was taken to refer to the Lulab, or a combination of twigs of willow and myrtle, with a palm branch, which, together with a citron, are held in the hand during processions in the synagogue. The Sadduccees and Karaites did not carry these in their hand, but used them as decorations of the booths. In the second temple there was a water libation every morning of the festival, and on the evening of the first day the great golden candelabrum was lit up and the men danced a torch dance around it (Mishnah, Sukkah, v. 2-4). It is reported by Josephus that, when Alexander Jannaeus, in the year 95 B.C., was acting as high-priest in the temple on the Feast of Tabernacles, instead of pouring the water libation on the altar, according to the Pharisaic custom, he poured it at his feet, giving rise to a riot in which 6000 men are said to have lost their lives (Ant. xii., xiii., 5; Talmud, Sukkah, 48b).

The festival is certainly an agricultural one, and is so termed in the Pentateuch. Whether it was derived from the Canaanites, who had similar festivals (Judges xxix. 27), is uncertain. All nations have similar harvest festivals, but the connection to the vintage feasts; as, for instance, the Athenian Oschophoria. The Syrians celebrated every three years a "Booth Festival." At the Hindu Festival of Dasara, which lasted nine days from the new moon of October, tents made of canvas or booths made of branches were erected in front of the temples. The Spartans had a nine days' festival termed Carnea, during which they dwelt in pavilions and tents in memory of their old camp life (Athenaeus, iv. 19). The Feast of Tabernacles is one of the few Jewish festivals described in classical writers. Plutarch (Symposion iv., vi. 2) compares Tabernacles with the Bacchic rites. It was pre-eminently the period of exultation in ancient Jewish rite, and the Mishnah declares that "He who has not seen the joy of the libations of Tabernacles has never in his life witnessed joy." So much importance was attributed to this festival that it was chosen as the occasion on which the Law should be recited during the sabbatical year (Deut. xxxi. 9-12), and the Messianic vision of Zechchariah xiv. 16 sees the remnant of all the nations coming up to Jerusalem to worship the Lord of Hosts, and to keep the Feast of Tabernacles.

In later Jewish custom the one-year cycle of reading of sections from the Pentateuch ends on the concluding day of Tabernacles, which is therefore known as the Rejoicing of the Law (Simhat Torah). The custom of dwelling, for part of the day at least, in booths, is still kept up by orthodox Jews, who have temporary huts covered with branches erected in their courtyards, and those who are not in possession of a house with a backyard often go to pathetic extremes in order to fulfil the law by making holes in roofs, across which branches are placed.

(J. J.A.)
TABLE.—TABLE, MATHEMATICAL 325

TABLE (Lat. tabula), a flat, oblong slab supported upon legs or pillars; originally anything flat. As one of the few indispensable pieces of domestic furniture, the table is of great antiquity. It was known, in a small and rudimentary form, to the Egyptians, who used wood for its construction; the Assyrians certainly employed metal and stone, at times in its manufacture. Greek tables were also often of metal, with three or four legs and of considerable variety of form; they were small and low. By Roman times the table had apparently become somewhat more common. The favourite form was the tripod, but one and four legs were also used. Already the shape varied considerably, and in addition to wood, there were tables of marble, ivory, bronze and the precious metals. The more costly examples were carved, inlaid or otherwise ornamented; cedar and the finely marked or grained woods generally were much sought after. As in Greece the tables were low; they were intended for reclining, rather than sitting; their legs were those of wild beasts, or were formed of sphinxes, termini and other figures. Some of those which remain are of extreme grace and most delicate workmanship; to them the Empire style is immensely indebted. In antiquity tables of any kind can only have been the appannage of the rich. In the early middle ages, although there was variety of form—the circular, semi-circular, oval and oblong were all in use—tables appear, save in rare instances, to have been portable and supported upon trestles fixed or folding, which were cleared out of the way at the end of the meal. The custom of serving dinner at its manufacture. For hands tables were reserved. Even at a period when domestic furniture was of a very primitive character and few modern conveniences had been evolved, costly tables were by no means unknown—some dim traditions of Rome’s refinements must necessarily have filtered through the centuries. Thus Charlemagne possessed three tables of silver and one of gold—no doubt they were of wood covered with the precious metals. In the 15th century the number of tables properly so called was small; hence very few of earlier date than the middle of that century have come down to us. In the chapter-house of Salisbury cathedral is a restored 13th-century example which stands practically alone. In point of age it is most nearly approached by the famous pair of trestle tables in the great hall at Penshurst.

When the table became a fixed and permanent piece of furniture the word “board,” which had long connoted it, fell into disuse save in an allusive sense, and its place was taken by such phrases as “joyed table” and “framed table,” that is, jointed or framed together by a joiner, to whose name people spoke of a “standing” or “dormant” table. They were most frequently oblong, some two feet or two feet six inches wide, and the guests sat with their backs to the wall, the other side of the table being left free for service. Sometimes they were used as side-tables, or furnished with a cupboard beneath the board; they were supported on quadrangular legs or massive ends and feet full of Gothic feeling, and were several inches higher than the dining-table of the 20th century. Heavy stretchers or foot-rails were fixed close to the floor—for the avoidance, no doubt, of draughts. Oak was the usual material, but elm, cherry and other woods were sometimes used. Soon the legs became bulbous, and were gadooned or otherwise ornamented, and the frame began to be carved. The introduction, before the 16th century closed, of the “drawing table” marked the rapidity with which this piece of furniture was developed. This was the forerunner of the “extending dining table.” Of the three leaves of which these tables were composed two were below the other; they drew out and were supported by brackets, while the slab proper dropped to the same level. Somewhat later legs became excessively bulbous; this ugly form gave place soon after the middle of the 17th century to baluster-shaped legs. Hitherto tables had, generally speaking, been large and massive—little in the nature of what is now called the “occasional table” seems to have been provided until some years after the Restoration. About that time small tables and ball feet, sometimes with lions’ heads carved upon the knees; the top folded up to half its size when opened. The Chippendale school introduced small tables with carved openwork “galleries” round the edges (to protect china and other small objects), and clustered legs; Gothic forms and Chinese frets were for a time fashionable. Later in this century, so prolific in new forms of furniture, tables were frequently made of rosewood and satinwood; side-tables, often highly elaborate, adorned with swags and festoons and other classical motives, supported by termini or richly carved legs, were gilded and topped with marble slabs or inlaid wood. The Pembroke table, in which the legs were formed, with the top inlaid in serpentine edgings of marquetry, was a characteristic feature of late 18th-century English furniture, and still retains its popularity. Then came the Empire period; the taper was replaced by the round leg, rosewood grew commoner, and brass mountings the rule. For illustrations see Furniture.

TABLE, MATHEMATICAL. In any table the results tabulated are termed the “tabular results” or “respondents,” and the corresponding numbers by which the table is entered are termed the “arguments.” A table is said to be of single or double entry according as there are one or two arguments. When each argument (to each entry) has a table of single entry, the numbers being the arguments and the logarithms the tabular results; an ordinary multiplication table is a table of double entry, giving $xy$ as tabular result for $x$ and $y$ as arguments. The intrinsic value of a table may be estimated by the actual amount of time saved by consulting it; for example, a table of square roots to ten decimals is more valuable than a table of squares, as the extraction of the root would occupy more time than the multiplication of the number by itself. The value of a table does not depend upon the difficulty of calculating it; for, once made, it is made for ever, and as far as the user is concerned the amount of labour devoted to its original construction is immaterial. In some tables the labour required in the construction is the same as if all the tabular results had been calculated separately; but in the majority of instances a table can be formed by expedient methods which are applicable to the calculation of an individual result. This is the case with tables of a continuous quantity, which may frequently be constructed by differences. The most striking instance perhaps is afforded by a factor table or a table of primes; for, if it is required to determine whether a given number is prime or not, the only universally available method (in the absence of tables) is to divide it by every prime less than its square root until one is found that divides it without remainder. But
Million appearing at London in 1879, and those for the fifth Million in 1883, and the sixth Million in 1885 (all three Millions stereotyped). The tenth Million, though projected by Dase and Rosenberg, has not been published. The nine quarto volumes (Table des diviseurs, Paris, 1814-1817; Factor Tables, 3 vols., Vienna, 1840-1843) are printed on very thin paper to form one uniform table, giving the least divisor of every number not divisible by 2, 3, or 5, from unity to nine million. The arrangement of the results on the page, which is due to Burchardt, is admirably neat, and its clearness, accuracy, and useful character, render it highly creditable; but the other six Millions are all separate. Burchardt began the publication of his tables with the second Million instead of the first, as Chenu's factor table for the first Million was already in existence. Burchardt's work has been continued by his son, Albert Burchardt, who has added the first Million, and the first half of the second Million. All the prime divisors of numbers not divisible by 2, 3, or 5 up to 1,020,000. It occupied 1020 pages, and Burchardt found it very accurate; he detected only thirty-eight errors, of which nine were due to the author, the remaining twenty-nine having been caused by the slipping of type in the printing. The errata thus discovered are given in Burchardt's first Million. Other errata are contained in the 'Errata' printed at the rear of his work.

Burchardt gives but a very brief account of the method by which he constructed his table; and the introduction to Dase's Millions merely consists of Gauss's letter suggesting their construction, and the introduction to the Irishman's Table contains a full account of the method of construction and a history of factor tables, with a bibliography of writings on the subject. The introduction (pp. 103) to the Sixth Million contains an enumeration of factors and logarithms of all numbers up to five millions, and the distribution of primes in the whole nine millions, portions of which had been published in the Cambridge Philosophical Proceedings and the American Journal of Mathematics. In 1888, H. C. Factor published a table by Prof. D. N. Lehmer which gives the least factor of all numbers not divisible by 2, 3, 5, or 7, up to ten millions. This table, which covers a range of 21,000 numbers on each page, is not rectangular, and was cut from a written copy of the author's original manuscript. The introduction contains a list of errata in the nine millions previously published, completely confirming Burchardt's claim.

The factor tables which have just been described greatly exceed both in extent and accuracy any others of the same kind, the largest of which only reaches 405,000. This is the limit of Anton Felkel's Tafel aller einfachen Factoren (Vienna, 1776), a remarkable and extremely rare book, nearly all the copies having been destroyed. Georg Vega (Tabulae, 1779) gave a table showing all the divisors of numbers not divisible by 2, 3, or 5 up to 10,000, and it is the only one of this kind known. In 1808, Vega published a table of logarithms and factor tables, and in 1816, he exhibited a list of divisors of numbers not divisible by 2, 3, or 5 up to 1,020,111, and gave a list of numbers not divisible by 2, 3, or 5 up to 251,650. H. G. Köhler (Logarithmisch-trigonometrisches Handbuch, 1848, and subsequent editions) gives all factors of numbers not prime or divisible by 2, 3, or 5, up to 21,525. Peter Barlow (Tables, 1814) and F. Schaller (Primzahlen und ihre Tafeln, Weimar, 1855) give all factors of all numbers up to 10,000. Barlow's work also contains a list of primes up to 100,103. Both the factor table and the list of primes are omitted in the stereotyped (1840) reprint. Full lists of errata in Chenu (1811), Barlow (1814), Hilde's Vega (1840), Köhler (1848), Schaller (1855), and Goldscheider (1862) are contained in a paper by Allan Cunningham (Math. J., 1900, 22: 4, 1905, 35. 24). V. A. Le Besque (Tables diverses pour la décom- ponction des nombres, Edinburgh, 1863) gives in a table of twenty pages, the least factor of numbers not divisible by 2, 3, or 5 up to 115,500. In E. Rees's Cyclopaedia (1819), article "Prime Numbers," there is a list of primes to 217,219 arranged in decades. The Fourth Million contains a list of divisors of numbers not divisible by 2, 3, or 5 up to 20,000, and lists of the logarithms of the Logarithmic Tables (London, and Ithaca, N.Y., 1893) of G. W. Jones of Cornell University contains a table of all the factors of numbers not divisible by 2 or 5 up to 50,000. In the case of numbers not prime or divisible by 2 or 5 up to 1,000, there are also given the prime factors and the number of prime factors. This table does not occur in the third edition (Ithaca, N.Y., 1891). On the first page of the Second Million Burchardt gives the first nine multiples of the first Million, and in the third edition (1883) the number of primes only to 313, occurs in Lambert's Supplements (1798). Several papers contain lists of high primes (i.e. beyond the range of the

1 Referring to factor tables, J. H. Lambert wrote (Supplementa tabularum, 1798, p. xiv): "Universalis finis talium tabularum est ut semel pro semeno computator quod saepius de novo computa- tandum foret, ut pro omni casu computatur quo in futurum pro quovis casu computatur desiderabatur." This applies to all tables.

2 For information about it, see a paper on "Factor Tables," in Camb. Phil. Proc. (1878), ill. 99-138, or the Introduction to the Fourth Million.
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factor tables). Among these may be mentioned two, by Allan Cunningham and J. J. Woodall jointly (Phil. Mag., 1856, 2, 717-72). Also the pages on factorizations of high numbers referred to under *Tables relating to the Theory of Numbers*. The Vienna Academy possesses the manuscript of an early work on factors of numbers by Wlichter, who, many years ago by J. P. Kulik (1793-1864) (see Ency. math. Wiss., 1900-1904, i. 952, and Lehmer's *Factor Table*, p. ix.).

**Multiplication Tables.**—A multiplication table is usually of double extent, dividing the factors in two columns and when so arranged it is frequently called a Pythagorean table. The largest and most useful work is A. L. Crelle's *Rechenbühler* (Bremiker's edition, 1857, stereotyped; many facsimile *Abhandlungen* and *Math. Annalen*). An English edition, a second (stereotyped) edition is a convenient folio volume of 450 pages. In 1908 an entirely new edition, edited by O. Seeiger, was published in which the multiples of 10, 20, ..., 990 (omitted in previous editions) are included. This adds 50 pages to the volume, but removes what has been a great drawback to the use of the tables. Other improvements are that the tables are divided horizontally and vertically by lines, calculations in which the last two figures are rejected, a mark has been placed to show when the last figure retained should be increased. Two other tables of the same extent (1000 x 1000), but more condensed, were arranged by Crelle and H. Förster (Auschersleben, 1896), and A. Hensel's *Rechenbühler* (Berlin, 1897). An anonymous table, published at Oldenburg in 1860, gives products up to 500 x 500, and M. Cordier, *Le Multiplicateur de trois cents carrés* (Paris, 1872), gives a multiplication table up to 100 x 100 (intended for commercial use). In both these works the product is printed in full. The four following tables are for the multiplication of large numbers by a simple divisor digits, putting 10 to 20 pages of results on a single page. When we turn to page 825 and enter the right-hand table at line 77, column 7, where we find 77339; we then enter the left-hand table on the same line at 93, column 7, and find 656, so that the product is 77339 x 656 = 50258256. *Produktentafel* (Hamburg and Gotha, 1841), is somewhat similar to Crelle's table, but smaller, the number of figures in the multiplication being five instead of seven. (3) In *St Petersburg*, *A Table of Products* (London, 1865), the products of any five-figure number by a single digit is given by a double arrangement. The extent of the table is the same that of Bretschneider's, as also is the principle, but the arrangement is different. Laurent's table occupying only 10 pages and Bretschneider's 99 pages. (4) G. Diakow's *Multiplications-Tabelle* (St Petersburg, 1897) is of the same extent as Bretschneider's table but occupies 1000 pages. Among tables existing in the latter quarter of last century may be mentioned: (a) a table of squares, cubes, and square roots an hundred thousands (3) and 500 pages J. Peters (Rechenbühler für Multiplikation und Division mit ein- bis vierstelligem Zahlen, Berlin, 1909) gives products of four figures by two. The entry is by the first three figures of the multiplicand, and there are 2000 products on each page. Among earlier tables, the interest of which is mainly historical, mention may be made of C. Hutton's *Table of Products and Powers of Numbers* (London, 1781), which contains a table up to 100 x 100, and J. P. Gruson's *Groses Einmaleis von Eins bis Hunderttausend* (Berlin, 1799)—a table of products up to 9 x 10,000. The author's intention was to extend it to 100,000, but only the first part was published. In this book there is no condensation or double arrangement; the pages are very large, each containing 125 lines.

**Quartersquares.**—Multiplication may be performed by means of a table of single entry in the manner indicated by the formula—

\[ (n+1)(n+2)/2 \]

Thus with a table of quarter-squares we can multiply together any two numbers by adding their difference and dividing by two to obtain their difference from the quarter-square of their sum. The largest table of quarter-squares is J. Blatter's *Table of Quarter-Squares of all whole numbers from 1 to 200,000* (London, 1886), which gives squares, cubes, square roots, and square roots of reciprocals indirectly to the product of any two five-figure numbers. This fine table is well printed and arranged. Previous to its publication the largest table was S. L. Launoy's *Table of Quarter-Squares of all numbers up to 20,000*, which was on one sheet, and the extent, and therefore is only directly available when the sum of the two numbers to be multiplied does not exceed 100,000. Two other recent tables are *Mischtabellen und Quadrat-Tafeln* (Berlin, 1825), which extends to 20,000, and J. M. Merpaut, *Tables arithmétiques* (Vannes, 1832), which extends to 40,000. In Merpaut's work the quarter-square is treated separately from the square. This table contains two tables of squares to 100,000 (see next paragraph), explains in his introduction how his table may be used to effect multiplications by means of the above formula; but the earliest book on quarter squares is A. Voisin, *Tables des produits et des nombres entiers depuis 1 jusqu'à 20,000* (Paris, 1817). By a logarithm Voisin means a quarter-square, i.e. he calls a root a root of the subject of quarter-squares, &c, see Phil. Mag. [v.6] p. 331. *Squares, Cubes, &c., and Square Roots and Cube Roots.*—The most convenient table for general use is P. Barlow's *Tables* (Useful Knowledge, 1814), which gives products up to 100,000 for numbers up to 10,000, and for any number between the product gives squares, cubes, square roots, cube roots, and reciprocals to 10,000. These tables also occur in the original edition of 1814. The largest table of squares and cubes is J. P. Kulik, *Tafeln der quadratischen Zahlen* (Leipzig, 1853). Kulik's *Tafeln* contains two tables of squares to 100,000, and square and cube roots to 25,500, at first to fourteen decimals and above 1010 to five. E. Gélin (Receuil de tables numéricques, Huy, 1894) gives square roots (to 15 places) and cube roots (to 20) for numbers up to 100,000. C. H. Hulsse, *Tabulae Multiplicatoriae* (Venice, 1894), gives products up to 24,500, and square and cube roots to 25,500, and in the first ten figures of the first hundred numbers. P. Barlow, *Mathematical Tables* (original London ed.) gives the first ten powers of the first hundred numbers. The first nine or ten powers are given in Vega, *Tabulae* (1797), and in Hülse's edition of the same (1840), in Köhler, *Handbuch* (1848), and in other collections. C. F. Faal de Bruno, *Calcul des erreurs* (Paris, 1869), and J. H. T. Müller, *Vierstellige Logarithmen* (1844), give squares for use in connexion with the method of least squares. Four-place tables of squares are frequently given in engineering tables, and tables of products of numbers up to 100,000 occur in books intended for engineers and practical men. S. M. Drach (Messenger of Math., 1878, 7, p. 87) has given to 33 places the cubic roots of the cube roots of the primes smaller than 100,000. In general it must be said that the methods of calculations of squares, cubes, and roots of numbers are not the methods of the table of *Math. Curr*, or *Phil. Mag.*

**Triangular Numbers.**—E. de Joncourt, *De natura et praelato usu simplicissimae speciei numerorum triangularium* (The Hague, 1658), gives a poem in triangular numbers up to 20,000: viz. \(n(n+1)/2\) is given for all numbers from \(n = 1\) to \(n = 20\). The table occupies 224 pages.

**Reciprocals.**—P. Barlow's *Tables* (1814 and 1840) give reciprocals up to 100,000, the first four or five figures of which are given by W. H. Oakes, *Table of the Reciprocals of Numbers from 1 to 100,000* (London, 1865). This table gives seven figures of the reciprocal, and is arranged as a table of seven-figure logarithms, differences being added at the side of the page. The reciprocal

1 Only one other multiplication table of the same extent as Crelle's has appeared previously, viz. Herwart von Hohenburg's *Tabulæ arithmeticæ pro multiplicandia universales* (Munich, 1610), a huge folio volume of more than a thousand pages. It appears from the dedication to the Elector that Hohenburg, who took place at the end of 1608, that the latter used his table when in manuscript for the performance of multiplications in general, and that the occurrence of the word *prostrophaises* on the title is due to a misprint. It is sometimes said that three-dimensional spherical triangles could be solved more easily than by Wüttich's *prostrophaises*. The invention of logarithms four years later affects the value of these two papers. Bretschneider and Hohenburg's work never became generally known. On the method of *prostrophaises*, see NAPIER, JOHN, and on von Hohenburg's table, see a paper " On multiplication by a Table of Single Entry," Phil. Mag., 1878, ser. v., 6, p. 331.

2 The actual place of publication (with a German title, &c) is Vienna. The copies with an English title, &c, were issued by Trilfinger; and those with a French title, &c, by Gauthier-Villars. All bear the date 1888.
of a number of five figures is therefore taken out at once, and two more figures may be interpolated for as in logarithms. R. Picarte, La Division réciproq à une addition (Paris, 1861), gives to ten significant figures the reciprocals of the numbers from 10,000 to 100,000, and this subject is also treated of in his Tables of Sexagesimal Fractions (1862); he gives the reciprocals of numbers up to 100 to 2 places and their first nine multiplets to 12 places in the Bulletin de la Brussels Academy, 1875, 40, p. 107. E. Gellé (Recueil de tables numérotiques, ii. 1889), has only published the reciprocals of seconds for 15 places, in sexagesimals to 10 computing places.

Table of the Expression of Vulgar Fractions as Decimals. — Tables of this kind have been given by Wucherer, Goodwyn and Gauss. W. F. Wucherer, Beyträge zum allgemeinen Gebrauch der Decimalbrüche (Carlsruhe, 1796), gives the decimal fractions (to 5 places) for all vulgar fractions whose numerator and denominator are each less than 50 and prime to one another, arranged according to denominators. Similarly, elabore tables that have been published are contained in Henry Goodwyn's Centenary of Table of all Decimal Quotients (London, 1816), A Tabular Series of Decimal Quotients (1823), and A Table of the Circles arising from the Division of a Unit or any other Whole Number by all the Integers from 1 to 1024 (1823). The Tabular Series (1823), which occupies 153 pages, gives to 8 places the decimal corresponding to every vulgar fraction less than \( \frac{1}{99} \) whose numerator and denominator are each less than 1000, but no more was ever published. The Table of Circles (1823) gives all the periods of the circulating decimals corresponding to the denominators of single vulgar fractions of integers less than 1024. Thus for 13 we find 0.76923 and \( \frac{1}{13} \) = 0.076923, which are the only periods in which a fraction whose denominator is 13 can circulate. The table occupies 107 pages, some of the periods of which occur various times, and is arranged alphabetically under their denominators.

The First Centenary (1816) gives the complete periods of the reciprocals of the numbers from 1 to 100. Goodwyn's table, however, is preferable to this, with its various kinds of abbreviations and the different periods of the same fractions of different numbers. It was published under his own name. The Verwandlung gemeiner Brüche mit Neunern aus dem ersten Tausend in Dezimalbrüche, occurs in vol. ii. pp. 412-434 of his Gesammelte Werke (Göttingen, 1863), and resembles Goodwyn's Table of Circles, On the Data for the use of Trigonometrical Tables, and on the limit of Quantity in the tabulation of Decimal Quotients, with special reference to Henry Goodwyn's Table of Circles and Tabular Series of Decimal Quotients, in Camb. Phil. Proc., 1878, 3, p. 185, where is also given a table of the numbers of digits in the periods of fractions corresponding to denominators between 10 and 1024 obtained by counting from Goodwyn's table. See also under Circulating Decimals (below).

Sexagesimal Tables. — Originally all calculations were sexagesimal; and the relics of the system still exist in the division of the degree into 60 minutes and the minute into 60 seconds. To facilitate interpolation, therefore, in trigonometrical and other calculations, it was necessary to have sexagesimal tables constructed. John Bernoulli, A Sexentenary Table (London, 1779), gives at once the fourth term of any proportion of which the first term is 600 and each of the other two is less than 600, the table is of double entry, and may be described as giving the value of \( \frac{y}{x} \times 600 \) correct to tenths of a second, and \( \frac{x}{y} \times 600 \) correct to tenths of a second, and also the sine of any angle which is expressed in sexagesimal minutes.

Not much use seems to have been made of these tables, both of which were published by the Commissioners of Longitude. Small tables for the conversion of sexagesimals into centesimal and vice versa were given by F. W. von Vega, H. Schubert's Fünfzehlige Tafeln und Gegenfahnen (Leipzig, 1897) contains a sexagesimal table giving \( \frac{x}{y} \times 600 \) for \( x = 1 \) to 59 and \( \frac{y}{x} \times 600 \) for \( y = 1 \) to 59.

Trigonometrical Tables (Natural). — Peter Apian published in 1533 a table of sines with the radius divided decimally. The first complete trigonometric table covering all the parts of the circle, and the semiquadrantal arrangement. Rheticus's canon was calculated for every ten minutes to 7 places, and Vieta extended it to every minute (1579). In 1584 Richard published a table of tangents; but the complete canon published in England was by Thomas Blundeville (1594), although a table of sines had appeared four years earlier. Regiomontanus called his tables tabulae foecundae et canon foecundus. Besides "tangent," Finck also introduced the word "secent," the table of secants having previously been called tabula benefica by Maurolycus (1558) and tabula foecundissima by Vieta.

One of the greatest computer of pure trigonometrical tables is George Joachim Rheticus, whose work has never been superseded. He published his ten-decimal canon, the Opus palatinum, was published by Valentine Osto at Neustadt in 1596, and in 1613 his four-decimal tables (published by Otho von guericke) appeared in the edition of the Opus palatinum. The Opus palatinum contains a complete ten-decimal trigonometrical canon for every second of the quadrant, semiquadrantally arranged, with differences for all the tables results through the history. The same number of given on the left-hand pages in columns headed respectively "Perpendiculum," "Basis," "Hypotenusa," and on the right-hand pages the tangents, cotangents and segments headed respectively "Perpendiculum," "Hypotenusa," "Basis." At his death Rheticus left the canon nearly complete, and the trigonometry was finished and the whole edited by Valentine Osto; it was named in honour of the elector palatine Frederick IV., who bore the expense of publication. The Thesaurus of 1613 gives natural sines for every second ten minutes throughout the quadrant, to 15 places, semiquadrantally arranged, with first, second, and third differences. The rescue of the manuscript of this work by Piticus was a highly important event in the history of mathematical tables. The alterations and emendations in the earliest printed edition of the Opus palatinum were made by Piticus, who had his suspicions that Rheticus had himself calculated a ten-decimal canon, and that the original manuscript had been found. Eventually the last canon was discovered amongst the papers of Rheticus which had passed from Osto to James Christmann on the death of the former. Amongst these Piticus found (1) the first tables, (2) second and third differences, (3) the commencement of a canon of tangents and secants, and (4) complete tables of sines, secants, and tangents, and the opus palatinum, gives an idea of the enormous labours undertaken by Rheticus; his tables not only remain to this day the ultimate authorities but formed the data from which Vlacq calculated his tables. It is supposed that for twelve years Rheticus constantly had computers at work.

A history of trigonometrical tables by Charles Hutton was prefixed to all the early editions of his Tables of Logarithms, and forms Tract xix. of his Mathematical Tracts, vol. i. p. 279, 1812. A good deal of bibliographical information about the Opus palatinum and earlier trigonometrical tables is given in A. De Morgan's article, "Trigonometrical Tables," in the Encyclopaedia of Natural and Logarithmic, used in computing Lunar Distances for the Nautical Almanac. The Tables logarithmico-trigonometricae (Leipzig, 1817), contains a table of sin\( \frac{x}{2} \), cos\( \frac{x}{2} \), tan\( x \), cot\( x \) from \( x = 1^\circ \) to \( 45^\circ \) at intervals of \( 1^\circ \) to 7 places. J. Andrew, Astronomical and Nautical Tables (London, 1843, 5th ed. 1854), has a very elaborate table of Logarithmic Sines, Cosines, the same data as the table logarithmico-trigonometricae, gives natural sines and cosines (to 6 places) and their first nine multiples (to 4 places) for centesimal minute of the quadrant. The natural functions occur in many collections, the natural and logarithmic values being given on opposite pages, sometimes side by side on the same page.

The following works contains tables of trigonometrical functions of the same kind, and furnished tables of the same kind, and furnished tables logarithmico-trigonometricae (Leipzig, 1817), contains a table of sin\( \frac{x}{2} \), cos\( \frac{x}{2} \), tan\( x \), cot\( x \) from \( x = 0^\circ \) to \( 120^\circ \) at intervals of \( 10^\circ \) to 7 places. This table was greatly extended by Major-General Hannington in his Natural and Logarithmic, used in computing Lunar Distances for the Nautical Almanac. The tables logarithmico-trigonometricae (Leipzig, 1817), contains a table of sin\( \frac{x}{2} \), cos\( \frac{x}{2} \), tan\( x \), cot\( x \) from \( x = 0^\circ \) to \( 180^\circ \) at intervals of \( 10^\circ \) to 7 places, except near the beginning, where the logarithms are given to only 5 or 6 places. It occupies
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327 foldo pages, and was suggested by Andrew's work, a copy of which was also sent to Hanyngton. Hanyngton recomputed the whole of it by a partly mechanical method, a combination of two arithrometers being employed. A table of haversines is useful for the solution of spherical triangles when two sides and the included angle are given; and of the above-mentioned works, the most useful for the purpose is Andrews's Trigonometrical Survey of England. The results were published in the "R. Farley's Natural Sines" (London, 1856) and was used in the Nautical Almanac office in computing lunar distances. This figure table was also used in various tables of 125 to 175 arcs of 10° to 7 places, with proportional parts, and log versed sines from 0° to 135° at intervals of 15° to 7 places. The arguments are also given in time. The manuscript was used in the office for twenty-five years before it was printed in Travers values, which occur in most collections of navigation tables, contain multiples of sines and cosines.

Chapter I. Briggian Logarithms of Numbers and Trigonometrical Ratios—An account of the invention and history of logarithms, see LOGARITHM. The following are the fundamental works which contain the results of the original calculations of logarithms of numbers and trigonometrical ratios—Briggs, *Arithmetica logarithmica* (London, 1624), logarithms of numbers from 1 to 10,000, and from 90,000 to 100,000 to 14 places, with intercept differences; Vlacq, *Arithmetica logarithmica* (Gouda, 1628, also published in London by Andrews, 1633) and containing 5 log ten-figure logarithms of numbers from 1 to 100,000, with differences, also log sines, tangents, and secants for every minute of the quadrant to 10 places, with intercept differences; Vlacq, *Trigonometria * (Gouda, 1628), containing 33,000 numbers in ten places; ten seconds of the quadrant to 10 places, with differences, and ten-figure logarithms of numbers up to 20,000, with differences; Briggs, *Trigonometria* (London, 1633), natural sines to 15 places and tangents and secants to 10 places. The work in 1634 and 1635, to 10 places, at intervals of a hundredth of a degree from 0° to 45°, with intercept differences for all the functions. In 1632, Leibniz published two works, in a single vol. *Thesaurus logarithmorum completus*. The arrangement of the table of logarithms of numbers is more comprehensive than in Vlacq, being similar to that of an ordinary seven-figure table except that the former has no differences; and for the rest of the numbers it has all the differences and other problems of the trigonometrical canon is not wholly reprinted from the *Trigonometria artificialis*, as the log sines for every second of the first two degrees of which do not occur in Vlacq, were calculated for the work by Lieut. Von Eif, Vlacq devoted great attention to the detection of errors in Vlacq's logarithms of numbers, and has given several important errata lists. F. Lebelt (Annals of the Observer, p. 288) lists 8 places in the first four numbers given in Vlacq, of which 7 are correct. The following gives another method of logarithm computation: *the trigonometrical canon anything like the care that he devoted to the logarithms of numbers, as Gauss estimates the total number of last-figure errors at from 31,983 to 47,746, most of them only amounting to a unit, but some as much as 3 or 4. A copy of Vlacq's *Arithmetica logarithmica* (1628 or 1631), with the errors in numbers, logarithms, and differences corrected, is still the best table for a calculator who has to perform work requiring ten-figure logarithms of numbers, but the book is excessively rare, and Vlacq's *Thesaurus* has the advantage of having log sines, &c., in the same volume. The latter work also has been made more accessible by a photographic reproduction by the Italian government (Riproduzione fototecnografica dell' Ist. Geografico Militare, Florence, 1896). In 1879 Max Edler von Leber published tables for facilitating interpolations in Vlacq's *Thesaurus* (Tabulam ad interpolandas in Geodeticam Computations utilum Trias, Vienna, 1892). The object of these tables is to take account of the prefixed to the tables is a long list of errors in the *Thesaurus* and the interpolated values. Of the two tables of the tabular res's in the trigonometrical canon corresponding to 1060 angles von Leber estimates that out of the 90,720 tabular results 30,366 are in error by +1, 2793 by +2, and 191 by +3. Thus his work consists of three volumes, containing 636 tabular results, which is in accordance with Gauss's estimate. A table of ten-figure logarithms of numbers up to 100,000, the result of a new calculation by Leibniz, in *Res de la France* (1805), p. 261. *Geodetic Survey for 1805-6* (ex. 12, pp. 395-722) by W. W. Dall, superintendent of the survey. The table was compared with Vega's *Thesaurus* and found correct. S. Plencio's *Tables de logarithmes vulgaires à dix décimales, construites d'après un nouveau mode* (St. Petersburg, 1871), though a tract of only 80 pages, may be usefully employed when Vlacq and Vlacq's logarithms are not available. The table in question gives more rapidly, the first, or auxiliary table, contains a series of factors by which the numbers whose logarithms are required are to be multiplied to bring them within the range of table 2; it also gives the log sines, tangents, and secants to 10 places. Table 2 merely gives logarithms to 1000 to 10 places. Table 2 gives logarithms from 1,000,000 to 1,011,000, with proportional parts of 175 to 7 places. The log terms in table 3 are a function of the log logarithm, so as the result is concerned, log 1/M being given, so that both cases multiplication is used. The laborious part of the work is the multiplication by M, and it is somewhat compensated for by the ease with which, by means of the proper factors, the logarithm is obtained. The factors are 300 in number, and are chosen so as to minimize the labour, only 25 of the 300 consisting of three figures all different, or of three. The accuracy of this method is a factor which is subsequently cancelled by subtracting its logarithm is used also in a tract, containing only ten pages, published by A. Namur and P. Maison at Brussels in 1687 under the title *Logarithmes*.
further peculiarity of this paper is that multiples of the differences, instead of proportional parts, are given at the side of the page.

Typographically the table is exceptional, as there are no rules, the numbers being separated from the logarithms by reversed commas — a practice which had been adopted a century earlier. This was probably a result of an original calculation; see Trans. Roy. Soc. Edin., 1871, 26. Sang proposed to publish a nine-figure table from 1 to 1,000,000, but the requisite support was not obtained. Various papers of Sang and of Sharp contain logarithmic calculations will be found in the Proc. Roy. Soc. Edin. subsequent to 1872. Reference should here be made to Abraham Sharp's table of logarithms from 1 to 100 and of primes from 100 to 1100 to 61 places, also of numbers from 900,000 to 900,001 to 40 places. These first appeared in Geometry Improved, by A. S. Philiotis (London, 1717). They have been republished in Sherwin's, Callet's, and the earlier editions of the latter's tables. The 4th edition (Paris, New York, 1871), gives logarithms of numbers from 1 to 109 to 102 places.

In many seven-figure tables of logarithms of numbers the values of $S$ and $T$ are given, at the top of the page, with $V$, the variation of each, for the purpose of deducing log sines and tangents. $S$ and $T$ denote log (sin x/2) and log (tan x/2) respectively, the argument being the number of seconds denoted by certain numbers (sometimes only the first, sometimes every tenth) in the column number on each page. Thus, in Callet's tables, on the page on which the first number is 67200, $S$ = log (sin 67°20'/6720) and $T$ = log (tan 67°20'/6720), etc., and the corresponding values of $S$ and $T$ are given, for example, log sin $1^\circ52^\prime12^\prime$ = 0.72777, log sin $67^\circ32^\prime7^\prime$ = 2.76690, and have 8.5316873, whence, by addition, the arguments for the right-hand margin and with respect to the right-hand margin, the argument for the left-hand margin and with respect to the left-hand margin, the argument for the third figure to be increased. In some tables the line is broken where the change occurs; but the dislocation of the figures and the corresponding irregularity in the lines are very awkward. Babbage printed the fourth figure in small type after a change; and Bremiker placed a bar over it. The best method is to type or to reserve an extra three or four places to the right of the decimal point in each logarithm after the change, as is done in Schröd's and many other modern tables. This is beautifully clear and the asterisk at once catches the eye. Shortreude and Sang replace 0 after a change by a circled 0 (Sang); other methods are used by Gardiner, Mordors, etc.

Passing now to the logarithmic trigonometrical canon, the first great advance after the publication of the Trigonometria artificialis in 1590 was the establishment of a logarithmic canon, one of the earliest and most important of which is the one containing 708 sines and tangents to every second of the quadrant to 7 places. This contains about 450 pages with an average number of 7750 figures to the page, so that there are altogether nearly three millions and a half of figures. The change in the leading figures, when it occurs in a column, is not marked at all; and the table must be used with very great caution. In fact it is advisable to go through the whole of it, and fill in with ink the first 0 after the change, as well as make some mark that will catch the eye at the head of every column containing change. The table was calculated by interpolation from the Trigonometria artificialis to 10 places and then reduced to 7, so that the last figure should always be correct. Partly on account of the absence of a mark to catch the eye, the number of columns containing change is not in the size of the table and a somewhat inconvenient arrangement, the work seems never to have come into general use. Computers have always preferred Van Royen's Tables logarithmiques (Paris, 1823) which also contains a complete logarithmic canon to every second. The change in the column is very clearly marked by a large black nucleus, surrounded by a circle, which is at once caught by the eye. This was the only table of its kind which was not corrected. The reprint, however, bears the original title-page and date 1829, and there appears to be no means of distinguishing it from the original work except by turning to the table itself and then comparing it with the original edition and examining whether the correction has been made.

The only other canon to every second that has been published is contained in R. Shortreude's Logarithmische Tables (Edinburgh). This table was issued in 1844 in 4 volumes, the last 2 of which were devoted to the tables of logarithms, each of which is divided into 30 sections of 1000 logarithms, and the 2 others to the trigonometrical tables, being a revision and correction of the tables of Delambre and the latter, in the first of which the logarithms have been recomputed and corrected.

Previous to 1801 the only important tables in which the quadrant is divided centesimal was J. P. Houbert and L. Ideler, Nouvelles tables trigonométriques (Berlin, 1799), and C. Borda and J. B. Delambre, Tables trigonométriques du second ordre (Paris, 1801). The former gives among other things, natural and log sines, cosines, tangents, and cotangents, to 7 places, the arguments proceeding to 3' at intervals of 60' and thence to 50' at 3' intervals of 1'. The latter gives natural and log sines, cosines, tangents, cotangents, secants, and cosecants from 0' to 3' at intervals of 3' and thence to 50' at 3' intervals of 1'. The latter gives natural and log sines, cosines, tangents, cotangents, secants, and cosecants from 0' to 3' at intervals of 3' and thence to 50' at 3' intervals of 1'. The latter gives natural and log sines, cosines, tangents, cotangents, secants, and cosecants from 0' to 3' at intervals of 3' and thence to 50' at 3' intervals of 1'. The latter gives natural and log sines, cosines, tangents, cotangents, secants, and cosecants from 0' to 3' at intervals of 3' and thence to 50' at 3' intervals of 1'.

In Briggs's Trigonometria Britannica of 1633 the degree is divided into 104 parts; and before the appearance in the same year of Vilain's Trigonometria artificialis, in which the degree is divided sexagesimally, this reform might have been expected. It is clear that the most suitable time for making such a change was when the whole canon was being reissued after a long interval. It is probable that such a change was made in the 2nd edition of the Tables trigonométriques du second ordre by Delambre and the latter, in the first of which the logarithms have been recomputed and corrected. Briggs was not the only person to take advantage of this opportunity. He left the degree unaltered, but divided it centesimally instead of sexagesimally, thus ensuring the advantages of decimal division (a saving of work in interpolations, etc.), without the minimum of change. The French mathematicians at the end of the 18th century divided the right angle centesimally, completely changing the whole system, with no advantage whatever, and the change was even more disadvantageous in that the degree is as arbitrary a unit as the nonagesimal; and it is only the non-centesimal subdivision of the degree that gives rise to inconvenience. Briggs's example was followed in some instances; but the centesimal division of the degree seemed to have entirely passed out of use, till it was revived by C. Bremerlin in his Logarithmisch-trigonometrische Tafeln mit fünf Dezimalstelle (Leipsic, 1758).

This little book of 138 pages gives a five-figure canon to every hundredth of a degree with proportional parts, besides logarithms of numbers, addition and subtraction logarithms, etc. the use of a centesimal table compulsory, if this number of figures is required.
The Astronomische Gesellschaft are, however, publishing an eight- figure table on the sexagesimal system, under the charge of Dr. J. Bauschinger, the director of the k. Recheninstitut at Berlin. The arrangement is to be given in groups of three as in Bremiker's tables.

The September 1835 number of the Neue und erweiterte Logarithmen handbuch, containing the 108,000,000 of C. W. Wolfram's Lambert's Tables (2 vols. Berlin, 1778), is a valuable collection, and contains seven-figure logarit...
through several more. J. Galbraith and S. Haughton, Manual of Mathematical Tables (London, 1860), give five-figure logarithms to 10,000 and log sines and tangents for every minute, also a small table of squares and square roots, and a table of natural logarithms (1811; new edition 1877), is a convenient collection of five-figure tables; besides logarithms of numbers and circular functions, there are Gaussian logarithms, least divisors of numbers, and square roots. The logarithmic numbers are printed on thin paper. A. Gernerth, Fünftelstellige gemeine Logarithmen (Vienna, 1866), gives logarithms to 10,800 and a ten-second canon. There are thirty-six lines on the page, so that the double page contains 150 logarithms. It is arranged into intervals of 1 to 7 places, with differences and proportional parts, arranged as in an ordinary seven-figure table. By adding log 10 to the results there is obtained a table of log numbers, which has been formed part of the Annals of the Vienna Observatory for 1851, but separate copies were printed. The most elaborate table of hyperbolic logarithms is due to Wolfram, who calculated to 48 places the logarithms of all numbers up to 2200, and of all primes (also of many great composite numbers) between this limit and 10,000. Wolfram’s results first appeared in Schulze’s Sammlung (1776). Six logarithms which Wolfram had been prevented from computing by a serious illness were supplied in the Berliner Jahrh., 1758, p. 191.

The complete table was reproduced in Vega’s Thesaurus (1794), where several errors were corrected. Tables of hyperbolic logarithms were inserted in the last number of the second edition of Legendre’s Élements (1830), in which he used Wolfram’s tables to 100 and primes to 1907 to 48 places; Borda and Delambre (1801), all numbers to 1200 to 11 places; Salomon (1827), all numbers to 1000 and primes to 10,333 to 10 places; Vega, Tabulæ (including Hyperbolic Logarithms for numbers to 1000, to 10,000; Hutton, Mathematical Tables, and Willich (1835), all numbers to 1200 to 7 places; Dupuis (1839), all numbers to 1000; Hutton’s Logarithmic Tables from 1 to 10 at intervals of 0.01 to 7 places. Rees’s Cyclopaedia (1819), art. "Hyperbolic Logarithms," contains a table of hyperbolic logarithms of all numbers to 10,000 to 10 places.

Logarithms to base e are generally termed Napierian by English writers, and natural by foreign writers. There seems no objection to the former name, though the logarithms actually invented by Napier go beyond the natural logarithm in the sense that those logarithms depend on a constant other than e. They are generally found in collections of logarithmic tables, but rarely exceed a page in extent, and are very easy to construct. Schröer and Bruns both give the first hundred multiples of the modulus — 43429 44819 . . . and its reciprocal 210028 50029 . . . to 5, 6, 8, 10, or more places. They are generally to be found in collections of logarithmic tables, but rarely exceed a page in extent, and are very easy to construct. Schröer and Bruns both give the first hundred multiples of the modulus and its reciprocal to 10 places, and Bremiker (in his edition of 1844). hardly to 6 places; Degen, Tabularum Eenaæ (Copenhagen, 1824), gives the first hundred multiples of the modulus to 30 places.

Antilogarithms.—In the ordinary tables of logarithms the natural logarithm of 10 is 2.302585 and antilogarithms are thus obtained. In an antilogarithmic canon the logarithms are exact quantities, such as 1.0001, 0.0002, etc., and the corresponding numbers are given, as a rule, to the same number of places. Logarithms and antilogarithms are thus related by the equation:

\[ \log_{10} x = \log_e x \cdot \log_{10} e \]

where e is the base of natural logarithms. The logarithms and antilogarithms are added to the corresponding numbers in logarithmic tables.

By finding the logarithm of any number x and then writing it as a power of 10, we get its antilogarithm, i.e., the number 10 raised to the power of the logarithm:

\[ x = 10^{\log x} \]

Thus, for example, if \( \log x = 2.302585 \), then \( x = 10^{2.302585} \approx 1995.24 

#### TABLE, MATHEMATICAL

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Five-figure logarithms to 10,000 and log sines and tangents for every minute.</td>
</tr>
<tr>
<td>10</td>
<td>Ten-figure logarithms to 10,000, with log sines and tangents for every minute.</td>
</tr>
<tr>
<td>18</td>
<td>Eight-figure logarithms to 10,000, with log sines and tangents for every minute.</td>
</tr>
</tbody>
</table>

#### Hyperbolic or Napierian or Natural Logarithms

The logarithms invented by Napier and explained by him in the Descriptio (1044) were not the same as those now called natural or hyperbolic (viz., to base e), and very frequently also Napierian. Logarithms to base e are generally termed Napierian by English writers, and natural by foreign writers. There seems no objection to the former name, though the logarithms actually invented by Napier go beyond the natural logarithm in the sense that those logarithms depend on a constant other than e. They are generally found in collections of logarithmic tables, but rarely exceed a page in extent, and are very easy to construct. Schröer and Bruns both give the first hundred multiples of the modulus and its reciprocal to 10 places, and Bremiker (in his edition of 1844) hardly to 6 places; Degen, Tabularum Eenaæ (Copenhagen, 1824), gives the first hundred multiples of the modulus to 30 places.

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\[ x = 10^{\log x} \]

Thus, for example, if \( \log x = 2.302585 \), then \( x = 10^{2.302585} \approx 1995.24 

#### Logarithmic Numbers

Logarithmic numbers, such as 0.0001, 0.0002, etc., are given in logarithmic tables, and they are thus related by the equation:

\[ \log_{10} x = \log_e x \cdot \log_{10} e \]

where e is the base of natural logarithms. The logarithms and antilogarithms are added to the corresponding numbers in logarithmic tables.

By finding the logarithm of any number x and then writing it as a power of 10, we get its antilogarithm, i.e., the number 10 raised to the power of the logarithm:

\[ x = 10^{\log x} \]

Thus, for example, if \( \log x = 2.302585 \), then \( x = 10^{2.302585} \approx 1995.24 

#### Addition and Subtraction, or Gaussian Logarithms

The object of such tables is to give log (a+b) by only one entry when log a and log b are given. Let

\[ A = \log x, \quad B = \log (1+x^2), \quad C = \log (1+x) \]

Leaving out the specimen table in Z. Leonelli’s Théorie des logarithmes addtionnels et déductifs (Bordeaux, 1803), in which the first suggestion was made,¹ the principal tables are the following:

1. Dupuis’s Tables de Logarithmes (1812), gives B and C for argument A from 0 to 2 at intervals of 0.01, thence to 3.40

Leonelli’s original work of 1803, which is extremely rare, was reprinted by J. Houël at Paris in 1875.
TABLE,

MATHEMATICAL

to 5 places. This
table is reprinted in Gauss's Werke, vol. iii. p. 244. E. A. Matthiessen, Tafel zur bequemern Berechnung (Altona, 1818), gives B
and C to 7 places for argument A from o to 2 at intervals of -oooi,
thence to 3 at intervals of -ooi, to 4 at intervals of -01, and to 5
at intervals of -I; the table is not conveniently arranged. Peter
"
Addendum,"
Gray, Tables and Formulae (London, 1849, and
I at intervals of -ooi
1870), gives C for argument A from
3 to
I to 2 at intervals of -oooi, to 6 places, with proporand from
tional parts to hundredths, and log (l
x) for argument A from
3
i at intervals of -ooi and from I to -18999 at intervals of
to
-opoi,
to 6 places, with proportional parts. J. Zech, Tafeln der Additions-

at intervals

of -01,

and to 5

at intervals of

-I, all

und Subtractions-Logarithmen (Leipzig, 1849), gives B for argument
from o to 2 at intervals of -oooi, thence to 4 at intervals of
ooi and to 6 at intervals of -01
also C for argument A from
o to -0003 at intervals of -ooooooi, thence to -05 at intervals of
oooooi and to -303 at intervals of -ooooi, all to 7 places, with
These tables are reprinted from Hulsse's
proportional parts.
edition of Vega (1849);
the 1840 edition of Hulsse's Vega con-

A

;

tained a reprint of Gauss's original table.
T. Wittstein, Logarithmes de Gauss a sept decimates (Hanover, 1866), gives B Tor
argument A from 3 to 4 at intervals of -I, from 4 to 6 at intervals
of -01, from 6 to 8 at intervals of -ooi, from 8 to 10 at intervals
of -oooi, also from o to 4 at the same intervals.
In this handsome work the arrangement is similar to that in a seven-figure
logarithmic table. Gauss's original five-place table was reprinted
in Pasquich, Tabulae
Jerome de la Lande':
(Leipzig, 1817); Kohler,
Tafeln (Leipzig, 1832), and Handbuch (Leipzig, 1848) and Galbraith
and Haughton, Manual (London, 1860). Houel, Tables de logarithmes (1871), also gives a small five-place table of Gaussian
logarithms, the addition and subtraction logarithms being separated
as in Zech. Modified Gaussian logarithms are given by J. H. T.
;

Miiller,

Vierstellige

B and

table of

Logarithmen (Gotha, 1844), viz., a four-place
x- 1 ) from A =o to -03 at intervals of -oooi,

log (l

thence to -23 at intervals of -ooi, to 2 at intervals of -01, and to
4 at intervals of -i; and by Shortrede, Logarithmic Tables (vol. i.,
1849), viz., a five-place table of B and log (i+x) from A =5 to
3 at intervals of !, from A =3 to 2-7 at intervals of -01, to 1-3 at
intervals of -ooi, to 3 at intervals of -01, and to 5 at intervals
!.
Filipowski's Antilogarithms (1849) contains Gaussian logarithms arranged in a new way. The principal table gives log
(x+i) as tabular result for log x as argument from 8 to 14 at
intervals of -ooi to 5 places. Weidenbach, Tafel um den Logarith-

of

x-\-\

men

.

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(Copenhagen, 1829), gives log

j^

for

argument

A

from

382 to 2-002 at intervals of -ooi, to 3-6 at intervals of -01, and
to 5'5 at intervals of -I to 5 places. J. Houel's Recueil de formules
et de tables numeriques (2nd ed., Paris, 1868) contains tables of

+ i),

logio(*

logioj-^'

and

logioj^

from log x =

5 to

3 at in-

from log x=
i at intervals of -01, from
3 to
to o at intervals of -ooi.
F. W. Rex (Funfstellige
Logarithmen-Tafeln, Stuttgart, 1884) gives also a five-figure table

tervals of

x=

log

f

'S

-i,
I

'T^x'

ant^ E.

Hammer

in his Sechsstellige Tafel der Werthe

fur jeden Wert des Arguments log x (Leipzig, 1902) gives a sixfigure table of this function from log * = f to 1-99000, and thence
to 1-999700 to 5 places.

S. Gundelfinger's Sechsstellige Gaussische
siebenstellige gemeine Logarithmen (Leipzig, 1902) contains a
table of logic (i+x) to 6 places from log
2 to 2 at intervals
of -OOI.
G. W. Jones's Logarithmic Tables (4th ed., London, and
Ithaca, N.Y., 1893) contain 17 pages of Gaussian six-figure tables;
the principal of which give log (l +*) to argument log x from
2 -80 to o at intervals of -ooi, and thence to -1999 at
log
intervals of -oooi, and log (i
x~1) to argument log x from log
x = -4 to -5 at intervals of -oooi, and thence to 2-8 at intervals of
ooi. Gaussian logarithms to 5 or 4 places occur in many collections of five-figure or four-figure tables.
In a pamphlet Saggio di tavole dei logaQuadratic Logarithms.
ritmi quadratici (Udine, 1885) Conte A. di Prampero has described
a method of obtaining fractional powers (positive or negative) of
any number by means of tables contained in the work. If

und

x=

x=

*=

N, then

log log

og log a
,

the logarithms are taken to be Briggian and a = lO
and
6 = 2, then # = logio logioN/log 2
10.
This quantity the author defines as the quadratic logarithm of
and denotes by L q N.
It follows from this definition that
r
Thus the quadratic logarithms of
and N' where s is any power (positive or negative) of 2 have
the same mantissa.
A subsidiary table contains the values of the constant
The main table contains
logio'Ylogutf for 204 fractional values of r.
the values of 1000 mantissae corresponding to arguments N, JVi,
A/i,
(which all have the same mantissae). Among the arguments are the quantities 10-0, 10-1, 10-2,
99-9 (the interval
being -i) and 10-00, 10-01,
10-99 (the interval being -01). As
an example, to obtain the value of 12$ we take from the first table

and

if

+

N
N

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333

the constant
0-584962, which belongs to }, and entering the main
table with 12 we take out the quadratic logarithm
10-109937 which,
by applying the constant, gives 9-524975 the quadratic logarithm
of the
required.
quantity
An appendix (Tavola degli esponenti) gives the Briggian logarithms of the first 57 numbers to the first 50 numbers as base,
viz.

logxN

for

N = 2,

57 and x = 2,

3

3,^.

.

.,

50.

The

results

are generally given to 6 places.
In most collections of
Logistic and Proportional Logarithms.
tables of logarithms a five-place table of logistic logarithms for
every
second to i is given. Logistic tables give log 3600 log * at intervals of a second, x being expressed in degrees, minutes, and seconds.
In Schulze (1778) and Vega (1797) the table extends to ^ =
3600'
and in Callet and Hutton to x = 5280*. Proportional logarithms for
second
to
every
3 (i.e. log 10,800 log x) form part of nearly all
collections of tables relating to navigation, generally to
4 places,
sometimes to 5. Bagay, Tables (1829), gives a five-place table,
but such are not often to be found in collections of mathematical
tables.
The same remark applies to tables of proportional logarithms for every minute to 24h which give to 4 or 5 places the
values of log 1440 log x. The object of a proportional or
logistic
table, or a table of log o
log x, is to facilitate the calculation of
proportions in which the third term is a.
All tables of proportional parts may be
Interpolation Tables.
C. Bremiker, Tafel der Proregarded as interpolation tables.
portionalteile (Berlin, 1843), gives proportional parts to hundredths
of all numbers from 70 to 699.
Schron, Logarithms, contains an
interpolation table giving the first hundred multiples of all numbers
from 40 to 410. Sexagesimal tables, already described, are interpolation tables where the denominator is 60 or 600.
Tables of
the values of binomial theorem coefficients, which are
required
when second and higher orders of differences are used, are described
below.
W. S. B. Woolhouse, On Interpolation, Summation, and
the Adjustment of Numerical Tables (London,
1865), contains nine
pages of interpolation tables. The book consists of papers extracted from vols.
and 12 of the Assurance Magazine.
Dual Logarithms. This term was used by Oliver Byrne in his
Dual Arithmetic, Young Dual Arithmetician, Tables of Dual LogaA dual number of the ascending
,

n

branch is a continued product of powers of l-l, i-oi, l-ooi, &c.,
taken in order, the powers only being expressed; thus J,

6,9,7,8

denotes (l-l) 6 (l-oi) 9 (i-ooi) 7 (i-oooi), the numbers
following the |
being called dual digits. A dual number which has all but the
last digit zeros is called a dual logarithm;
the author uses dual
logarithms in which there are seven ciphers between the J, and the
logarithm. Thus since 1-00601502 is equal to 1 0,0,0,0,0,0,0,599702
the whole number 599702 is the dual logarithm of the natural number
1-00601502.
A dual number of the descending branch is a continued product
of powers of -9, -99, &c. : for instance, (-9) 3 ('99) 2 is denoted
by '3 '2 TThe Tables, which occupy 112 pages, give dual numbers and logarithms, both of the ascending and descending branches, and the
corresponding natural numbers. The author claimed that his tables
were superior to those of common logarithms.
Constants.
In nearly all tables of logarithms there is a
page
devoted to certain frequently used constants and their logarithms,
such as TT, ir" 1 ir 2 Vf- A specially good collection is printed in W.
Templeton's Millwright's and Engineer's Pocket Companion (corrected by S. Maynard, London, 1871), which
gives 58 constants
involving ir and their logarithms, generally to 30 places, and 13
others that may be properly called mathematical. A
good list of
constants involving ir is given in Salomon (1827). A
paper by G.
Paucker in Grunert's Archiv ( vol. i. p. 9) has a number of constants
involving IT given to a great many places, and Gauss's memoir on
the lemniscate function (Werke, vol. iii.) has e-*, e-i", e-t", &c.,
calculated to about 50 places. The quantity ir has been worked
J. C. Adams has calculated Euler's constant to 263 places (Proc.
Roy. Soc., 27, p. 88) and the modulus -43429 ... to 272 places
The latter value is quoted in extenso under
(Id. 42, p. 22).
LOGARITHM. J. Burgess on p. 23 of his paper of 1888, referred to
under Tables of e*, has given a number of constants involving r and
P (the constant -476936
occurring in the Theory of Errors),
and their Briggian logarithms, to 23 places.
Tables
of Cubic Equations.
Lambert, Supplementa
for the Solution
(x-* 3 ) from x = -ooi to 1-155 as intervals of -ooi to
(1798), gives
3
and
Barlow (1814) gives x
x from x=i to 1-1549 at
7 places,
intervals of -oooi to 8 places. Very extensive tables for the solution
of cubic equations are contained in a memoir "
Beitriige zur Auflosung
"
hoherer Gleichungen
der Wiss. (Prague, 1860), u, pp.
The principal tables
1-123.
(PP- 58-123) give to 7 (or 6) places the values of
(x-x*) from
* =o to = 3-2800 at intervals of -ooi. There are also tables of the
even and uneven determinants of cubic equations, &c. Other tables
for the solution of equations are by A. S.
Guldberg in the Forhand.
of the Videns-Selskab of Christiania for
1871 and 1872 (equations
of the 3rd and sth order), by S. Gundelfinger,
Tafeln zur Berechnung
der reellen Wurzeln samtlicher trinomischen
Gleichungen (Leipzig,
1897), which depend on the use of Gaussian logarithms, and by R.
Mehme, Schldmilch's Zeitschrift, 1898, 43, p. 80 (quadratic equations).
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### TABLE, MATHEMATICAL

#### Binomial Theorem Coefficients.

<table>
<thead>
<tr>
<th>n</th>
<th>Coefficients</th>
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<tr>
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<tr>
<td>2</td>
<td>1 2 1</td>
</tr>
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<td>1 4 6 4 1</td>
</tr>
<tr>
<td>5</td>
<td>1 5 10 10 5 1</td>
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where \( n \geq 0 \) and \( x + y \) is a binomial expansion.

#### TABLE

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<td>4125</td>
<td>5670</td>
<td>7575</td>
<td>9825</td>
</tr>
</tbody>
</table>

#### Supplements

Maynard's, to 12, and 2) to the at Quar. places.

In 1855, gives for \( n = 3, 4, \ldots 20 \) places. The latter also gives \( n, s, \sigma \) for \( n = 2, 4, \ldots 36 \) to 15 places (Compte rendu de l'Assoc. Francaise, 1878, p. 172).

C. W. Merrifield (Proc. Roy. Soc. Lond., 1861, 31, p. 4) gave the values of \( x = 2, 0 \) to 15 places, and \( x = 3, 4, \ldots 20 \) places.

The table is reprinted in De Morgan's Diff. and Int. Calc. (1842), p. 549. Various small tables of other series, involving inverse powers of prime numbers, such as \( 1^{1/10} - 1^{1/2} + \ldots \), are given in vol. 25 of the Quart. Jour. Math.
also at intervals of a minute, from 88° to 100° (centesimal) to 11 places.
A. M. Legendre, *Tractatus de functionibus ellipticis* (vol. ii, p. 256), gives the same function for every half degree (sexagesimal) of the argument.


\[ \log \frac{\pi}{2} = 1 + \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{2n-1} \]

The first figure of the values omitted are also supplied, so that the full table can be reproduced. A seven-place abridgment (without differences) is published in J. Bertrand, *Calcul Integral* (1867), p. 285, and a six-figure abridgment in R. J. Mill, *Diff. and Integral Calculus* (1884), p. 160. In vol. i. of his *Exercices* (1811), Legendre had previously published a seven-place table of *loga* *f* (x), without differences.

**Tables connected with Elliptic Functions.**—Legendre published elaborate tables of the elliptic integrals in vol. ii. of his *Traité des fonctions elliptiques* (1826). Denoting the modulus angle by *θ*, the amplitude by *α*, the complete integral of the first and second kind by *F*(*θ*) and *E*(*θ*), and the complete integrals by *K* and *E*, the tables are:

1. \( \log \frac{\pi}{2} = 1 + \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{2n-1} \)
2. \( E(\theta) - \frac{\pi}{2} \)
3. \( E(\theta) - \frac{\pi}{2} \)
4. \( E(\theta) - \frac{\pi}{2} \)
5. \( E(\theta) - \frac{\pi}{2} \)
6. \( E(\theta) - \frac{\pi}{2} \)
7. \( E(\theta) - \frac{\pi}{2} \)
8. \( E(\theta) - \frac{\pi}{2} \)
9. \( E(\theta) - \frac{\pi}{2} \)
10. \( E(\theta) - \frac{\pi}{2} \)

In J. Bertrand's *Calcul Integral* (1870), a table of *loga* *f* (*x*) to 90° is given at intervals of 0° to 90° to 10 places. Glashier, in *Monthly Notices* of the R.A.S., 1875, 37, 211, 1876, 37, 2, have worked out the values of the same functions from *x* = 0 to 1 at intervals of 0° and from 1 to 7 at 5° intervals to 10 places. Two tracts by L. Sterk, in *Scritti in memoria di J. von Soldner* (Brunswick, 1863), and by H. Weisstrahler, in *Abhandlungen der Akademie, 1867*, p. 520, contains \( T(\theta, x) \), that is, \( 2 * \text{erf}(x) \) from *x* = 0 to 5 at intervals of 0° to 10 places. J. F. Encke, *Berliner Astr. Jahrbuch* for 1834, gives \( 2 * \text{erf}(x) \) from *x* = 0 to 2 at intervals of 0° to 7 places and \( 2 * \text{erf}(x) \) from *x* = 0 to 3 at intervals of 0° to 5 places, as being \( 47.6936 \). Glashier, in *Phil. Mag.* December 1871, gives \( 2 * \text{erf}(x) \) from *x* = 0 to 4 at intervals of 0° to 10 places, and (p. 603) a table of \( 2 * \text{erf}(x) \) from *x* = 0 to 2 at intervals of 0° to 5 places. Both tables were the result of original calculations. A very large table of \( 2 * \text{erf}(x) \) was calculated by K. Radau and published in the *Années de l'observatoire de Paris* (1888). It contains the values of \( 2 * \text{erf}(x) \) from \( x = -0.120 \) to 1 at intervals of 0° to 10 places, with differences. A. Markoff in a separate publication, *Table des valeurs de l'intégrale* \( \int_{-\infty}^{x} \frac{e^{-t^2}}{t} dt \)

(St. Petersburg, 1888), gives \( 2 * \text{erf}(x) \) from *x* = 0 to 3 at intervals of 0° and from *x* = 3 to 4 at 0° to 1 at intervals of 0° to 11 places, first, second, and third differences to 11 places. He also gives a table of \( 2 * \text{erf}(x) \) from *x* = 0 to 2 at intervals of 0° and thence to 3 at 3° intervals to 7 places, with differences. A. Markoff in a separate publication, *Table des valeurs de l'intégrale* \( \int_{-\infty}^{x} \frac{e^{-t^2}}{t} dt \)
Quart. Jour. Math., 1906, 37, p. 122, he gives a table of Haupt-exponents of 2 for all primes up to 10,000. In Acta Math. (1893, 1-3, 7 and 19), G. H. Hardy gives a table of values of the least primitive roots of primes up to 5000. The following papers contain lists of high primes or factorizations of high numbers: A. K. L. Illiacs (1906, 3, p. 285 (Pellian factorizations); 1907, 37, p. 145 (Quotient factorizations); 1908, 37, p. 65 (Trinomial binary factorizations); 1909, 38, pp. 81, 145 (Diophantine factorization of quartans); 1910, 39, pp. 33, 145 (Quartan factorization). For primes up to 100,000, a table has been published in Quart. Jour. Math., 1885, 20, p. 152, and a seven-place table of $f(x)$ and log $(x)$, where $(x)$ denotes $(x)$, the denominators being the series of prime numbers up to 10,000, in Mess. of Math., 1899, 28, p. 1.

TABLE MOUNTAIN

(Neumarken, 1861; Eng. trans., 1823), and Minding, Integralalgebra (Berlin, 1849), give values of indefinite integrals and formulae of reduction; both are useful and valuable works. De Haan, Nouvelles tables d'integrales definies (Leiden, 1867), is a quarto volume of 727 pages containing evaluations of definite integrals, arranged in 485 tables. The first edition appeared in vol. i. of the Transactions of the Amsterdam Academy of Sciences. This edition, though not so full and accurate as the second, gives references to the original memoirs in which the different integrals are considered. B. O. Perron's A Short Table of Integrals (G. Reuschle, 1865) contains four-place numerical expansions, &c., as well as some four-place numerical tables, including those of hyperbolic sines and cosines and their logarithms.

Lauterer, "Tableaux relatifs to the Theory of Numbers."—These are so of technical a character that no precise account of them can be attempted here. The reader is referred to Cayley's report in the Brit. Ass. Rep. for 1873, p. 303, where a full description with references is given. It is sufficient to state that these tables are not always a continued fraction; (2) C. G. J. Jacobi, Canon arithmeticus (Berlin, 1839), is a quarto work containing 240 pages of tables, where we find for each prime up to 1000 the numbers corresponding to given indices and the indices corresponding to given numbers, on certain primitive roots (10 is taken whenever it is a primitive root) of the prime being selected as base; (3) C. G. Reuschle, Tafeln complex Primasahlen, welche aus Wurzeln der Einheit gebildet sind (Berlin, 1815), includes an enormous mass of results relating to the higher complex theories.

Paving new to tables published since the date of Cayley's report, the two most important works are (1) Col. Allan Cunningham's Table of the number of Primes (London, 1890), a quarto volume similar in construction, arrangement, purpose, and extent to Jacobi's Canon arithmeticus, but differing from it in using the base 2 throughout, i.e. in Jacobi's Canonical Fraction, which is always a root of unity, while in Cunningham's it is always 2. The latter tables in fact give the residues R of $2^n$ (where $x$ = 0, 1, 2, ...) for every prime $p$ or power $2^n$ of 2, and also the indices of these $2^n$, which yield the residues $R$ to the same modulus. The work contains over 30,000 errors found in the Canon arithmeticus. (2) The same author's Quadratic Partitions (London, 1904). These tables give for every prime $p$ up to 101,000 the values of $a$, $b$, $c$, $d$, $e$, $f$; and $(a, b)$, where $p = a^2 + b^2 + c^2 + d^2 + e^2 + f^2$, and a similar table up to 101,000, indicating the number of ways of expressing $p$ as the sum of $x$ squares. Alix's Tables have been published in Mess. of Math., 1904, 34, p. 132. The resolution of $a^n-1$ into its numerical factors is treated in detail by C. E. Bickmore in Mess. of Math., 1903, 34, p. 11. On this subject the former volume he gives a table of the known factors of $a^n-1$ for $a = 2, 3, 5, 6, 7, 10, 11, 12$ and from $n = 10$ to $50$. Other papers on the same subject contained in the same periodical are by Allan Cunningham, Cunningham, and C. E. Bickmore. A. B., p. 49. These papers contain references to other works. Tables of the resolutions of $10^a-1$ are referred to separately in this article under Principal resolutions. If $n$ is the smallest power of $a$ for which the congruence $a^p = 1$ (mod. p) is true, then it is a root of the exponent for modulo $p$, and may be called the chief exponent (Haupt exponent by Allan Cunningham) of the base $a$. The chief exponent is $1$, and is the exponent 1's in the circulating period of the fraction $1/p$ in the scale of radian $a$, and (2) when $p = a = 1$, $a$ is a primitive root of $p$. In Mess. of Math., 1904, 33, p. 145, Allan Cunningham has given a complete list of Haupt-exponent tables with lists of errata in them; and in
Table-turning—Taboo

Table-turning is still in vogue amongst spiritualist circles. The device was employed with success by Professor Charles Richet and others in thought-transference experiments.

See A. E. de Gasparin, Des Tables tournantes, du Surnaturel, &c. (Paris, 1854); Thury, Des Tables tournantes (Geneva, 1855); Faraday's letter on Table-turning in The Times, 30th June 1853.


Tablum (or tabalum, from tabula, board, picture), in Roman architecture, the name given to an apartment generally situated on one side of the atrium and opposite to the entrance; it opened in the rear on to the peristyle, with either a large window or an ante-chamber to persons. Walls were richly decorated with fresco pictures, and busts of the family were arranged on pedestals on the two sides of the room.

Taboo (also written tapu and tabo), the Polynesian name given to prohibitions enforced by religious or magical sanctions. As a verb it means to "prohibit," as an adjective "prohibited, sacred, dangerous, unclean."

1. The word "taboo" or its dialectical forms are found throughout Polynesia; in Melanesia the term is tambu; in various parts of Malaysia and the East Indies pantong, baboso, pawalli, &c.; in Madagascar fadj includes taboo; in North America the Dakota term wakan bears a similar meaning. Taboo is perhaps derived from ta, to mark, and pu, an article of intensity.

2. Fundamental Ideas.—In taboo proper are combined two notions which with the progress of civilization have become differentiated—(i) sacred and (ii) impure, or unclean; it must be borne in mind that the impurity is sacred, and is not derived from contact with common things. It does not imply any moral quality; it has been defined as an indication of "a connexation with the gods, or a separation from ordinary pur- poses, or exclusively an appropiation to persons or things consi- dered sacred; sometimes it means devoted by a vow."

This definition does not cover the whole connotation of taboo as it is employed at the present day, but it indicates clearly the non-moral character of the idea. The ordinary usage is perhaps best defined—the statement that taboo is "negative magic," i.e. abstinence from certain acts, in order that undesired magical results may not follow; in this sense a taboo is simply a ritual prohibition. Properly speaking taboo includes only (a) the sacred (or unclean) character of persons or things, (b) the kind of prohibition which results from this character, and (c) the sanctions or consequences incurred by transgression of the prohibition. The converse of taboo in Polynesia is nau and allied forms, which mean "general" or "common"; by a curious coincidence nau is the term used in Central Australia to express the relation of persons of opposite sexes whose intercourse there is no restriction.

3. Classification.—Various classes of taboo in the wider sense may be distinguished: (i) natural or direct, the result of mana (mysterious power) inherent in a person or thing; (ii) com- municated or indirect, equally the result of mana, but (a) acquired by a person or thing from another person or thing; (b) imposed by a priest or other person; (c) intermediate, where both factors are present, as in the appro- priation of a wife to her husband. These three classes are those of taboo proper. The term taboo is also applied to ritual prohibitions of a different nature; but its use in these senses is better avoided. It might be argued that the term should be extended to embrace cases in which the sanction of the pro- hibition is the creation of a god or spirit, i.e. to religious inter- dictions as distinguished from magical, but there is neither automatic action nor contagion in such a case, and a better term for it is Religious Interdiction.

4. Objects of Taboo are many: (i) direct taboos aim at (a) the protection of important persons—chiefs, priests, &c.—and things against harm; (b) the safeguarding
of the weak—women, children and common people generally—from the powerful mana (magical influence) of chiefs and priests; (c) the provision against the dangers incurred by handling or coming in contact with corpses, by eating certain foods, &c.; (d) the guarding the chief acts of life—birth, initiation, marriage and sexual functions, &c., against interference; (e) the securing of human beings against the wrath or power of deities and spirits; (f) the securing of unborn infants and young children, who stand in a specially sympathetic relation with one or both parents, from the consequences of certain actions, and more especially from the communication of qualities supposed to be derived from certain foods. (ii.) Taboos are imposed in order to secure against thieves the property of an individual, his fields, tools, &c.

5. Sanctions.—The sanctions of taboo may be (i) natural or direct; (ii.) social or indirect. Natural sanctions are (a) automatic, where the punishment of the offender results from the operation of natural laws without any element of volition; just as some kinds of magic are held to bring about their results without the intervention of a spirit; (b) animistic, where the penalty results from the wrath of a god, deceased human being, or other spirit. The motive of the social sanction is ultimately religious or magical, but the penalties incurred by the violator of a taboo are social; they are inflicted by other members of the community, firstly, as a means of averting the supernatural sanctions, which, not having fallen on the actual offender, may visit his innocent fellows; and secondly, as a means of discouraging other offenders; in these cases the case is considered as one of theft, and the networks are laid for the supernatural consequences; the social penalty is also inflicted on those who, like mourners, are themselves taboo and refuse to take steps to seclude themselves, in defence of the community; in the first class the social penalty is at once repressive and prophylactic, saving the innocent by punishing the guilty, and thus averting by a pia culum the vengeance which would otherwise fall somewhere; in the second the penalty is purely repressive.

The violation of a taboo makes the offender himself taboo; other penalties are not unkind to a man who partakes of a forbidden animal will break out in sores or the animal will reproduce itself within him and devour his vitals. Sometimes it is thought that the penalty falls on the kinswomen of the offender and that they produced, instead of children, animals of the taboo species. In Melanesia burial-grounds are taboo, and if the shadow of a passer-by falls on one, this entails upon him the loss of his soul; sometimes misfortune is held to dog the footsteps of the offender in this life and the next. But in some of these cases the observer who reports them has probably confused taboos proper with negative magic. The social sanctions range from the death penalty down to the infliction of a fine or exaction of money compensation; the Polynesian custom of despoiling a man who breaks a taboo is perhaps a special case of this penalty, but the practice of ceremonial plundering cannot always be so explained, and may perhaps in this case too be capable of an entirely different explanation.

Possibly the savage is more susceptible to suggestion than civilized man; at any rate, cases are not unknown in which the violation of a taboo has been followed by illness or even death, when the offender discovers his error. Not unnaturally rites of purification act as counter suggestions and save the offender from the effects of his erroneous beliefs.

6. Mana.—In the case of automatic taboos, and to some extent of other ritual prohibitions, the penalties for violation are unequal; they may be regarded as varying with the relation between the mana of the person or object and the mana of the offender against the prohibition. In the words of Dr R. H. Codrington, mana "is a power or influence, not physical and in a way supernatural; but it shows itself in physical force or in any kind of power or excellence which a man possesses. This mana is not fixed in anything, and can be conveyed in almost anything; but spirits, whether disembodied souls or supernatural (e. g. non-human) beings, have it and can impart it; and it essentially belongs to personal beings to originate it, though it may act through the medium of water, or a stone or a bone" (cf. the subman of West Africa, in Fetishism). Persons or things which are regarded as taboo may be compared to objects charged with electricity; they are the seat of a tremendous power which is transmissible by contact, and may be liberated with destructive effect if the organisms which provoke its discharge are too weak to resist it; the result of a violation of a taboo depends partly on the strength of the magical influence inherent in the taboo object or person, partly on the strength of the opposing mana of the violator of the taboo. Thus, kings and chiefs are possessed of great power, and it is death for their subjects to address them directly; but a minister or other person of greater mana than common can approach them unharmed, and can in turn be approached by their inferiors without risk. The burial-place is often taboo for the common people, save when they are actually engaged in funeral rites; but the sorcerer, thanks to his indwelling power, is able to resist the deadly influences which would destroy the common folk, and may enter a cemetery for ritual or other purposes. So too indirect taboos depend for their strength on the mana of him who imposes them; if it is a chief or a priest, they are more powerful than those imposed by a common person. The mana of the priest, or chief, does not depend on his position; on the contrary, it is thanks to his mana that he has risen above the common herd.

7. Transmissibility.—It is characteristic of taboo proper that it is transmissible; as a logical corollary of this idea, commoners who may be said to have died, or who, in any case, have been released from the penalties of their offenses, are not taboo proper; though they are transmissible, they do not depend on the transmission of an undifferentiated mana; what the parents seek to avoid is often the transmission of specific qualities, conceived as inherent in certain animals, e.g. cowardice in the hare, slowness in the tortoise; the animal is not necessarily in any sense sacred, nor are the parents, if they disregard the prohibition, liable to any penalty, direct or indirect; neither they nor the child are rendered taboo by any violation; finally, save that the child acquires its qualities by a sympathetic process, the abstinence of the parents is correlative to the converse operation of eating an animal or otherwise acquiring by a magical process the good qualities inherent in anything.

8. Duration of Taboos, Imposition, and Abrogation.—Taboo is properly sanctity and the kind of interdict which it entails; by a transference of meaning it is sometimes used of a period of time during which ritual prohibitions of a religious nature are enforced; these periods were proclaimed in Polynesia on important occasions and sometimes lasted for many years; they may be termed interdicts. Many persons and things are permanently taboo; among them may be mentioned kings and chiefs, the property of dead persons and, a fortiori, their bodies or anything in contact with them. Other taboos are temporary. Temporary direct taboos, whether natural or acquired, may be removed by a process of desacralization or of purification. Thus, new crops are frequently taboo till the chief has partaken of them; his mana enables him to run risks which would be fatal to ordinary people, and the crops thus desacralized become free to all; perhaps, however, we may regard the practice as a case of sacralization, in which the chief, like a sacrificing priest, acquires special sanctity, and in so doing fortifies his people by a sympathetic process against supernatural dangers. A
new-born child may also make the crops .nga, just as it may remove the taboo from a temporarily affected person.

In the Tonga Islands a person who became taboo by touching a chief or his property had to put away his sacred character, before he was allowed to make use of his lands, by touching the soles of a higher chief's feet and washing in water. Strangers before penetrating into a village, priests after a sacrifice, warriors, women after child-birth, at puberty, the menstrual period, &c., must submit to lustration. Sometimes the purification was effected by inhaling the sacred contagion; in New Zealand a chief who touched his own head had to apply his fingers to his nose, and then to the top of the other person's head. In other cases mere lapse of time sufficed to cause the removal of a taboo; in Melanesia, where taboos are largely animistic, mourners go away for some months and on their return are free from taboo, the explanation given being that the spirit has got tired of waiting for them.

Indirect taboos are imposed in various ways, and unless they are removed may be as permanent as direct taboos, save that the death of the persons by whom they are imposed must result in their abrogation. In Polynesia a general taboo was imposed by the magician that the tabooed object must not be in his personal possession; by this means he retained control over it. In New Zealand a taboo imposed on an animal was restricted to its use by its owner. Often the taboo extended to the personal use of an object. Thus a talking frog was tabooed to a person who had committed murder, and the object must not be in his possession. In Melanesia, corresponding to the animistic character of tabu, a method of imposing taboo is to mention the name of the spirit.

Taboo objects were marked in various ways: a piece of white cloth, a bunch of leaves, a bundle of branches (in Melanesia) painted red and white, a stick with dry leaves, are among the methods in common use; in Samoa one mark of a taboo was to set up the image of a shark; in New Zealand it sufficed to give a chop with an axe to make a tree taboo. Particular taboos thus imposed seem to be abrogated by the declaration of the person who imposes them; on the other hand, he, no less than others, is bound by the taboo until it is abrogated.

9. Taboo and the Evolution of Punishment.—Penal codes may be largely, if not wholly, traced to religious sources of which taboo is certainly one; the violation of any taboo may impel the life or health of other members of the community besides the offender; it calls for measures intended to discourage others, as well as for steps to avert the immediate evil; if a taboo is imposed upon an individual, the penalty is not fixed; the authority has been set at nought, but he, and in the second place, other members of the community may suffer if the real offender gets off scot free, thanks to the mana which enables him to defy supernatural sanctions. The importance of this in the evolution of law and order is manifest; for whereas a chief would not intervene to protect the property of an individual simply to punish what we regard as a transgression, he is bound to do so when a taboo is broken. That the taboo may be of his own imposition does not affect the question, for he is bound to observe it himself, and conversely may suffer supernatural penalties when it is violated by another. Just as blood-guiltiness may be wiped out by composition, the violation of a taboo may be atoned for by a money payment or similar consideration for the revocation of the taboo; this compensation seems to have a retrospective effect, and thereby removes the dangers brought into existence by the violation.

10. Taboo and Moral Obligation.—In proportion as a taboo becomes a custom and its sanctions fall into the background and are forgotten, its obligations thus transformed are one source of the categorical imperative, the distinguishing feature of which is that it is non-rational and instinctive. We are ignorant of the origin of exogamy and the prohibition of incest, the sanctions of which in Australia and among other peoples of low culture seem to be purely social, for as a rule irregular marriages seem to be regarded simply as offences against tribal morality; if the rules were originally of the nature of taboos, the transformation into customs must have been very early, and the same may be said of the rules by which the relations of members of the same kin are regulated.

11. Royal and Priestly Taboos.—Among people of low culture the chief, and in higher cultures the king, is sometimes held responsible for the order of nature, the increase of the crops, and the welfare of his people generally; it is therefore of the highest importance that nothing should diminish or perturb his influence, and, as a logical consequence, the life of the king, and to a less degree of the chief, is surrounded with a complicated system of taboos and ritual prohibitions. Even where this idea of the magician-king or chief is not found, his position is an expression of the more powerful mana dwelling within him; consequently the king or chief may not come in contact with the common folk, they must avoid his touch, while his approach to lightning withers the life of the oak. We can usually see why a king or chief must hold aloof from those whom he might injure, but it is not always easy to see the basic idea of the taboos, if such they be, which aim at protecting the potentate, or ensuring his due regulation of the course of nature. Some African kings may not see the sea; another may not lie down to sleep; in the Mentawei Islands the chief will die who during an interdict eats at the same time as common people; it is frequently forbidden to see the king partake of food. At a further stage some taboo restrictions are extended to other people, the violation of which involves the punishment of the offender, but the punishment is justified on formal grounds only. In early society the king and the priest often stand very near together; just as we find a war chief and a peace chief, so we meet with political and religious sovereigns. Sometimes the political king is, also the priest and therefore sacred; the web of ritual prohibition woven round him may result in the creation of a secular authority like the Tycoon in Japan, who can rule the state without reference to the ceremonial observances prescribed for the nominal sovereign. Sometimes, on the other hand, the priest bears the title of king, but has lost in the shadow of political power and is free to perform his priestly functions. In these, however, as we see by the example of the flamen dialis at Rome, or the kings of fire and water in Cambodia, he is still hedged round by manifold restrictions as a person who must be protected from doing harm to others or suffering harm himself. In the exercise of his priestly functions he is called upon to offer sacrifice; before fulfilling his office he is often required to submit to additional ritual prohibitions; his personal sanctity, already great, is augmented, and his power to control the evolution of these taboos degenerate into mere rules of etiquette. Over these, he performs lustral rites, in part to free himself from the taint of errors of ritual, but also to desacralize himself.

12. Funerary and Allied Taboos.—Taboos of mourners, widows, and of the dead are common all the world over, but they are especially prominent in Melanesia. These are explained on an animistic hypothesis as due to the fear of the dead man's spirit, but we seem to see traces, e.g. in Madagascar, of the idea that the contagion of death and not the wrath of the dead is the underlying motive; for it is not clear why the soul of a dead kinsman should necessarily be hostile. With funerary taboos may be compared taboos of warriors both on and after an expedition, taboos of hunters during the chase and especially after killing a dangerous animal, taboos of canibals, and on participants in all other ceremonies which involve contact with death or the dead. Temporary seclusion and lustration before return to ordinary life are commonly prescribed for all in this category, even though their connexion with the dead be no closer than is implied in consanguinity. The property of the dead man is commonly burnt or deposited with him in the grave, in part as a protective measure, in part under the influence of belief in the continuity of this and the future life, and as a need of supplying him with necessaries. Burial grounds are avoided, animals or plants from the neighbourhood are not used as food. Finally the name of the dead is not used, partly for fear of summoning him by the power of the word, but partly also from a conviction that, like the name of a king or chief, it is too holy or too dangerous for common use.

13. Taboos of the Sick.—Both disease and death are unnatural in the eyes of the savage; they are often the result of the magic
of some enemy; but they may also be the result of an infraction of a taboo. Some part of the funerary taboos may perhaps be referred to this belief; whatever be the case with taboos of the dead, there can be no question that the sick are secluded or even abandoned, subjected to rites of purification and to restrictions of various sorts, not because their malady is contagious in our sense, but because they are temporarily taken as impure to the health of the community. The sick have imposed on them curative as well as prophylactic taboos; in Madagascar the sun is said to "die" when it sets; therefore it is forbidden to a sick man to look upon it as it goes down.

14. Taboos of Women, Sexual Taboos, Avoidance.—The age of puberty is especially dangerous for both sexes; in the case of a woman the danger is not so much for herself as for others, and results from her physiological state; this danger is renewed with each successive menstrual period, and the frequently long seclusion at puberty finds a parallel in the universal practice in lower stages of culture of separating adult females, not only from males, but from the whole of the community at such periods. At puberty girls are confined for months or even years; they may not see the sun nor touch the earth; many foods are forbidden to them, and special costumes are prescribed for them, as for mourners. The expectant mother is taboo for months before the birth of her child, and her disabilities are not removed for a long period after delivery. Women may not look upon the performance of rites of initiation nor of secret societies; they may not eat new crops in New Caledonia till long after the material stage of the young girls has passed; the taboos are the men's club-house. Both parents, but especially the mother, are subjected to restrictions, having for their object the preservation of the health of the unborn or newly born child. Women are often forbidden to eat with their husbands; nor may they share his labours, especially at sea.

The relations of the sexes are regulated by complicated rules, but they are not necessarily taboos. In the first place, laws of exogamy and similar regulations limit the field of choice; even where no obstacle on this side is present the intercourse of the sexes is often, especially at first, hedged round with numberless interdictions and rites. Connected with the rules of exogamy are the customs of avoidance, which prescribe that a man may not speak to nor even look at his mother-in-law, sometimes also his father-in-law, daughter, and other relatives; in like manner the wife must avoid the husband's relatives, and the brother may often not speak to the sister.

15. Other Taboos.—Taboos of various kinds are imposed on strangers, on sorcerers, and on children. Certain places are taboo; taboos protect the crops and ensure that landmarks are not removed. In fact the number of taboos is so great that it is impossible to enumerate them all.

16. Distribution.—Although taboo is a Polynesian word the institution is far from being restricted to Oceania. Similar prohibitions, though they seldom reached the Polynesian level, are found in America, Africa, and especially Madagascar, North and Central Asia, and among the non-Aryan tribes of India. But taboo and its survivals are not confined to the civilized.

17. Developments of Taboo.—It would be remarkable if a feature which has taken such deep root in the custom and belief of savage and barbarous peoples did not leave a marked influence on the development of thought. The sacred may become moral pari passu with mankind, so the ceremonially clean has become the physically and morally clean, the pure has become the moral, and taboo has changed its name to holiness. At a certain point in evolution the notion of unclean, sometimes positive and implying the possession of dangerous properties, sometimes negative and denoting no more than mere absence of holiness, which is in this case indistinguishable from mana, becomes a prominent element in religion. At a later stage and as a result of the greater weight attached to morality, the positive unhallowed falls into the background, leaving only the negatively unclean, the unholy, which is not in itself death-dealing, but may, like its savage analogue, call down on the community, innocent and guilty alike, the wrath of higher powers, the remedy being, not so much the punishment of the offender, still less mere physical purification, but their moralized analogues, prayer, fasting and repentance.

18. Among the Greeks.—The general word for taboo among the Greeks in ἄγος, which may bear the sense of "sacredness" or "pollution"; derivates occur in the same meanings. Usually, however, the nots in sacred and unclean are distinguished by the use of different terms from this root, ἄγος for sacred, ἄγος for unclean or accursed. The rules of the Greek ἄγος (pagan) season of tabooes (Polynesia) do not differ markedly from those of the Polynesians. Corresponding to the war-taboo of Oceania we find in Homer that the army (Od. xxv. 81) and the sentinel (II. x. 56, xxiv. 681) are sacred; and we learn from Plato that warriors never eat fish, from which indeed there was a general custom of abstinence except under the pressure of famine. The epithets ἵππος, ἰππος, &c., which may point to beliefs similar to those of Polynesia, are applied to chiefs and kings, and further to the swineherd, thus suggesting that the pig, which bore a mixed reputation for holiness and uncleanness (ceremonial) both in Egypt and west Asia, was similarly regarded in Greece.

19. Among the Romans.—The term for taboo is sacer; any one who removed a landmark became sacer and was outlawed, any citizen having the right to kill him. Conscriutori capitis et honorum was the term for devotion to the nether gods. The flamen dialis and his wife were hedged in by a perfect network of ritual prohibitions; he might not ride upon nor even touch a horse. The taboos at the puberty of girls were so strong that he might not walk under a vine; he might not name a goat, raw meat, beans, ivy, a dog, and so on; his hair might be cut only by a friar; he might not touch a corpse. The flamincas might not comb her hair at certain festivals; she was taboo (feriates) after hearing thunder till she had purified herself by a sacrifice. The Roman feriae were periods of taboo.

20. Among the Jews.—The Hebrew for holy is כָּלִי which means "separated, cut off," while its correlative כָּל means "open for common use"; another sense of sacer is conveyed by הָלָּד, "accursed, devoted to destruction." Holiness is transmissible by contact (Ezek. xliv. 19, xlv. 20; Ex. xxxix. 37; Lev. vi. 27). It is distinct from purity in the moral sense; the names of the hierodulri כָּלִי and hierodulra מָדַי are connected with the word כָּל. Taboo among the Jews are: (1) things connected with Jehovah, his name is holy and terrible; his arm is holy; holy places are taboo (see Sanctuary); the ark is actively dangerous, and Uzzah, no less than the men of Bethhemesh, pays the penalty for too nearly approaching it; (2) the Nazarite might not partake of certain foods, nor touch a dead body nor shave his head, which was specially sacred. In fact the Nazarite was absolutely unclean and could communicate his uncleanness to others; (4) the birth of a child made the mother taboo; she was required to purify herself; (g) leprosy, menstruation, and sexual functions generally occasioned longer or shorter periods of uncleanness; and warriors, who were taboo on a campaign vessel, were required to observe continence; (6) certain foods were taboo, and the uncleanness might be communicated to an earthen vessel, which, under certain circumstances, would be broken, like a pot in Polynesia; (7) the use of iron was forbidden in the case of the Nazarite; (8) there were different kinds of herbs which "becomes holy," and (h) bystanders are warned not to approach a heathen rite, lest they be "sanctified"; (9) to the Polynesian interdicts, often termed taboos, corresponded certain periods of time, such as the Sabbath and the Jubilee year, but these are not connected with taboo proper.

TÁBOR—TACHEOMETRY


TÁBÓR, a town in western Bohemia, on the Francis-Joseph railway, 104 kilometres from Prague. Pop. (1908) 7,073.

It is the chief town of a government district and the seat of a provincial law-court, and also of an industrial school. The town was founded in 1420 by the more advanced party of the church-reformers or Hussites, who, as it became their centre, soon began to be known as the Taborites. The town is situated on the summit of an isolated hill, at an elevation of about 2,800 ft. above the surrounding country by the Lužnice stream and by an extensive pond, to which the Hussites gave the biblical name of Jordan. The historical importance of the city of Tábor only ceased when it was captured by King George of Poděbrad in 1452. Though a large part of the ancient fortifications has recently been demolished, Tábor—or Hradiste Hory Tábor, the castle of the Tabor Hill, as it was called in the Hussite period—has still preserved many memorials of its past fame. In the centre of the city is the market-place (rybník). Only very narrow streets lead to it, to render the approach to it more difficult in times of war. In the centre of the market-place is the statue of Žižka, the greatest of the Taborite leaders. Here also is the diagonal church, built in 1536 in the style of the Bohemian Renaissance, and the town hall, in connexion with which a museum has been founded, which contains interesting memorials of the Hussite period. Some parts of the ancient fortifications and the very ancient Kotnov tower also still exist.

See Thir, Hradiste Hory Tábor (1835).

TÁBRIZ, the capital of the province of Azerbaijan in Persia, situated in the valley of the Ali-Chat, "Bitter River," at an elevation of about 2,800 ft. above sea level. The first complete census taken in 1871 the population of Tábriz was in 1888 estimated at 165,000, and is now said to be about 200,000.

The popular etymology of the name Tábriz from tabe=fever, ris=pourer away (verb, ribkhan=pour away, flow; German rieseln?), hence "fever-deestroying," is erroneous and was invented in modern times. It is related that Zobeideh, the wife of Harun-al-Rashid, founded the town in 797 after recovering there from fever, but the earlier chronicles give no support to this statement, and it is nowhere recorded that Zobeideh ever visited Azerbaijan, and the name Tabriz was known many centuries before her time. In 1842 Hammer-Purgstall correctly explained the name as meaning the "warm-flowing" (tab=warm, same root as lep in "tepid") from some warm mineral springs in the neighbourhood, and compared it with the synonymous Tepltz in Bohemia. In old Armenian histories the name is Tavresh, which means the same. The popular pronunciation to and taw for tab has given rise to the spellings Toris and Tauris met with in older travellers and used even now.

Overlooking the valley on the N.E. and N. are bold bare rocks, while to the S. rises the majestic cone of Sahand (13,000 ft.). The town possesses but few buildings of note, and of the extensive ruins very few present attention. The area, or citadel, in the south-west extremity of the city, now used as a arsenal, is a noble building of burnt brick with mighty walls and a tower 20 ft. in height. Among the ruins of old Tábriz the sepulchre of the Mongol king, Ghazan Khan (1295-1304), in a quarter once known as Shab (generally pronounced Sham and Shám) i Ghazan, is no longer to be distinguished except as part of a huge tumulus. The great shab (cupola or dome) and other buildings erected by Ghazan have also disappeared. They stood about 2 m. S.W. from the modern town, but far within the original boundaries. The "spacious arches of stone and other vestiges of departed majesty," with which Ker Porter found it surrounded in 1818, were possibly remains of the college (medresseh) and monastery (zavieh) where Ibn Batūta found shelter during his visit to the locality. On the eastern side of the city stand the ruins of the Masjed i Jehan Shah, commonly known as the Masjed i Kebud, or "Blue Mosque," from the blue glazed tiles which cover its walls. It was built by Jehan Shah of the Kara Kuyunlī or Black Sheep dynasty (1437-1467).

Tábriz is celebrated as one of the most healthful and pleasant of Persian towns.

Tábriz was for a long period the emporium for the trade of Persia on the west, but since the opening of the railway through the Caucasus and greater facilities for transport on the Caspian, much of its trade with Russia has been diverted to Astara and Resht, while the insecurity on the Tábriz-Trebizond route since 1878 has diverted much commerce to the Bagdad road. According to consular reports the value of the exports and imports which passed through the Tábriz custom-house during the years 1867-73 averaged £5,936,600 and £1,126,660 (total for the year), and the exports of silver were £1,213,886 and £344,510. There are reasons to believe that these values were considerably understated. For the year 1868-9 the present writer obtained figures directly from the books kept by the custom-house official at Tábriz, and although, as this official informed him, some important items had not been entered at all, the value of the exports and imports shown in the books exceeded that of the consular reports by about 10 per cent. Since that time the customs of Azerbaijan have been taken over by the central customs department under Belgian officials, and it is stated that the trade has not decreased. British, Russian, French, Turkish and Austrian consulates and a few European commercial firms are established at Tábriz; there are also post and telegraph offices. Tábriz has suffered much from earthquakes, notably in 1858, 1842 and 1721, each time with almost complete destruction of the city.

(A. H.-S.)

TABULARIUM (tabula, board, picture, also archives, records), the architectural term given to the Record office in ancient Rome, which was built by Q. Lutatius Catulus, the conqueror of the Cimbri. It was situated on the west side of the Forum Romanum, and its great corridor, 220 ft. long, raised 50 ft. above the forum without support by pillars. The substructure of this corridor was lighted through a series of arches divided by semi-detached columns of the Doric order, the earliest example of this class of decoration, which in the Theatre of Marcellus, the Colosseum, and all the great amphitheatres throughout the Roman empire constituted the decorative treatment of the wall surface and gave scale to the structure. Traces of an upper corridor with semi-detached columns of the Ionic order have been found in the Tabularium, but this structure was much changed in the 13th century, when the Palace of the Senators was built.

TACHEOMETRY (from Gr. tachy-, quick; metrēo, a measure), a system of rapid surveying, by which the positions, both horizontal and vertical, of points on the earth's surface relatively to one another are determined without using a chain or tape or a separate levelling instrument. The ordinary methods of surveying with a theodolite, chain, and levelling instrument (see SURVEYING) are fairly satisfactory when the ground is pretty clear of obstructions and not very precipitous, but it becomes extremely cumbersome when the ground is much covered with bush, or broken up by ravines. Chain measurements are then both slow and liable to considerable error; the levelling, too, is carried on at great disadvantage in point of speed, though without serious loss of accuracy. These difficulties led to the introduction of tacheometry, in which, instead of the pole formerly employed to mark a point, a staff similar to a level staff is used. This is marked with heights from the foot, and is graduated according to the form of tacheometer in use. The azimuth angle is determined as formerly. The horizontal distance is

1 This mosque is popularly attributed to Ghazan Khan (end of 13th century).
inferred either from the vertical angle included between two well-defined points on the staff and the known distance between them, or by readings of the staff indicated by two fixed wires in the diaphragm of the telescope. The difference of height is computed from the angle of depression or elevation of a fixed point on the staff and the horizontal distance already obtained. Thus all the measurements requisite to locate both vertically and horizontally with reference to the point where the tacheometer is centred are determined by an observer at the instrument without any assistance beyond that of a man to hold the staff.

The simplest system of tacheometry employs a theodolite without additions of any kind, and the horizontal and vertical distances are obtained from the angles of depression or elevation of two well-defined points on a staff at known heights from the foot, the staff being held vertically. In fig. 1 let T be the telescope of a theodolite centred over the point C, and let AB be the staff held vertically on the ground at A. Let P and P' be the two well-defined marks on the face of the staff, for distant readings, and from the great simplicity of the observations there is little likelihood of errors in the field. But the reduction in the observed elevations and horizontal distances will be heavy under the conditions described below. Since the accuracy of the method depends entirely upon the accuracy with which the vertical angles are measured, it is advisable that the vertical circle should be as large as possible, very finely and accurately divided, and fitted with good verniers and microscopes.

In Eckhold's omnimeter the vertical circle of the theodolite is dispensed with, and a reading of reduction work is effected by reading, not the vertical angles themselves, but the tangents of the angles.

In the Ziegler-Hager tachograph the tangents are read not horizontally but vertically, and the arrangement is as follows:

In fig. 2 O is the axis of rotation of the telescope; m is the axis of a steel bolt, which carries on its top a knife-edge, on which the telescope rests by means of an agate plate. The bolt is carried in a socket in which it can be raised or lowered by a micrometer screw fitted with a graduated head. The slide plays between the vertical cheeks of a standard rigidly attached to the frame of the instrument, and it can be raised or lowered by a rack and pinion. The telescope, which rests on the knife-edge, follows the movement of the bolt. The slide carries on one side a vernier by which to read the divisions on a scale fixed to one of the vertical legs of the standard, and the zero point o of the scale is the point where the horizontal plane through O cuts the scale when the plane-table or upper plate of the theodolite is truly level. The scale is graduated in divisions, each of which is the 1/34th part of the distance Op, or h. The head of the micrometer screw which raises or lowers the steel bolt in the slide is graduated with a zero mark and with marks corresponding to a vertical movement of the knife-edge of 1/4 of an inch. The instrument is used as follows:—Let AB be the surface of the ground, and BC a staff held vertically at B, and let CB be produced to meet the horizontal line through O in M. Let the head of the micrometer screw be turned until the zero division is exactly under the point B. Let P be the zero division on the staff, and let the slide and bolt be raised by the rack and pinion movement till the telescope is directed towards P. Then p may be the point where the line OP cuts mn, and let the tangent reading be taken on the scale. Then let the telescope be lowered by the micrometer screw in the slide till the division on the head of the screw marked 1 is exactly under the point B; the knife-edge of the bolt has then been lowered through a distance 1 equal to 1/100. Let g be the point on the staff where the line of sight Pt exactly coincides with line of sight at point g be taken. Then since the triangles between O and m, and O and CM are similar to each other, and does its base by 1/100, or OM = 100 x p. This gives the horizontal distance of the staff from O, and the vertical distance PM of above O is OM tan MOP = OM x mg, and since mg has been read in

![Fig. 1](image1)

![Fig. 2](image2)
ED' is one-half of the distance ED, and so on in proportion. The distance ED can be instantly inferred from the readings of the staff, if the latter be suitably graduated. If, for example, it is desired to know the distance ED in yards, and by construction the proportion EC/BC = 50, then the intercept on the staff at 1 yard from E would be &frac12;th of a yard, or &frac12;2 inch, the intercept at 2 yards from E would be 2&times;&frac12;2 inches, and so on. If therefore the staff be graduated with divisions of &frac12;2 inch, and the intercept be 45 of such divisions, it would be inferred that the distance of the staff from E was 45 yards. The constant proportion EC/BC can be checked by measuring 100 yards from E and observing whether the intercept is exactly 100 divisions or not. If it is not, the wire diaphragm must be shifted in the tube until it is. In figs. 3, 4, 5 and 6 the distances are deduced from the readings of a central wire in the optical axis of the telescope and of a wire above it, for the sake of simplicity. The usual arrangement is to fit the diaphragm with a central wire and with one or two wires above and below it, at equal distances from the central wire. The vertical angle of depression or elevation is fixed by directing the central wire to a well-defined division on the staff, and the distance of the staff is inferred from the reading given by the corresponding wires above and below the central wire.

The elementary form of tacheometer given above illustrates the general principle of the class of tachometers now under consideration, and as leading up to the practical form, in which the staff is viewed with a telescope mounted in the manner of a theodolite. The simplest form is Reichenbach's tacheometer, which may be investigated as follows:—In fig. 4 let A be the object glass by which an image of the staff ST is formed at HK. The wire diaphragm is moved in the tube so as to coincide with the image, and the image and wires are viewed with an eye-piece (not shown) in the usual way. Let O be the point where the vertical axis of the instrument cuts the axis of the telescope, the instrument being central being placed in a position in which the distance to the staff is required. The object glass (of focal length = f) is at a distance c from O. Let AT = u and AH = v, and the angle SAT = HAK = $\theta$. Then if $i$ be the height of the image HK, $i = s\tan \theta$. Since $f/4 + 1/u = 1/f$, we have $v = -u/(u-f)$, and hence $i = u\tan \theta / (u-f)$. Let F be some point on AT such that AF = x and FT = u'. Let the angle SFT = $\phi$. Then $u = u/4 + x$ and $\tan \theta = u/4 + x = \tan \phi; and, if $x = f_1$, $i = f_1\tan \phi$.

If therefore the point F be taken at a distance f from the object glass, every intercept of ST between O and F, such as ST', ST'', &c., which are bounded by the line FS, and for which consequently $\theta$ is the same, will have the same height of image at the diaphragm. Conversely, if K be a wire in the diaphragm it will cut the image of the staff for all positions of the staff between T and F in points which lie on the line FS. Now the intercept ST', half-way between F and T, will be one-half of ST, and therefore if the reading on the staff indicated by the wire in question be one-half of ST, it may be inferred that the position of the staff is half-way between F and T, and similarly for other distances. If the distance of ST from O is required, as is usually the case, a quantity $f + c$ must be added to every distance from F determined as above.

It is very seldom that the line of sight AT of the telescope is at right angles to the staff. In general it is more or less inclined to the staff, which is almost always held vertical, and the horizontal and vertical distances of the staff from the axis of rotation of the telescope are found thus:—In fig. 5 let ST be the observed intercept on the Staff when the telescope is inclined at an angle $\alpha$ to the horizontal. Draw TS' at right angles to OT. The angle TS'S will be very nearly a right angle, and ST'S may be taken as equal to $\alpha$. If there were $n$ graduations (each corresponding to 1 yard in distance) in ST, there would be $n\cos \alpha$ graduations in ST', and therefore the distance of the staff from F, as inferred from the observed number of graduations in ST, must be multiplied by $\cos \alpha$ to give the true distance FT. Again FN = FT $\cos \alpha$, so that the distance inferred from the observed number of graduations in ST must be multiplied by $\cos \alpha$ to give the horizontal distance of F from T. To this must be added the distance OL = $OF\cos \alpha = (f+c)\cos \alpha$ to get the horizontal distance, OM, of O (the vertical axis of the instrument) from T. This value of OM must be multiplied by $\tan \alpha$ to obtain the value of $h$, the vertical distance of T from O. Tables of the value of $\cos \alpha$, $\cos^2 \alpha$, and $\tan \alpha$ are necessary to facilitate these calculations.

In this tacheometer the distances as inferred from the readings of the staff are the distances of the staff from F and not from O. This defect was remedied by Porro, who added a lens (called the anallatic lens) to the telescope. The arrangement of the telescope as manufactured by Messrs Troughton and Simms, is as follows:—In fig. 6 O is the point where the vertical axis of the instrument cuts the axis of the telescope. The object glass is fixed at a distance c from O, and the anallatic lens at a distance d from the object glass. The distances c and d are chosen to suit the constructive conveniences of the instrument. The diaphragm at K is movable so that it can be made to coincide with the image of the staff. The focal length $f_1$ of the object glass is arbitrary, and the focal length $f_2$ of the anallatic lens is determined from the equation of condition between c, d, $f_1$, and $f_2$. The image of the staff ST would be formed by the object glass at H, at a distance $v$ from the object glass, were it not that the rays, after passing through the object glass, are received by the anallatic lens and the image of the staff is formed at K on the wire diaphragm, which is slid in the tube till it coincides with the position of the image. The image at K is viewed by an eye-piece in the usual way. Let T be the point where the image of the staff is cut by the central wire of the diaphragm, and S the point where the image is cut by one of the outer wires of the diaphragm. If $\theta$ and $\phi$ be the angles subtended by ST at the object glass and at the point O, respectively, and if $i$ be the height of the image at K, $h$ the height of the virtual image at H, then by elementary geometry and from optical considerations, we obtain

$$ i = \frac{uf_1}{f_1 - d + f_1 \tan \phi} $$

Let $f_1$ be made such that $uf_1 = (c+f_1)/(d-f_1)\tan \phi$, the equation of condition above mentioned. Then $f_1 = (c+f_1)/(d-f_1)$, and

$$ i = \frac{uf_1}{f_1 - d + f_1 \tan \phi} $$

Therefore all the readings of the staff which would be given by the outer wire of the diaphragm will lie on the line OS (for all of
which is the same, and the distance from O along OT will be proportional to the reading on the staff. Thus if the staff be suitably graduated, the distance from O can be immediately deduced from the reading. Also, as before, if the telescope be inclined at an angle $\alpha$ to the horizontal, the distance OT inferred from the number of graduations in ST must be multiplied by cos $\alpha$ to give the horizontal distance of O from T, and the horizontal distance so obtained must be multiplied by tan $\alpha$ to obtain the vertical distance of T from O.

The inconvenience of the reduction work necessary to obtain the horizontal and vertical distances produced the Wagner-Feunel tacheometer, by which the distances can be read directly from the instrument. As is seen from fig. 7, three scales are provided, to measure the inclined distance, the horizontal distance, and the vertical distance respectively. All three are arranged in a plane parallel to the plane in which the telescope turns. The inclined scale is attached to the telescope exactly parallel to its line of collimation, and moves with it. The horizontal scale is fixed to the upper horizontal plate of the theodolite. The vertical scale is on the vertical edge of a right-angled triangle, which can be slid along on the top of the horizontal scale. The inclined scale carries a slide which is provided with two verniers. One of these is parallel to the inclined scale, and is for the purpose of setting off on the scale (in terms of the divisions on the scale) the inclined distance of the staff from the axis of rotation of the telescope. The other turns on a pivot whose centre is accurately in the edge of the inclined scale at the point where the zero division of the inclined vernier cuts the edge, and is for the purpose of reading the vertical scale; it can be turned on its pivot so as to be vertical whatever may be the inclination of the telescope. Moreover, since the distance from the centre of the pivot to the zero of the vernier is always constant and known, the vertical scale can be graduated so that the reading of the vernier gives the height (in terms of the division on the scale) of the staff above the axis of rotation of the telescope. The horizontal scale attached to the horizontal plate of the theodolite is read by means of a vernier carried by the triangle. To ascertain the horizontal and vertical distances of the point on the staff which is cut by the middle wire in the diaphragm of the telescope from the rotation axis of the telescope, the inclined distance of the point on the staff is read by means of the wires, as in Porro’s tacheometer. This distance (in terms of the division) is then set off on the inclined scale by means of the inclined vernier, and the vertical scale on the triangle is moved up to the vertical vernier, which is adjusted to its edge. With proper graduation of the horizontal and vertical scales, the horizontal and vertical distances can be determined on the scales. This method, however, requires that the staff be held so that its face is perpendicular to the line of sight, which is more troublesome than holding the staff vertical.


TACHIELU, a town of China, in the province of Sze-ch’uen. It is the great tea mart for Tibet, and from Tachienu the two trade-routes, the Gya lam and the Chang lam, diverge, the former to Ladakh and the latter to Kashgar.

TAHYLYTES, or TACHYLYTES (from Gr. ταχυλύτης, swift, λύειν, to dissolve, meaning “easily fused,” though some have erroneously interpreted it as “easily soluble in acids”), in petrology, the vitreous forms of the basic igneous rocks; in other words, they are basaltic obsidians. They are black in colour, dark brown in the thinnest sections, with a resinous lustre and the appearance of the appearance of the larger crystals; but in all the other crystals and sometimes spherical. They are very brittle, and break down readily under the hammer. Small crystals of felspar or olivine are sometimes visible in them with the unaided eye. All tachylytes weather rather easily, and by oxidation of their iron become dark brown or red. Three modes of occurrence characterize this rock. In all cases they are found under conditions which imply rapid cooling, but they are much less common than acid volcanic glasses (or obsidians), the reason being apparently that the basic rocks have a stronger tendency to crystallize, partly because they are more liquid and the molecules have more freedom to arrange themselves in crystalline order.

The fine scoria ashes or “cinders” thrown out by basaltic volcanoes are often spongy masses of tachylyte with only a few larger crystals or phenocrysts imbedded in black glass. Such tachylytes are usually bombs and scoriæ and are frequent in Strombolos, Etna, and are very common also in the ash beds or tuffs of older date, such as occur in Skye, Midlothian and Fife, Derbyshire, and Yorkshire. Basaltic pieces of this kind are exceedingly widespread on the bottom of the sea, either on the bottom of the sea, the sea bottom, and other deposits or forming layers coated with oxides of manganese, precipitated on them from the sea water. These tachylyte fragments, which are included in the basalt, are usually broken, but the hydration of their ferrous compounds, have taken on a dark red colour. This altered basic glass is known as “palagonite”; concentric bands of it often surround kernels of unaltered tachylyte, and are as easy to cut with a knife. Palagonite and olivine, with the minerals also are decomposed, and are represented only by pseudomorphs. The fresh tachylyte glass, however, often contains large-shaped crystals of plagioclase felspar and small prisms of augite and olivine, but all these minerals very frequently occur mainly as microlites or as beautiful skeletal growths with sharp-pointed corners or ramifying processes. Palagonite tuffs are found along with the older volcanic rocks, and in many of these rocks, described as “the palagonite formation,” is said to cross the island from south-west to north-east. Some of these tuffs are fossiliferous; others are intercalated with glacial deposits. Palagonite tuffs are found in Sicily, the Eifel, Hungary, Canay Islands, &c.

A second mode of occurrence of tachylyte is in the form of lava flows. Basaltic rocks often contain a small amount of glassy ground-mass, and in the limburgites this becomes more important and conspicuous, but vitreous types are far less common in these than in andesites. Acid lavas from the Eifel volcanoes have poured out vast floods of black basalt, containing felspar, augite, olivine, and iron ores in a black glassy base. They are highly liquid when discharged, and the rapid cooling which takes place prevents their complete crystallization and a new place completely. Many of them are spongy or vesicular, and their upper surfaces are often exceedingly rough and jagged, while at other times they assume rounded wave-like forms on solidification. Great cavities are found where the crust has solidified and the liquid interior has subsequently flowed away, and stalactites and stalagmites of black tachylyte adorn the roofs and floors. On section these growths show usually a central cavity enclosed by walls of dark brown glass in which skeletons and microliths of augite, olivine and felspar lie imbedded. From the crater of Kiluaea thin clouds of steam rise constantly, and as the bubbles of vapour are forced down to the molten core of the volcano, the air in them is rapidly cooled and fuses into a sort of jet of thin fibres of basalt which solidifies at once and assume the form of tachylyte threads. Under the microscope they prove to be nearly completely glassy with small circular air vesicles sometimes drawn out into gas tubes. Other volcanic islands in the Hawaiian Islands are glassy basaltic lavas of this kind at all common.

A third mode of occurrence of tachylyte is as the margins and thin often present at the edges of crystals of basalt, dolerite and diabase. They are sometimes only a fraction of an inch in thickness, resembling a thin layer of pitch or tar on the edge of a crystalline dolerite dike, but veins several inches thick are sometimes met with. In these situations the tachylyte is rapidly solidified, but it is usually very finely and the fusion banding accentuated by the presence of rows of spherulites which are visible as dark brown rounded spots. These spherulites exhibit a distinct radiate structure and sometimes exhibit a rather of varying colour. These glasses forming polyhedrons, sometimes perlitic and these rocks are always brittle. The commonest crystals are olivine, augite and felspar, with swarms of minute dusty black grains of magnetite. At the extreme edges the glass is often perfect free from crystalline products, but it merges rapidly into the
ordinary crystalline dolerite, which in a very short distance may contain no vitreous base whatever. The spherulites may form needles of felspar or feather-like growths of augite. The ultimate product of decomposition in this case also is a red palagonitic substance, but owing to the absence of steam cavities the tachylyte selvages of dikes are more often found in a fresh state than the basic lapilli in ash-beds. Many occurrences of lascivious dolerites have been reported from Skye, Mull, and the western part of Scotland; they are found also in connexion with the intrusive dolerite sills of the north of England and the central parts of Scotland. In the Saar district of Germany similar rocks occur, some of which have been described as weisselbergites (from Weisselberg). Other localities for tachylytes of this group are Nassau, Siliesia and Shetland. The chemical composition of some of the rocks of this group is indicated by the analyses given below:

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TACITUS, CORNELIUS

(TACITUS, CORNELIUS (c. 55-120), Roman historian. Tacitus, who ranks beyond dispute in the highest place among men of letters of all ages, lived through the reigns of the emperors Nero, Galba, Otho, Vitellius, Vespasian, Titus, Domitian, Nerva and Trajan. All we know of his personal history is from allusions to himself in his own works, and from eleven letters addressed to him by his very intimate friend, the younger Pliny. The exact year of his birth is a matter of inference, but it may be approximately fixed near the close of the reign of Claudius. Pliny indeed, though himself born in 61 or 62, speaks of Tacitus and himself as being "much of an age," but he must have been some years junior to his friend, who began, he tells us, his official life under Vespasian,2 no doubt as quaestor, and presumably tribune or aedile under Titus (80 or 81), at which time he must have been twenty-five years of age at least. Of his family and birthplace we know nothing certain; we can infer nothing from his name Cornelius, which was then very widely extended; but the fact of his early promotion seems to point to respectable antecedents, and it may be that his father was one Cornelius Tacitus, who had been a procurator in one of the divisions of Gaul, to whom allusion is made by the elder Pliny in his Natural History (vii. 76). But it is all matter of pure conjecture, as it also is whether his "praenomen" was Publius or Gaius. The most interesting facts about him to us are that he was an eminent pleader at the Roman bar, that he was an eye-witness of the "reign of terror" during the last three years of Domitian, and that he was the son-in-law of Julius Agricola. This honourable connexion, which testifies to his high moral character, may very possibly have accelerated his promotion, which he says3 was begun by Vespasian, augmented by Titus, and still further advanced by Domitian, under whom we find him presiding as praetor at the celebration of the secular games in 88, and a member of one of the old priestly colleges, to which good family was an almost indispensable passport. Next year, it seems, he left Rome, and was absent till 93 on some provincial business, and it is possible that in these four years he may have made the acquaintance of Germany and its peoples. His father-in-law died in the year of his return to Rome. In the concluding passage of his Life of Agricola he tells us plainly that he witnessed the judicial murders of many of Rome's best citizens from 93 to 96, and that being himself a senator he felt almost a guilty complicity in them. With the emperor Nerva's accession his life became bright and prosperous, and so it continued through the reign of Nerva's successor, Trajan, he himself, in the opening passage of his Agricola, describing this as a "singularly blessed time," but the hideous reign of terror had stamped itself ineffaceably on his soul, and when he sat down to write his History he could see little but the darkest side of imperialism. To his friend the younger Pliny we are indebted for the little we know about his later life. He was advanced to the consulship in 97, in succession to a highly distinguished man, Verginius Rufus, on whom he delivered in the senate a funeral eulogy. In 99 he was associated with Pliny in the prosecution of a great political offender, Marius Priscus, under whom the provincials of Africa had suffered grievous wrongs. The prosecution was successful, and both Tacitus and Pliny received a special vote of thanks from the senate for their conduct of the case. It would seem that Tacitus lived to the close of Trajan's reign, as he seems4 to hint at that emperor's extension of the empire by his successful Eastern campaigns from 115 to 117. Whether he outlived Trajan is matter of conjecture. It is worth noticing that the emperor Tacitus in the 3rd century claimed descent from him, and directed that ten copies of his works should be made every year and deposited in the public libraries. He also had a tomb built to his memory, which was destroyed by order of Pope Pius V. in the latter part of the 16th century.

Pliny, as we see clearly from several passages in his letters, had the highest opinion of his friend's ability and worth. He consults him about a school which he thinks of establishing at Comum (Como), his birthplace, and asks him to look out for suitable teachers and professors. And he pays5 him the high compliment, "I know that your Histories will be immortal, and this makes me the more anxious that my name should appear in them."

The following is a list of Tacitus's remaining works, arranged in their probable chronological order, which may be approximately inferred from internal evidence:—(1) the Dialogue on Orators, about 76 or 77; (2) the Life of Agricola, 97 or 98; (3) the Germany, 98, published probably in 99; (4) the Histories (Histories), completed probably by 115 or 116, the last years of Trajan's reign (he must have been at work on them for many years); (5) the Annals, his latest work probably, written in part perhaps along with the Histories, and completed subsequently to Trajan's reign, which he may very well have outlived.

The Dialogue on Orators discusses, in the form of a conversation which Tacitus professes to have heard (as a young man) between some eminent men at the Roman bar, the causes of the decay of eloquence under the empire. There are some interesting remarks in it on the change for the worse that had taken place in the education of Rome now, the style of the Roman orator is far more Ciceronian than that of Tacitus's later work, and critics have attributed it to Quintillian; but its genuineness is now generally accepted. It is noticeable that the mannerisms of Tacitus appear to develop through his lifetime, and are most strongly marked in his latest books, the Annals.

The Life of Agricola, short as it is, has always been considered an admirable specimen of biography. The great man with all his grace and dignity is brought vividly before us, and the sketch we have of the history of our island under the Romans gives a special interest to this little work.

The Germany, the full title of which is "Concerning the geography, the manners and customs, and the tribes of Germany," describes with many suggestive hints the general
Tacitus, Marcus Claudius

character of the German peoples, and dwells particularly on their fierce and independent spirit, which the author evidently felt to be a standing menace to the empire. The geography is its weak point; much of this was no doubt gathered from vague hearsay. Tacitus dwells on the contrast between barbarian freedom and simplicity on the one hand, and the servility and degeneracy of Roman life on the other. The Histories, originally composed in twelve books, brought the history of the empire from Galba in 69 down to the close of Domitian's reign in 97. The first four books, and a small fragment of the fifth, giving us a very minute account of the eventful year of revolution, 69, and the brief reigns of Galba, Otho and Vitellius, are all that remain to us. In the fragment of the fifth book we have a curious but entirely inaccurate account of the Jewish nation, of their character, customs and religion, from a cultivated Roman's point of view, which we see at once was a strongly prejudiced one.

The Annals—a title for which there is no ancient authority, and which there is no reason for supposing Tacitus gave distinctively to the work—record the history of the emperors of the Julian line from Tiberius to Nero, comprising thus a period from A.D. 14 to 68. Of these, nine books have come down to us entire; of books v., xi. and xvi. we have but fragments, and the whole of the reign of Galba (Caligula), the first six years of Claudius, and the last three years of Nero are wanting. Out of a period of fifty-four years we thus have the history of forty years.

The principal MSS. of Tacitus are known as the "first" and "second" Medicean—both of the 10th or 11th centuries. The first six books of the Annals exist nowhere but in the "first Medicean" MS., and an attempt was made in 1878 to prove that the Annals are a forgery by Poggio Bracciolini, an Italian scholar of the 15th century, but their genuineness is confirmed by their agreement in various minute details with coins and inscriptions discovered since that period. Moreover, Ruodulphe, a monk, writing in the 9th century, shows that he is acquainted with a MS. of Tacitus containing at least the two first books. Add to this the testimony of Jerome that Tacitus wrote in thirty books the lives of the Caesars and the evidence of style, and there can be no doubt that in the Annals we have a genuine work of Tacitus.

Much of the history of the period described by him, especially of the earlier Caesars, must have been obscure and locked up with the emperor's private papers and memoranda. As we should expect, there was a vast amount of floating gossip, which an historian would have to sift and utilize as best he might. Tacitus, as a man of good social position, no doubt had access to the best information, and must have talked matters over with the historians who were then several writers and chroniclers, whom he occasionally cites but not very often; there were memoirs of distinguished persons—those, for example, of the younger Agrippina, of Thrasea, and Helvidius. There were several collections of letters, like those of the younger Pliny; a number, too, of funeral orations; and the "acta senatus" and the "acta populi" or "acta diurna," the first a record of proceedings in the senate, the latter a kind of gazette or Journal. Thus there were the materials for history in considerable abundance, and Tacitus was certainly a man who knew how to turn them to good account. He has given us a striking, and on the whole a doubtless true, picture of the empire in the 1st century. The rhetorical tendency which characterizes the "silver age" of Roman literature, given perhaps exaggerated expression to his undoubtedly strong sense of the badness of individual emperors, but he assuredly wrote with a high aim, and we may accept his own account of it: "I regard it as history's highest function to rescue merit from oblivion, and to hold up as a terror to base words and actions the reproach of posterity." He is convinced of the degeneracy of the age, though it be relieved by the existence of truly noble virtues: he connects this degeneracy more or less directly with the

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2 Ann. iii. 65.
3 Dill, Roman Society from Nero to Marcus Aurelius, Bk. i. ch. i.
4 Ann. vi. 21, 22.
TACNA—TACTICS

had considerable literary culture, and was proud to claim descent from the historian, whose works he caused to be transcribed at the public expense and placed in the public libraries. Tacitus possessed many admirable qualities, but his gentle character and advanced age unfitted him for the throne in such lawless times.

See Life by Vopiscus in Historiae Augustae Scriptores; also Eutropius, ix. 10; Aurelius Victor, Caesares, 36; Zonaras xii. 28; H. Schiller, Geschichte der römischen Kaiserzeit, i. 1883; Pauly-Wissowa, Realencyclopädie, iii. 2871 ff.

TACNA, a northern province of Chile, in dispute with Peru from 1803 onwards, bounded N. by Peru, E. by Bolivia, S. by Tarapaca, and W. by the Pacific. Area, 9251 sq. m. Pop. (1895) 24,160. It belongs to the desert region of the Pacific coast, and is valuable because of its deposits of nitrate of soda and some undeveloped mineral resources. There are a few fertile spots near the mountains, where mountain streams afford irrigation and potable water, and support small populations, but in general Tacna is occupied for mining purposes only. None of its streams crosses the entire width of the province; they are of their inhabitants to determine what they would remain with Chile or return to Peru, the country acquiring the two provinces in this manner to pay the other $10,000,000. At the termination of the period Peru wished the plebiscite to be left to the original population, while Chile wanted it to include the large number of Chilean labourers sent into the province. Chile refused to submit the dispute to arbitration, and it remained unsettled. Meanwhile Chile expelled the Peruvian priests, and treated the province more like a conquered territory than a temporary pledge.

TACOMA, a city and sub-port of entry, and the county-seat of Pierce county, Washington, U.S.A., on Commencement Bay of Puget Sound, at the mouth of Puyallup river, about 80 m. from the Pacific coast, and about 23 m. S.S.W. of Seattle. Pop. (1890) 36,006; (1900) 37,714, of whom 11,032 were foreign-born (including 1603 Swedes, 1534 English-Canadians, 1474 Norwegians, 1424 Germans, and 1523 English; (1910, U.S. census) 53,743. Tacoma is served by the Northern Pacific, the Chicago, Milwaukee & Puget Sound, and the Tacoma Eastern railways; the Chicago, Burlington & Quincy railway operates through trains to and from Missouri river points and Tacoma, and over the Northern Pacific tracks. Other important lines enter by the Great Northern and Oregon & Washington railways. There is electric railway connexion with Seattle. Tacoma is the starting-point of steamship lines to Alaska, to San Francisco, and to Seattle, Port Townsend, Olympia, Victoria, and other ports on Puget Sound. There are trans-oceanic lines to Japan and China, to the Philippines and Hawaii, and to London, Liverpool and Glasgow, by way of the Suez Canal. The city is situated on an excellent harbour and has 25 m. of waterfront. From the tidelands the city site slopes gradually to a plateau about 300 ft. high, commanding fine views of Puget Sound and its wooded islands, and parts of the Cascade and Olympic ranges. Tacoma is the seat of Whitworth College (1890, Presbyterian), the University of Puget Sound (1903, Methodist Episcopal), the Annie Wright Seminary (1884), a boarding and day school for girls, and the Pacific Lutheran Academy and Business College. The Tacoma High School has an excellent stadium for athletic contests, seating 25,000. The city has a Carnegie library (1899), with about 51,000 volumes. Among other public buildings are the opera house, and a city hall which are the rooms of the State Historical Society (organized, 1893; incorporated, 1897); the Federal Building; an armory; the Chamber of Commerce, and several fine churches. The Ferry Museum, founded by Clinton P. Ferry, has interesting historical and ethnological collections. In 1910 the city had seven public parks (1120 acres), including Point Defiance, a thickly wooded park (about 460 acres), and, in the centre of the city, Wright Park, in which is the Seymour Conservatory. Tacoma is a sub-port of entry in the Puget Sound Customs district (of which Port Townsend is the official port), which is second only to San Francisco on the Pacific coast in the volume of foreign trade. The city has a large jobbing trade, a coal supply from rich deposits in Pierce county, and abundant water-power from swift mountain streams, which is used for generating electricity for municipal and industrial use. In 1900 and in 1905 Tacoma ranked second among the cities of the state in the value of factory products. Lead smelting and refining (by one establishment) was the most important industry in 1905; lumber, timber and planing mill products, valued at $3,407,951, were produced in that year, and flour and gist mill products, valued at $4,205,873. Other important manufactures were furniture, ships and boats, railway cars (the Chicago, Milwaukee & Puget Sound and the Northern Pacific systems having shops here), engines, machinery, shoes, water pipes, preserves and beer. In 1905 the total value of the factory products was $12,501,816, an increase of 121.4% since 1900. The assessed property valuation of the city in 1909 was $54,226,261, being about 42% of the actual valuation.

The site of Tacoma was visited by Captain George Vancouver in 1792; Commencement Bay was surveyed for the United Port government by Lieutenant Charles Wilkes in 1841, and the present city was founded by General Morton Matthew McCarver in 1868 and was at first called Commencement City. That name was soon changed to Tacoma, said to be a corruption of Ta-ho-ma or Ta-ho-bet, Indian terms meaning "greatest white peak," the name of the peak (14,526 ft.), also called Mt. Rainier, about 50 m. S.E. of the city. General McCarver's original plat included what is now the first ward of the city, and is called the Old Town. In 1873 the Northern Pacific railway (completed in 1887) established its terminal on Commencement Bay, and named it New Tacoma. A town government was formed in 1874, the place became the county-seat in 1880, and in 1883 the two "towns" were consolidated and incorporated as a city under the name Tacoma. In 1900 a new city charter was adopted under which the city government is vested in five commissioners (one of whom acts as mayor), each in charge of a city department.

TACTICS (Gr. τακτική, sc. τέχνη, from τάσις, to arrange in order of battle). It may perhaps seem superfluous at the present time to emphasize the distinction between strategy and tactics. Moreover, definitions are rarely quite satisfactory, for they can seldom be perfectly clear and at the same time perfectly comprehensive. Yet, since it is necessary that the parties to any discussion should have some common starting-point, it will be as well to begin by stating exactly what is meant to be included under the heading of this article.

Strategy (g.v.) is the art of bringing the enemy to battle on terms disadvantageous to him. Combined, or to use the phraseology of the Napoleonic era, "grand" tactics are the
methods employed for his destruction by a force of all arms, that is, of infantry (q.v.), artillery (q.v.) and cavalry (q.v.). Each of these possesses a power peculiar to itself, the full development of which depends to a greater or less degree upon the aid and co-operation of the other two. Now it is quite evident which is the force which can ensure this co-operation, and can produce harmonious working between the various components of that complex machine, a modern army, is the will-power of the supreme commander. It is, then, the sphere of the higher commander on the day of battle which is generally expressed by the term “combined tactics,” and which will be dealt with in this article. Yet it must not be understood that because the term higher, or supreme, commander is used that the theory of combined tactics may be safely neglected by those soldiers whose ambitions or opportunities do not seem to lead them to that position. In the British Army more than in any other, as the South African war showed, a comparatively junior officer may at any moment find himself placed in command of a mixed force of all arms, without any previous practical knowledge of how it should be handled. It will not then be possible to make the best use of such opportunities by the uneducated light of nature, and such theoretical knowledge as may have been gleaned from books and matured by thought will be of great value.

It is of the first importance that the commander of a mixed force should know the powers and limitations of the units under his control. Should he not be a master of his profession, he will at times demand more from his subordinates than they can reasonably be expected to perform; at other times he will miss his chances by ignorance of their capabilities. An uneducated commander may indeed be likened to an indifferent mechanic, who sometimes places an undue strain upon the engine he is supposed to control, and sometimes allows its precious powers to run to waste.

There is, however, a still stronger reason why all officers should study and understand tactics. In every battle situations arise of which the issue is decided by the promptitude and efficiency of the co-operation between the three arms. At such moments, an officer in charge of a battery of artillery, or of a squadron of cavalry, may find an opportunity of rendering valuable aid to his own infantry; and a knowledge of the tactics and training of the other arms may then be essential, for it will probably be necessary to act without instructions from superior authority.

But although the importance of studying tactics may be readily allowed, there would appear to be considerable diversity of opinion as to the best method of conducting that study. It is often confidently asserted that tactics cannot be learnt from books; and in support of this theory it is customary to adduce Napoleon’s well-known statement that tactics change every ten years. But if we examine the matter more closely, it will become evident that the changes which the great captain had in his mind were those of formations, due principally to improved weapons, rather than of the principles upon which combined tactics are based. Indeed, it could hardly be otherwise, for military history furnishes many instances of great changes which have been brought about by the introduction of new weapons, although separated in point of time by many centuries. The great similarity between Rossbach (q.v.), Austerlitz (q.v.) and Salamanca (q.v.) has often been quoted since Napoleon first drew attention to it, but a great deal more remarkable and instructive is the similarity between the battle of the Metaurus, which dealt the final blow to the hopes of Carthage in Italy, and Marlborough’s masterpiece, the battle of Ramillies (q.v.). In both cases the battle was lost through faulty dispositions before it had been begun. In both cases the ultimate loser took up a position behind a stream, thereby losing his mobility and voluntarily surrendering the initiative to an enemy who was not slow to take advantage of it. Precisely the same error was committed time after time by the Austrian generals who fought against Frederick, notably at Leuthen (see Seven Years’ War), a battle closely resembling both Ramillies and the Metaurus. Coming to a later date, we find the same error committed, with of course precisely the same result, in Manchuria, where the Russian generals repeatedly surrendered the initiative to their enterprise opponents, and allowed them to dictate the course of events. It is only when we have correctly understood that this is not a position that no commander should ever stand upon the defensive; rather it is meant that we should learn from history the proper method of doing so. This we cannot do better than by studying Wellington’s battles in the Peninsula, for never have tactics been brought to higher perfection. Although frequently compelled to adopt the defensive, he never surrendered the conduct of the battle to his enemy. Even when surprised and taken at great disadvantage by Soult at Maya (see Peninsular War), it can be seen how well lesser men would have been content to reinforce the threatened points, Wellington’s one thought was to discover where he could deal the most effective blow. Nearly a hundred years later and in a theatre of war many thousands of miles away, a very similar battle was fought out by Kuropatkin and Oyama, though on a vastly greater scale.

But history teaches us more than the methods of the great captains; for from it we may learn those changes which have been introduced into both organization and tactics by the improved weapons which science has placed in our hands, and thence the tactician may deduce the changes of the future.
more rifles into action than his opponent is able to do. From this it follows that the enveloping action will be the usual form of battle; and that although the extent of front may not always be so great, in proportion to the numbers engaged, as on the battlefields of South Africa or even of Manchuria, the general tendency of modern invasion will undoubtedly be to increase the area of the battlefield.

If then we are right in supposing that the front of an army in action will cover many miles of country, it necessarily follows that in approaching the field many roads will be used. Here the duties of the cavalry will begin; for the commander who can discover earliest the approaches by which the flank detachments of his opponent are moving, is obviously in the best position to form his plans for envelopment. Here we are verging upon the strategic use of cavalry. Cavalry.

In modern conditions which, in the main, that arm is almost merged in the strategic use. No doubt it has always been the object of the wise commander to attain his enemy’s flank; yet, since, owing to the increased range of small-bore rifles, turning movements like those which formed such a marked feature of Frederick the Great’s battles can no longer be made after the infantry troops have come into contact, they must be prepared as soon as the necessary information has been obtained. Moreover, nothing must be left to chance, for it can hardly be denied that if the battle of Gravelotte were to be fought again to-morrow, the failure to locate the right flank of the French army would have even more serious consequences than were actually the case (see Mazz: Battles of 1870). Such mistakes can only be avoided by obtaining good information, and thus it will be seen that the chances of bringing off a successful converging attack are greatly in favour of the commander who is best served by his cavalry. But, as the opposing forces draw near, a gradual change comes over the duties of the mounted arm, for it must then protect the troops in rear from observation, so that the preparations for envelopment may be concealed. To this end the occupation of points of tactical vantage, such as hills, woods, and similar conditions which the use of cavalry can employ, or the outflanking columns march in security, becomes its chief aim. In the next stage, i.e., when one or other army is forced to stand on the defensive, reconnaissance of the position held will be the duty of the cavalry of the attack.

So far its functions are clear enough, but when the preparations for the infantry attack have been completed we have practically nothing to guide us. Unfortunately the two most recent wars, in South Africa and Manchuria, have taught us but little of the handling of cavalry in battle. In South Africa the peculiar characteristics of the Boers gave no scope for cavalry action; while in Manchuria the theatre of operations was practically dead between the mountains and the Liao river, which afforded no room for manoeuvre. With regard to the handling of cavalry in conjunction with the other arms there is, therefore, more room for diversity of opinion than is the case with either infantry or artillery. Time alone will show the real capabilities of the cavalry of to-day, and the opening battles of the next great campaign in Europe will bring about many changes. Meanwhile such experience as we have to guide us seems to indicate that the development of fire has rendered cavalry, even when highly trained, almost ineffective as a weapon. It is obvious to see, therefore, that the tactical use of its cavalry is clearly directed against infantry than it was formerly. Throughout the war in Manchuria, we constantly find the Russian cavalry reconnaissance checked by Japanese infantry; and on the other hand the weak Japanese cavalry closely supported by infantry was fairly effective. The circumstances were of course peculiar, but the inference appears to be that unsupported mounted troops cannot be expected to achieve important results except when acting against similar bodies of the enemy; that is to say, under conditions which fall outside the province of combined tactics. Moreover, since well-posted infantry can easily hold in check greatly superior numbers of cavalry, it would certainly seem that wide tactical movements, intended to threaten the enemy’s line of retreat, are more likely than not to result in prodigious waste of strength. This being the case it would seem that the best use of cavalry on the battlefield will be on the flanks of, and in close touch with, the infantry, where each arm can render support to the other. On the defensive the tactical action of cavalry is not less important than on the offensive.

Accompanied and strengthened by horse artillery it may occupy tactical points either the flanks of the main position or thrown out well to the front. Aided by smokeless powder, magazine rifles and quick-firing guns, numbers may be concealed and the attacking enemy may be induced to deploy his troops and to reveal his movements prematurely. Should he do so, much of his advantage will be gone, for the defender will be greatly helped in his preparations for the counter-attack, the most effective weapon at his command.

But when at last the slower moving bodies of infantry and artillery come into contact, the battle enters upon a new phase. It has long been recognized that the first stroke towards the attainment of fire superiority over a vigilant enemy is a vigorous artillery bombardment. For many years this action of the artillery was regarded merely as a preliminary to the infantry attack; and it was not until the rude awakening of the early battles of the Boer war, that it was realized in England that unless the infantry co-operate, the artillery is not likely to produce any result. If the attacking infantry is kept at such a distance from the position that it cannot pass quickly to the assault, the enemy will retain his troops under cover during the cannonade, perhaps even leaving his trenches unoccupied and presented to the main attack. Indeed, a most instructive instance of this very line of action is furnished by the battle of Ta-shih-chiao. There the right of the Russian line was held by the infantry of the 1st Siberian army corps, supported throughout the greater part of the day by only two batteries of artillery. So heavy was the fire of the Japanese artillery in this portion of the field that General Stakelberg, the commander of the Russian corps, sent word to his superior officer that he had not considered it advisable to occupy his trenches, and that should he be compelled to do so his troops must suffer. But things turned out the Japanese infantry did not deliver any attack against the Russian right, the defenders remained under cover, and the losses inflicted by the bombardment were almost negligible. Other instances might be quoted, but enough has been said to prove that to render the artillery bombardment effective the infantry must co-operate; for by this means only will the enemy be compelled to man his defences, to show himself above his parapets, and to expose himself to shrapnel fire.

Here arises one of those questions which are the outcome of modern science, but which have not been finally answered by war. As a result of the immense amount of observational and practical work, it is now possible for field artillery to make use of indirect fire from behind cover. Against stationary objects, such as a battery in action, the results achieved by this method are as good as those which are obtained by firing directly over the sights. At the same time the control of indirect fire is slow, and it still remains to be proved whether it can be used satisfactorily against quickly moving targets. If it should be found that, in spite of scientific aids, the artillery of the defence can be made to leave its cover and still be successful, the advantage of the advance of the infantry, the importance of the aid which one arm can render to the other needs no demonstration. After all, however, the silencing of the guns of the defence is but a means to an end, and the principal aim of the guns of the attack is to enable the infantry to get sufficiently close to the position to deliver an assault; for the infantry assault is the crowning act of battle. Similarly the gunners of the defence must never forget that their great object is to repel this same assault. The artillery duel, therefore, is but a phase. Sooner or later one side will gain the upper hand. Then it must be decided whether the inferior artillery can best serve the interests of the infantry by continuing the duel, or by ceasing to fire until it can find some more vulnerable target.

Should the guns of the defence have proved inferior to those
of the attack, it will probably be wise for them to wait until the advancing columns of infantry have deployed; should the positions be reversed, it will be well for the gunners of the attack to leave their weapons and to remain under cover until such time as their opponent is compelled to turn his attention to repelling the infantry. So great is the power of the modern rifle and quick-firing gun that infantry, unsupported by artillery, has but little chance of carrying a position held by determined men, and it is for this reason, and not with a view to saving their own lives, that the gunners must reserve themselves until the last moment. They must be ready and alert when their services are most required; moreover their final positions should be selected with a view to keeping up their fire until the last possible moment. Indeed they must often run the risk of injuring some of their own troops when firing over their heads. Sometimes a favourable position may be found for the artillery upon the flank of the attack. Such positions have a double advantage. Not only do they bring enfilade or oblique fire to bear upon the enemy’s trenches, but they are able to continue the bombardment much longer than is possible when posted directly in rear of the assaulting columns. But whatever the position of the artillery may be, one thing is certain: namely, that the infantry of the attack can hardly hope to succeed if its own guns have been disabled while striving to maintain an unequal duel. Thus in the earlier stages of battle the action of the artillery will be characterized by a certain degree of prudence. The Commander in chief will strive to conceal the true position of their batteries, and will not employ more guns than are absolutely necessary for the attainment of any particular object they may have in hand. But when the preliminary stages are over, and the infantry is finally committed to the assault, a change must come over the conduct of the artillery. In this final phase there is no longer room for prudence. Indirect fire is out of place, and the duty of the guns cannot be better described than in the words of the French text-books, "to follow the infantry in a series of rapid advances, by éclatons, without hesitating to come into action within the shortest range of the battle-line."

But when the time comes to follow up the infantry the skill and knowledge of the battery commander are most highly tried. Concealment is no longer his object, and he must trust all to his offensive power. To make the most of this power it is of the first importance that his guns should be brought at once into positions whence they can be effectively used; for, quoting again from the French instructions, "considerations of concealment lose their importance for artillery that is told off to follow up the movements of the infantry. In this case artillery must not fear to come into action in the open, although in this situation a battery usually forfeits its freedom of movement."

Even the introduction of shielded guns will not affect this loss of mobility, for batteries which are brought to within effective rifle range of the defence must expect to lose a considerable proportion of their horses. Hence it follows that although the position into which they are brought in support of infantry may prove to be unsatisfactory it cannot be changed; their assistance will be lost at the most critical moment, with the result that the attack, deprived of their support, will probably fail. In France, where artillery tactics have perhaps received even more attention than in other countries, the necessity for this close support by guns has been so far recognized that the batteries of the attack have been divided into two distinct portions. The duties of one section have already been described. Those of the second are:-(1) To continue to shell the enemy’s position as long as possible without danger to the advancing infantry; (2) To engage the hostile infantry "avec la dernière énergie"; (3) To watch carefully for counter-attack.

It is perfectly clear that the performance of these duties, in fact, the application of the whole principle of co-operation between infantry and artillery, is intimately connected with the use of ground which brings the superior numbers and must therefore be deeply studied. If we look back upon history, we cannot but be struck by the important part that the appreca-
reinforcing his own threatened flank; that is to say, that he would have conformed to the movements of his adversary and permitted him to dictate the course of events. This was not the Japanese system. Oyama had no intention of fighting a purely defensive action. He knew that his opponent had massed his strength upon his left, and it was only reasonable to assume that if one portion of his line was strong, some other portion must be weak. The actual point first selected by Oyama for decisive attack was the centre of Kuropatkin's line. Troops were deployed, and the scales were ultimately turned by an almost unexpected success against the Russian right. The resulting victory was certainly less complete than would have been the case had the Japanese commander been able to carry through his original plan, but it is obvious that a force operating against the centre of a hostile line must itself be in danger of envelopment; and in this case it is interesting to note that the battle was really decided by an outflanking movement by a weak force, while the central attack in considerable strength achieved but little. Oyama's conduct of this battle has been much criticized by writers he has been blamed for leaving his own defensive line too weak; by others he has been accused of attempting too much. These are difficult questions, requiring detailed examination; for the present it is sufficient to note that, although inferior in numbers, he succeeded in accomplishing an enveloping movement which forced his enemy to retire. The fact is that by superior skill, although actually inferior in numbers, he succeeded in placing more rifles in the firing line than did his opponent. During a great part of this struggle, which lasted for five days, it would be difficult to say which side was on the defensive and which on the offensive. No doubt at the moment Kuropatkin was the assailant; it is equally certain that in the end it was Oyama who attacked; yet it would be impossible to say, as at Austerlitz and Salamanca, exactly at what moment the roles were exchanged.

If then we are justified in assuming that in the great battles of the future neither army will be acting entirely on the offensive or entirely on the defensive, it may seem idle to speculate as to whether the recent improvements in firearms and ballistics are in favour of one side or the other. In this connexion the lessons which may be learned from the South African and the Russo-Japanese wars are most instructive. After the former it was often urged that the conditions of modern battle are distinctly in favour of defensive tactics; in other words, that the force which awaits attack can develop the full power of each arm with greater facility than that which delivers it. This contention had much to support it, but it was not always realized that anything which gives new strength to the defence must at the same time add something to the advantages of the army which attacks. The outcome of the improvements in rifles, guns and powder is quite sufficient to make the unity of command, as a defensive method, quite as effective as, or more effective than, that of a previous epoch. To a certain extent this favours the defence. A much larger proportion of the available troops can be set free to act in reserve, and to deliver the counter-stroke, i.e. a much larger number than formerly can be employed by the defenders in attack. This is to the good. But the assailant profits in almost equal ratio. His strength has always lain in power of manœuvring, of hiding his movements, and of massing suddenly against some weak point. To-day this power is greater than ever before. The increased power of the rifle renders it comparatively easy for him to form an impenetrable barrier with part of his force, perhaps with his cavalry supported only by a small proportion of his infantry, behind which the remainder can move unobserved. Moreover, the object of the assailant's manœuvres will be to place portions of his forces on the flank or flanks of the position he is attacking. If he can accomplish this, the effect, moral and physical, of the enfilade fire which is brought to bear upon the enemy's front will be far greater than that which attended a similar operation when fire was of less account. In addition to this increased facility for manœuvring, the great strength of the local defensive confers upon the assailant the power of denuding certain portions of his line of troops, in order that he may mass them for offensive action elsewhere. Here again the study of ground and a true knowledge of the capabilities of the various arms are of supreme importance. Well-placed artillery, aided by machine guns, may enable a comparatively weak force of infantry to hold a wide extent of front, provided that each arm is able to use its strength to the fullest extent. In this way the skilful commander can turn each feature of the battlefield to account and can release a greater number of his troops for the all-important enveloping movements. The principal power which enabled Oyama to outflank the Russian XVII. Corps at the battle of Sha-ho, for he was able to weaken his own right to an extent which a very few years ago would have been impossible. In short, the process of envelopment is more easy than it used to be; and, envelopment, which means that the enemy is under fire from several directions, is much more effective now than in the past.

In Germany this fact has long been recognized, and it was for this reason that German soldiers refused to accept the conclusions at which many English military critics arrived after the African war. Under the influence of their German teachers the Japanese never hesitated to attack, even with inferior numbers, and to make the envelopment of the enemy more certain they went into battle practically without reserves. In this respect the war in Manchuria marks an epoch in the history of tactics; and for that reason, if for no other, it should be carefully studied. Moreover, it emphasizes an important difference in the handling of large and small armies which is of quite recent origin. Until a few years ago all continental armies were organized in army corps. These corps were composed of two or three infantry divisions with a large body of corps artillery. In the Russo-Japanese war, the line of action through which this artillery was to form the nucleus of a reserve which could be retained under the hand of the corps commander to be used as required. That is to drive home the infantry attack, to deliver or repel a counter-attack, or, but very sparingly, to strengthen a weak point in the defensive line. With the development of the enveloping battle, it was soon realized in Germany that corps artillery was an anachronism, for the distances are now so great that reserve artillery can hardly be moved to the particular part of the battlefield where its services are required in time to be of any use. Thus the corps artillery was first split up among the divisions, and soon a number of divisional reserves took the place of the great central body, while the corps commander retained a comparatively small number of troops under his own hand. In this way the control of the supreme commander over the course of the battle is greatly weakened and the chance of correcting any error in the original plan is diminished. It had long been realized that errors in the strategic deployment of troops were almost impossible to correct; and now it came to be seen that this was equally true of the tactical deployment. Just as under modern conditions even Napoleon could hardly have recovered from errors like those which marked the opening phases of the Eckmühl campaign (see NAPOLEONIC CAMPAIGNS), so the most brilliant genius will no longer be sufficient to win battles if the original plan is not correct. It was upon this theory that the Japanese commanders planned their battles, and it was very soon proved that they had the courage of their convictions. For the first time it was seen that battles were no longer won by the general who husbanded his reserves, but by him who first got every available man into the firing line. But, while giving Oyama, Kurokawa and Kuropatkin much credit for the strength of mind which enabled them to divest themselves of reserves when their battles were far from being won, we must also remember that they were fighting an enemy who, like the Boers, were incapable of organizing a really decisive counter-stroke. For English soldiers this point has a peculiar interest, as it has a very distinct bearing upon the tactics of our own army. From what has already been said it is, or should be, clear that the value of numbers upon the battlefield is greater now than formerly; for, granting that the leadership on either side is equally skilful, the chances of envelopment are in favour of him who commands the greater number of men. Owing
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to our geographical position and to the conditions under which we live, the number of British troops available for employment in any war against a continental Power will almost certainly be inferior to that which can be employed against us. It is of course true that we should never engage in operations on the continent of Europe except in alliance with some other Power; but it is quite possible that the British army might be entrusted with the execution of the three definite tasks which, while part of a general strategical scheme, would involve completely independent action. It is under such circumstances as these that we must be prepared to encounter troops which in leadership and training will be at least the equal of our own, and in numbers will probably be superior to them. In these circumstances our chances of envelopment will not be great, but this must by no means be taken to mean that our chances of success are to be despised of. Far from it. In the first place strategy may induce the enemy temporarily to divide his forces, and thus afford favourable opportunity for an effective blow. Failing this, it remains to be considered how a general may best employ inferior numbers with a reasonable hope of gaining a tactical victory. To this the answer must be that his best, indeed his only, chance of victory lies in the counter-stroke.

In France this fact has received due recognition, and since that country is in the unfortunate position of having to be prepared to encounter superior numbers, the training and organization of her armies differ essentially from those of her most formidable neighbour. Acknowledging that at the outset of a war she stands upon the defensive, she has endeavored to develop her power of manoeuvre and of delivering a strategic counter-stroke. With this object her armies move in deep formations on a comparatively narrow front, covered by strong advanced guards. Thus, in the earlier stages, they are much less committed to a definite line of action than are armies moving upon a widely extended front, and, provided intelligence is received in time, they can be massed quickly against the enemy’s flanks. Similarly in the later stages she trusts to the tactical counter-stroke, and hence the corps artillery, which has been abandoned in Germany for reasons which have already been given, is still retained in France.

In the foregoing pages the question was raised as to whether the great tactical counter-strokes of the past are still possible under modern conditions. Unfortunately the battles in Manchuria afford no instance of a successful counter-stroke, for the Sha-ho is more an example of an encounter action than of a carefully conceived counter-attack. In these circumstances we are forced to rely upon theory; but theory based upon a correct understanding of the past should form no uncertain guide to the formation of the future. Then are the principles upon which our theory is to be based? First, that the defensive battle is only a step towards assuming the offensive. Secondly, that the only means of assuming the offensive with success is the counter-stroke. Thirdly, that the counter-stroke, in at least nine cases out of every ten, should aim at the envelopment of the attack. From these premises it follows that the most effective form of the defensive battle will be that which compels the enemy to deploy his forces and then uses the reserve to envelop one or both of his flanks. Since, however, modern battles are fought over a very wide extent of front, it necessarily follows that the possibility which the defence possesses of successfully enveloping the attack must depend to a very great extent upon the correct disposal of the reserves when drawing up the original line of battle. Just as the chances of making the best use of superior number in the attack depend upon a correct strategical deployment at the commencement of a campaign, so the chances of a successful counter-stroke depend upon a correct distribution of troops at the commencement of an action. Hence we see that the most important point which a general who finds himself compelled to take up a defensive position has must be placed at grave disadvantage, the other aid he hopes eventually to seize the offensive. One thing is clear, namely, that the worst place for men who are destined to envelop one or other flank of the attack must be behind the centre of the defensive line. Time alone must render such a position unsuitable, for it must entail a march of many hours, if not of days, before the troops can reach the point from which they are to be launched to the attack. This being so, it would seem that the right place for the general reserve of the defending army under modern conditions must be on one or other of the flanks; and, always bearing in mind that the chief object to be attained is regaining the initiative, we are driven to the conclusion that the best place is that flank from which an effective blow can be dealt at the assailant’s most vulnerable point, that is to say, at the flank through which his line of communication may be most easily attained. If this theory be correct, yet another point has been established, namely, that the main plan of the decisive counter-stroke must be decided before, and not after, the first shot in the general engagement has been fired. Under these conditions when to-day it is no use waiting for the enemy to make a mistake, for the odds against it being detected are great. A hundred years ago armies manoeuvred in full view of one another, and mistakes could be perceived by every company officer on either side. Now all this is changed, and the difficulties of the defence are increased by the fact that although the attack may make many blunders, it will do so at such a distance from the defence as to render them comparatively secure from detection. Having prepared his counter-stroke, the chief point towards which the commander of the defence must direct his attention after battle has been decided. Needless to say that the chances of success will be enormously increased if the counter-stroke is unexpected, for in war the demands which surprise makes upon moral are quite out of proportion with the physical danger which men are called upon to undergo. If the defence is ever to be converted into attack, it would appear: (1) That the counter-stroke must be carefully planned, and must form an integral part of the original scheme of defence. (2) That it must be properly directed. (3) That it must be correctly timed. (4) That if possible it must come as a surprise. Of these conditions, the first three are dependent for their fulfilment upon good intelligence, careful preparation, and correct appreciation of the enemy’s plans; but it is in the fourth that the inspiration of the really great commander will be most conspicuously displayed on the day of battle, and the greater the numbers under his command the more difficult his task must be.

When, as at the Sha-ho and Mukden, the troops on either side are numbered by hundreds of thousands, the commander-in-chief cannot hope to keep the direction of events in his own hands very long; but when tens of thousands only are engaged, the whole battle can be controlled as well and as well as the past. The extent of front will certainly be greater than it was formerly, but against this may be set the fact that improved communications by telegraph and telephone enable the commander to keep in touch with events in a manner which until recently was quite impossible. It is for this reason that the earlier and smaller battles of the Russo-Japanese War contain many lessons which are of more use to British soldiers than are those which may be learned from the great struggles which took place later on. But in all battles, whether great or small, the first requirement is a commander who possesses sufficient steadiness of character to carry out on the day of battle the plans he has formed beforehand. War is like a game of bridge, for the most successful player is not he who best remembers the fall of the cards or who knows the correct leads by heart, but he who can decide upon and carry out the plan best suited to the strength of his hand. In both cases a bad plan is better than none, and vacillation even between two good plans is fatal. In both cases side issues are constantly arising which tend to obscure the main issue. On the battlefield the side-issue is save the form of gas in the shape of a large cloud from various quarters, all of which must tempt the supreme commander to weaken the general reserve which has been set aside for his decisive stroke. To such appeals he must turn

Economy of force.
a deaf ear, confident in the knowledge that the best way of assisting his sorely-pressed troops is by a vigorous blow at his enemy's weakest spot. Hence it follows that the force which is to deliver the blow must be kept perfectly distinct from the local reserves under subordinate commanders, which are held in readiness to strengthen weak places in the offensive line, or to deliver local counter-attacks. It also follows that this force must comprise every man who can be spared from the passive portion of the defence, and that to produce the fullest results there must be complete co-operation between the three arms.

It is in this way that cavalry will actually be used. It will then be the task of the cavalry to seize the initiative, and to bring it to bear upon the enemy with the greatest possible effect in the limited time which will be available for the purpose. For this purpose the cavalry will have to be concentrated on the part of the line which is already in the main line of advance. To do this, the cavalry will first have to secure the main line of advance, and then to concentrate its forces at the point of attack. It will then be necessary to decide whether the attack will be made against the main line of advance or against the flank. If the attack is made against the flank, it will be necessary to make sure that the flank is secure, and that the enemy's attention is fixed upon it. If the attack is made against the main line of advance, it will be necessary to make sure that the main line of advance is secure, and that the enemy's attention is fixed upon it. In either case, it will be necessary to make sure that the enemy's attention is fixed upon the point of attack, and that the enemy's forces are not diverted to another point.

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no cartilages being formed in this organ, which is destined to disappear with the gills. The hind limbs appear as buds at the base of the tail, and gradually attain their full development during the tadpole life. The fore limbs grow simultaneously, and even more rapidly, but remain concealed within a diverticulum of the branchial chambers until fully formed, when they burst through the skin (unless the leaf spiraculum be utilized for the egress of the corresponding limb).

The above description applies to all European and North American tadpoles, and to the great majority of those known from the tropics. The following types are exceptional.

The circular lip is extremely developed in Megalophrys montana, and is expanded and prolonged in the inner radiating series of horn teeth, acts as a surface-float, when the tadpole rests in a vertical position; the moment the tadpole sinks in the water the funnel collapses, taking on the form of a pair of horns, curling backwards along the side of the head; but, as they touch the surface again, it re-expands into a regular parachute.

In some species of Ranidae and Stauroides inhabiting mountainous districts in south-eastern Asia, the larvae are adapted for life in torrents, being provided with a circular adhesive disc on the ventral surface behind the mouth, by means of which they are able to anchor themselves to stones.

Several American and Malay Enyostomatids of the genera Callula and Microhyla, the tadpoles are remarkably transparent, and differ markedly in the structure of the buccal apparatus. There is no funnel-shaped lip, nor horn teeth, and no beak. The spiraculum is not a cleft, but a vent. In the Aglossid Xenopus, the tadpoles are likewise devoid of circular lip, horn teeth, and beak, and they are further remarkable in having no tail-folds. There are, however, tentacles barbel on each side of the mouth, which appears to represent the "balance" of Urodèle larvae; the spiraculum is paired, one on each side; the fore limbs develop externally, like the hind limbs.

Some tadpoles reach a very great size. The largest, that of Pseudis paradoxus, may measure a foot, the body being as large as a turkey's egg. The perfect frog, after transformation, is smaller than the larva. Pseudis was first described by Marie Sibylle de Mérian (1647-1717), in her work on the fauna of Surinam (published first in 1705 at Amsterdam, republished in Latin in 1719), as a frog changing into a fish. Among European forms, some tadpoles of Pelobates attain a length of seven inches, the body being of the size of a hen's egg. The tadpole of the North American bull-frog measures six inches, and that of the Chilian Calyptocheilus gayi seven and a half inches.


TAEL (Malay tael, tabil, weight, probably connected with Hind. iola, weight), the name current in European usage for the Chinese lang or ounce, the former of fine uncolored silver being the monetary unit throughout the Chinese empire. The tael is not a coin, the only silver currency, apart from imported dollars, being the ingots of silver known as "syce"; the only other native currency is the copper "cash." As a money of account the tael is divided into 10 mace (isten), 100 conditioner or caneonder (jun), 1000 li. The value varies with the price of silver. The "Halkwan tael," i.e. the custom-house tael, that in which duties are paid to the Imperial Maritime Customs, is 58-57 grains Troy, the value of which varies; thus it was reckoned at 38. 1/3d. in 1903, 32. 3/4d. in 1906, 36. 3d. in 1907, and 36. 3d. in 1908. The "Fez tael" is 38. 2/3d. in 1903, 32. 3/4 in 1906, 36. 3d. in 1907, and 36. 3d. in 1908.

TAENIA (Gr. taenia, ribbon, fillet), the term in architecture given to the projecting fillet which crowns the architrave of the Greek Doric order.

TAFILALT, or Tafilet (i.e. "The Country of the Filâl"), as its inhabitants are called, because descended from the Arabian tribe of Filâl, settled here in the 11th century), the most important oasis of the Moroccan Sahara, ten days' journey south of Fez, across the Atlas. It is celebrated for its large and luscious dates, to the successful cultivation of which, soon after the arrival of an ancestor of the reigning dynasty of Morocco (hence called the Filâl Sharifs, i.e. descendants of Mahomet) the country owes its rise to power. Since 1648 it has been the custom of Moorish sultans to despatch superfluous sons and daughters to Tafilet, and as the males are all sharifs, the fanaticism against Europeans is comprehensible. Instead of living in towns its bellicose inhabitants occupy isolated fortified buildings, and are constantly at war. In the central portion, formerly existed the town of Saglimosa, founded by the Moors in 787. It was on the direct caravan route from the Niger to Tangier, and attained a considerable degree of prosperity. It was destroyed at the end of the 11th century, but its ruins still extend five miles along the river bank.

The first European to visit Tafilet was Rene Caillie (1828), and the next Gerhard Rohlfis (1864). A later visit to the oasis by W. H. Harris is described in his book Taflet (London, 1895).

TAFT, LORADO (1860- ), American sculptor, was born at Elmwood, Illinois, on the 29th of April 1860. He graduated from the University of Illinois in 1879, and from 1880 to 1883 studied in the Ecole des Beaux Arts, Paris. In 1886 he became admitted at the Art Institute, Chicago, lecturing there, at the Chicago University, and elsewhere in the United States. He is the author of an exhaustive and authoritative work, The History of American Sculpture (1903). Among his works, in addition to much portraiture, are: "Sleep of the Flowers" and "Awakening of the Flowers," both made for the Columbian Exposition; "Despair" (1898); "Solitude of the Soul" (1900), and "Fountain of the Lakes" (1903).

TAFT, WILLIAM HOWARD (1857- ), the twenty-seventh President of the United States, was born in Cincinnati, Ohio, on the 15th of September 1857. His father, Alphonso Taft (1820-1901), born in Townshend, Vermont, graduated at Yale College in 1833, became a tutor there, studied law at the Yale Law School, was admitted to the Connecticut bar in 1838, removed to Cincinnati in 1839, and became one of the most influential citizens of Ohio. He served as judge of the Superior Court (1861-72), as secretary of war (1876) and as attorney-general of the United States (1876-77) in President Grant's cabinet; and as minister to Austria-Hungary (1882-84) and to Russia (1884-85).

William Howard Taft attended the public schools of Cincinnati, graduated at the Woodward High School of that city in 1874, and in the autumn entered Yale College, where he took high rank as a student and was prominent in athletics and in the social life of the institution. He graduated second (salutatorian) in his class in 1878, and began to study law in Cincinnati College, where he graduated in 1880, dividing the first prize for scholarship. He was admitted to the Ohio bar in 1880. For a few months he worked as a legal reporter for the Cincinnati Times (owned by his brother C. P. Taft), and then for the Cincinnati Commercial. Early in 1881 he was appointed assistant prosecuting attorney of Hamilton county (in which Cincinnati is situated), but resigned in 1882 on being appointed collector of internal revenue of the United States for the first district of Ohio. The work was distasteful, however, and in 1883 he resigned to return to the law. From 1885 to 1887 he served as assistant solicitor of Hamilton county, and in the latter year was appointed judge of the Superior Court of Ohio to fill a vacancy. He was elected by the people in the next year and served until 1890, when he was appointed solicitor-general of the United States by President Benjamin Harrison. His work in connexion with the drafting of the Sherman Anti-Trust Act and with the Bering Sea controversy attracted attention. In 1892 he was appointed a judge of the Sixth Circuit, United States Court, and became known as a fearless administrator of the law. Several decisions were particularly objectionable to organized labour. The first of these, decided in 1890, upheld the verdict of a jury awarding damages to the Moores Lime Company, which had sustained a secondary boycott because it had sold material to a contractor who had been boycotted by Bricklayers' Union No. 1. The second decision grew out of the attempt of the Brotherhood of Locomotive Engineers to prevent
other roads from accepting freight from the Toledo, Ann Arbor & North Michigan railroad, against which a "legal" strike had been declared. Judge Taft granted an injunction (7th March 1893) against the Pennsylvania railroad, making P. M. Arthur, chief of the Brotherhood, a party, and called Rule 12, forbidding engineers to haul the freight, criminal. During the great railway strikes of 1894 Eugene V. Debs, president of the American Railway Union, sent one Frank W. Phelan to tie up traffic in and around Cincinnati. The receiver of the Cincinnati, New Orleans & Texas Pacific railway applied for an injunction against Phelan and others, which was granted. Phelan disobeyed the injunction and on the 13th of July 1894 was sentenced to jail for six months for contempt. The doctrine that "the starvation of a nation cannot be the last word in industrial oratory" and "a combination" was announced, and Judge Taft said further that "if there is any power in the army of the United States to run those trains, the trains will be run." In 1896-1900 Judge Taft was professor and dean of the law department of the University of Cincinnati.

A movement to elect Mr Taft president of Yale University gained some strength in 1898-99, but was promptly checked by him, on the ground that the head of a great university should be primarily an educationalist. In 1900 he was asked by President McKinley to accept the presidency of the Philippine Commission charged with the administration of the islands. Though this was opposed to his principles and to the judgment of Mr Phelan, he did not believe that the inhabitants were capable of self-government, and he foresaw some of the difficulties of the position. Yielding, however, to the urgent request of the president and his cabinet, he accepted and served from the 13th of March 1900 to the 1st of February 1904. On the establishment of civil government in the islands, on the 4th of July 1901, he became governor, ex officio. The task of constructing a system of government from the bottom, of reconciling the conflicting and often jealously sensitive elements, called for tact, firmness, and deep knowledge of human nature, all of which Governor Taft displayed in a marked degree. (See PHILIPPINE ISLANDS.) The religious orders had been driven out during the insurrection, but held title to large tracts of land which many Filipinos and some Americans wished to confiscate. This delicate matter was arranged by Mr Taft in a personal interview with Pope Leo XIII. in the summer of 1902. The pope sent a special delegate to appraise the lands, and the sum of $7,250,000 was paid in December 1903. Mr Taft gained great influence among the more conservative Filipinos, and their entreaties to him to remain influenced him to decline the offer of a place on the Supreme bench offered by President Roosevelt in 1902.

Finally, feeling that his work was accomplished, Mr. Taft returned to the United States to become secretary of war from the 1st of February 1904. With a party of congressmen he visited the Philippines on a tour of inspection July-September 1905, and in September 1906, on the downfall of the Cuban republic and the intervention of America, he took temporary charge of affairs in that island (September–October). In the next year (March–April) he inspected the Panama Canal and also Cuba, and Porto Rico. He then visited the Philippines to open the first legislative assembly (16th October–December 1907), and returned by way of the Trans-Siberian railway. On this tour he visited Japan, and on the 2nd of October, at Tokyo, made a speech which had an important effect in quieting the apprehensions of the Japanese on the score of the treatment of their people on the Pacific coast.

With the approach of the presidential election of 1908, President Roosevelt reiterated his pledge not to accept another nomination, and threw his immense influence in favour of Mr Taft. At the Republican convention held in Chicago, in June, Mr Taft was nominated on the first ballot, receiving 702 out of 980 votes cast. James S. Sherman of New York was nominated for Vice-President. During the campaign many prominent labour leaders opposed the election of Mr Taft, on the ground that his decisions while on the bench had been unfriendly to organized labour. In the campaign Mr Taft boldly defended his course from the platform, and apparently lost few votes on account of this opposition. At the ensuing election in November, Taft and Sherman received 321 electoral votes against 162 cast for William Jennings Bryan, and John W. Kern, the Democratic candidates.

In his inaugural address (4th March 1909) President Taft announced himself as favouring the maintenance and enforcement of the reforms initiated by President Roosevelt (including a strict enforcement of the Sherman Anti-Trust Act, an effective measure for railway rate regulation, and the policy of conservation of natural resources); the revision of the tariff on the basis of affording protection to American manufactures equals to the difference between home and foreign cost of production; a reduction of the postal rates; the extension of the war of peace; postal savings banks; free trade with the Philippine Islands; and mail subsidies for American ships. He also announced his hope to bring about a better understanding between the North and the South, and to aid in the solution of the negro problem. In accordance with his pre-election pledge, Congress was called to meet in extra session on the 15th of March to revise the tariff. Hearings had been previously held by the Ways and Means Committee of the House of Representatives, and a measure was promptly reported. After passing the House it was sent to the Senate, where it was much changed. The final Payne-Aldrich Act was approved by the President on the 5th of August 1909, though in many respects it was not the measure he desired. The wish to meet people of the different sections of the country and to explain his position upon the questions of the day led the President to begin (14th September 1909), a tour which included the Pacific coast, the South-west, the Mississippi Valley and the South Atlantic states, and during which he travelled 13,000 miles and made 266 speeches.

Mr Taft delivered the Dodge lectures at Yale University in 1906 on the Responsibilities of Citizenship I published as Four Aspects of Civic Duty (1906). Some of his political speeches have been published under the titles Present Day Problems (1908), and Political Issues and Outlooks (1909).

TAGANROG, a seaport of southern Russia, on the N. shore of the Sea of Azov, in the Don Cossacks territory, some 170 m. S.E. of the town of Ekaterinoslav. It is built principally of wood, stands on a low cape, and has the aspect of an important commercial city. The imperial palace, where Alexander I. died in 1825; and the Greek monastery (under the patriarch of Jerusalem) are worthy of notice. Statues of Alexander I. (1830) and Peter the Great (1903) adorn the town. In the 13th century Pisan merchants founded there a colony, Portus Pisanus, which, however, soon disappeared during the migrations of the Mongols and Turks. An attempt to obtain possession of the promontory was made by Peter the Great, but it was not definitely annexed by the Russians until seventy years afterwards (1769). The commercial importance of the town dates from the second half of the 19th century; in 1870 its population had risen to 38,000, and after it was brought into railway connexion with Kharkov and Voronezh, and thus with the fertile provinces of south and south-east Russia, the increase was still more rapid, the number reaching 56,047 in 1885, and 68,928 in 1900—Greeks, Jews, Armenians and West-Europeans being important elements. The town was bombarded and in part destroyed by an Anglo-French fleet in May 1855. Taganrog is an episcopal see of the Orthodox Greek Church, and has tanneries, tallow works and tobacco manufactures. The roadstead is very shallow, and exposed to winds which cause great variations in the height of the water; it is, moreover, rapidly silting up. At the quay the depth of water is only 8 to 9 feet, and large ships have to lie 5 to 13 miles from the town. Moreover, the port is closed by ice three to four months in the year. Notwithstanding the disadvantages of its open roadstead, the foreign trade has rapidly expanded, the annual value of the imports having increased from 62 millions sterling in 1899 to over 10 millions sterling in 1904. The chief article of export being corn, the trade of the city is subject to great fluctuations. Linseed and other oil-bearing grains are also important articles.
of commerce, as well as wool and butter. The imports, which consist chiefly of machinery, fruits (dried and fresh), wine, oil and textiles, do not much exceed half a million sterling annually.

TAGES—TAHITI

TAGES (Tâgês), a minor Etruscan deity, grandson of Jupiter, and founder of the art of divination in Etruria. According to the story, during the ploughing of a field near Tarquinii a being of boyish appearance sprang out of the furrow. The shouts of the ploughman (Tarchon) brought to the spot all the people of Etruria, whom the boy proceeded to instruct in the art of divination. Having done this, he suddenly disappeared. His instructions were for some time handed down orally, but were subsequently transcribed in writing by the scribes of the city. The books of Tages, containing a complete system of Etruscan lore.

See Cicero, De Divin. ii. 23; Ovid, Metam. xv. 553; Festus, s. v.; Mommsen, Hist. of Rome (Eng. tr.), bk. i. ch. 12.

TAGLIAZZOZI, GASPARO (1546–1599), Italian surgeon, was born at Bologna in 1546, and studied at that university under Cardan, taking his degree in philosophy and medicine at the age of twenty-four. He was appointed professor of surgery and afterwards of anatomy, and achieved notoriety at least, and the fame of a wonder-worker. He died at Bologna on the 7th of November 1599.

His principal work is entitled De Curtorum Chirurgia per Insitionem Liber Duo (Venice, 1598), of which it was reprinted in the following year under the title of Chirurgia Nova de Nirium, Aurium, Labori, etque Dejecta per Insitionem Culis ex Humere, arte haciancus omnibus ignota, sarscendo (Frankfort, 1598, 8vo).

TAGLIAZZOZI, a town of the Abruzzi, Italy, in the province of Aquila, 56 m. by rail E.N.E. of Rome, and 10 m. W. of Avezzano. Pop. (1901) 4517 (town); 9661 (commune). It lies 2428 ft. above sea-level, at the mouth of the deep ravine of the Imele. It contains several old churches, notably S. Francesco, with a fine rose-window in the façade, and mediaeval houses. The palace, built at the end of the 14th century by the Orsini, is fine. The place was given to the Colonna family in 1526. At the end of 1668 a battle took place here between Conradin of Hohenstaufen and Charles of Anjou, which resulted in the defeat of Conradin and his execution.

TAGLIONI, MARIA (1804–1884), Italian ballet dancer, daughter of Filippo Taglioni (1777–1871), master of the ballet at Stockholm, Cassel, Vienna and Warsaw, was born at Stock- holm on the 23rd of April 1804. She was trained by her father, who is said to have been pitilessly severe. It was to his care and her own special talent for dancing that she owed her success, for she possessed no remarkable personal attraction. Her first appearance was at Vienna on the 10th of June 1822, in a ballet of which her father was the author, La Réception d’une jeune nymphe à la cour de Terpsichore. Her success was immediate, and was repeated in the chief towns of Germany. On the 23rd of July 1827 she made her Paris début at the Opéra, in the Ballet de Sicilien, and aroused a furor of enthusiasm. Among her more remarkable performances were the dancing of the Tyrolienne in Guillaume Tell, of the pas de fascination in Meyerbeer’s Robert le Diable, and in La Fille du Danube, and in all these the contemplation of her husband, and period the ballet was an important feature in opera, but with her retirement in 1847 the era of grand ballets may be said to have closed. In 1832 she married Comte Gilbert de Voisins, by whom she had two children. Losing her savings in speculation, she afterwards supported herself in London as a teacher of deportment, especially in connexion with the ceremony of presentation at court. During the last two years of her life she lived with her son at Marseilles, where she died on the 23rd of April 1884. Taglioni is frequently mentioned in the novels of Balzac and Thackeray, in The Newcomes, says that the young Taglioni ‘will never see anything so graceful as Taglioni in La Sylphide.’

TAGUS (Span. Tajo, Portog. Tejo), the longest river of the Iberian Peninsula. Its length is 565 m., of which 192 are on or within the frontier of Portugal, and the area of its basin is about 31,850 sq. m. The basin is comparatively narrow, and the Tagus, like the other rivers of the Iberian tableland, generally flows in a rather confined valley, often at the bottom of a rocky gorge below the general level of the adjacent country. The river rises on the western slope of the Muela de San Juan (873 ft.), a mountain which forms part of the Sierra de Albarracin, 88 m. E. of Madrid. Thence the Tagus flows at first north-westwards, but, after receiving the Gallo on the right, it flows west, and then south-west or west-south-west, which is its general direction for the rest of its course. Regular river navigation begins only at Abrantes, a few miles below which the Tagus is greatly widened by receiving on its right bank the impetuous Zecere from the Serra da Estrela. Passing Sanarem, the highest point to which the tide ascends, and the limit of salt water, the Tagus passes through the town of Figueira da Foz. The river divides below Salvatierra into two arms, called the Tejo Novo (the only one practicable for ships) and the Mar de Pedro. These branches enclose a deltaic formation, a low tract of marshy alluvium known as the Lezirias, traversed by several minor channels. Both branches terminate in a broad tidal lake immediately above Lisbon (q.v.). The Tagus estuary, though partly blocked by a bar of sand, is one of the chief harbours of south-western Europe.

The narrower part of the Tagus basin lies to the south, and the left-hand tributaries of it are almost all mere brooks, dry in summer. The principal exception is the Zatas or Sorraia, which, rising in the Serra d’Ossa, flows westwards across the plateau of Alentejo, and joins the Mar de Pedro. The principal right-hand tributaries, besides the Gallo and Zecere, are the Jarama, descending from the tableland of New Castle a little below Aranjuez, the Alberche and the Tietar, which collect their head waters from opposite sides of the Sierra de Gredos, and the Alagon, from the rough and broken country between the Sierras de Gredos and Gata.

TAHITI, the largest and most important of the French Society Islands (q.v.), in the Pacific Ocean, in 17° 38’ S., 149° 30’ W. Pop. about 10,300. The island, in shape not unlike the figure 8, has a length of 33 m., a coast-line of 210, and an area of 402 sq. m. It is divided into two portions by a short isthmus (Isthmus of Taravao) about a mile in width, and nowhere more than 50 ft. above sea-level. The southern, the peninsula of Taiarapu, or Tahiti-titi (Little Tahiti) measures 17 m. in length by 6 m. in breadth; while the northern, the circular main island of Porionou, or Tahiti-uni (Great Tahiti), has a length of 22 m. and a breadth of 20. The whole island and its islands is 9 square miles. A little to the north of the island is the double-peaked Orohena rises to 7340 ft., and the neighbouring Oroari is only a little lower. Little Tahiti has no such elevation, but its tower-like peaks are very striking. The flat land of the Tahitian coast, extending to a width of several miles—with its chain of villages, its fertile gardens, and its belt of palms, sometimes intersected by stream-fed valleys which open on the seashore—forms a most pleasing foreground to the grand mountain ranges. A good road surrounds the island, the extreme north of which is formed by Point Venus, W. of which lie the Bay of Matavai and Papeete, the European town and seat of government, on its beautiful harbour.

Climate.—The seasons are not well defined. Damp is excessive; there is little variation in the weather, which, though hot, is never very oppressive. The depression of the tropics may be considered remarkably healthy. The rainfall is largest between December and April, but there is so much at other times of the year also that these months hardly deserve the name of the rainy period. The wind is for the most part light, though sometimes it is very strong, and is generally on the land at night, but often coming from the sea during the day. The winds off the coast are west-south-west, and are generally quite calm from April to November (8 months), 15 inches.

Fauna.—Mammals, as in other Polynesian islands, are restricted to a few species of bats (mostly of the genus Pteropus), rats and mice, none of them peculiar. Of domestic animals, the pig and the dog—the former a small breed which quickly disappeared before
the stronger European strains—were plentiful even in WALLACE's days. The ornithology is very poor as compared with that of the Western Pacific; but the sweaters of the Sandpiper (Tringa hypoleucos), a group of black birds, may be seen among the waders in the marshes, but the domesticated fowls were abundant, even when Tahiti was first discovered by Europeans, these wild birds are doubtless the offspring of tame birds. The lagoons swarm with fish of many species, but are poor in mollusca, though a good many species are indigenous. Crustaceans and molluscs, on the other hand, are well represented; worms, echinoderms, and corals comparatively poorly. A noteworthy feature of Tahitian ornithology is the number of peculiar species belonging to the genus Pardius, almost every valley being the habitat of a distinct form.

**Flora.**—The flora, though luxuriant and greatly enhancing the beauty of the island, is very imperfectly known. The woods, as a general statement, the Tahitian forests are perhaps the softest in all Oceania. The women rank with the most beautiful of the Pacific, though the accounts given of them by early voyagers are much exaggerated; and for general symmetry of form the people are unsurpassed by any race in the world. Even now in its decadence, after generations of drunkenness and European disease and vice, grafted on inborn indolence and licentiousness, many tall and robust people (6 ft. and even upwards in height) are to be found. Men and women of good birth can generally be distinguished by their height and fairness, and often, even in early age, by their clear complexion, from those of low birth and olive to a full dark brown. The wavy or curly hair and the expressive eyes are black, or nearly so; the mouth is large, but well-shaped and set with beautiful teeth; the nose broad (formerly flattened in infancy by artificial means); and the chin well developed.

The native costume was an oblong piece of bark-cloth with a hole in its centre for the head, and a plain piece of cloth round the loins was worn alike by men and women of the higher classes. Men of all ages wore a jacket, which they called the pahu. The women concealed their breasts except in the company of their superiors, when etiquette demanded that inferior of both sexes should uncover the upper part of their bodies. The Brazilians, who were the first to arrive, had strange cylindrical hats, made of wicker-work and over a yard in height. Circumcision, and in both sexes tattooing, were generally practised, and much significance was attached to some of the marks. The houses were long, low, and open at the sides. Household utensils were few—plain round wooden dishes, sometimes on legs, coconut-nut shells, baskets, &c. Low stools and head-rests were used. Pottery being unknown, all food was baked in a hole dug in the ground or roasted over the fire. Their chief musical instruments were the nose-flute—often used as the accompaniment of song—and the drum. Cock-shells were also used. Tahitian stone adzes, which are the only European tools which the islanders used, are, like the adzes of Polynesia in general, distinguished from those of Melanesia by their triangular section and adaptation to a socket. Slings were favourite weapons of the Tahitians; they had also plain spears expanding into a wide blade, and clubs. The bow and arrow seem only to have been used in certain ceremonial games. Their canoes, from 20 to 70 ft. in length, were double or single, and provided with sail and outriggers. They were not well finished, but were kept in excellent condition. Tahitian ships are named after the gods of those destined to carry the images of their gods, and the several ships with strange figures and hang with feathers. Cannibalism is unknown, though the use of human sacrifices is. It is very probable that human sacrifices may possibly be survivals of this practice. The staple food of the islanders consisted of the bread-fruit, the taro-root, the yam, the sweet potato, and in some districts the wild plantain; but they also ate much fish (the turtle was considered sacred food), as well as pigs and dogs, though of the latter, as pets, the sons of priests, and the puppies sometimes even to the exclusion of their own children.

Tahitians were good fishermen and bold seamen. They steered by the stars, and their own vessels were built as well as those of any other Polynesian islands. The land was carefully tended and the fields well irrigated. Three great classes were recognized:—(1) The sovereign, who bore a semi-pretended women, and the reigning chieftains of districts, and the princes of the royal line, who were also holders of certain estates. Rank is hereditary and determined by primogeniture, not necessarily in the male line. The firstborn of a sovereign succeeded at once to the title, but his brother, or any son by a concubine, who was a chief, or a commoner, and who was extremely dear to his child, then abdicated, and became regent. It is easy to see that, while this custom tended to keep honours within a family, it may have encouraged the practice of infanticide, which was common in all grades of society when Tahiti was first visited by Europeans. The age at which the child's authority became real varied according to his own abilities and the will of his subjects. Though arbitrary, the power of the king was limited by the power of his vassals, the district chiefs, who ruled absolutely over their respective districts, and who might be as of good blood as himself. The king had a councilor, but was alone responsible for any act. The government was a formal thing, the chief men of the council, and the chiefs, and war was rarely declared without their being first summoned to council. Their power over their own people was absolute. The form of government was thus strictly feudal in character, but it is centrally administered. The French colony, which was placed under government by the direction of M. Pomare II, the English missionaries greatly helped to regulate and strengthen. The sovereign sent his commands by a messenger, who was accompanied by a certain number of attendants and the fuft was returned intact as a sign of assent or token in token of refusal.

The temples were square tree-surrounded enclosures, with a single entrance and several small courts, within which were houses for the priests and other persons of inferior rank. A single temple, on which were the actual altars, stood at the further end of the square. In the temples were buried the chieftains, whose embalmed bodies, after being exposed for a time, were interred in a crouching position, their skin being kept whole. The chieftains were buried near their nearest relatives. In the great temple at Atahura the stone structure was 270 ft. long, 94 ft. wide, and 50 ft. high, and its summit was reached by a flight of 120 steps. Various Sacrificial offerings, including human sacrifices, formed a prominent part of Tahitian worship. An eye of the victim was offered to the king, and placed within his mouth by the officiating priest. Every household possessed its own guardian spirits, but there were several superior divinities, of which, at the beginning of the 19th century, Oro was the most venerated. The images, which are less remarkable than those of Hawaii, were rough representations of the human form carved by the chief artisans, and a religious association, was a special feature of Tahitian society.

The Tahitians are light-hearted, frivolous, courteous and generous, and always ready to help one another. Their social games, which were not played by the women, were simple and highly moral, in which one of their customs was a systematic exchange of wives. Besides dancing, the singing of songs, and the recitation of historical and mythological ballads, the natives had also a variety of dances, the game of bowling (in which the canoe was propelled by matches, with foot and canoe races, were held; also sham fights and naval reviews. They had several ball games—one (played chiefly by women), a kind of football; but surf-swimming was perhaps the favourite sport, and cock-fighting was much practised.

**Products, Trade, Administration.**—Papeete, as the emporium for a widely scattered archipelago (including Otaheite, &c.), has an export trade in mother-of-pearl, pearls (mainly from the PEARL Islands, trunks, oranges, tobacco for China, copra and vanilla. Many whalers formerly visited Papeete harbour. During the American Civil War, in the middle of the 19th century, Tahitian cotton was purchased by the United States, but its export has since declined, and it is said 1884, and it has been little grown since. This is also true of coffee and tobacco, and among other crops which have been tried. Sugar and rum are also produced.

The government has had the title of "labor," chiefly for the plantations, from other Polynesian islands was placed under government control in 1862. The Tahitians themselves prefer handcrafts to agricultural work, and many are employed as artisans by European manufacturers. In 1882, 127,660 were in the employment of the government. The French establish-ments in the Eastern Pacific are administered by a governor, a pilot, and a Chief of Police, who is also the head of the government and the president of the chambers of commerce and agriculture.

**History.**—The discovery and early exploration of the Society Islands is treated under that heading. In 1768, when Lieutenant Bligh in the "Bounty" visited Tahiti, the leading chief was Pomare, whose family had been pre-eminent in the island for

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more than a century. Aided by sixteen of the "Bounty" mutineers, and armed with guns procured from Bligh and a Swedish vessel, Pomare greatly strengthened his power and brought to a successful close a long struggle with Eimeo.

The attempt at colonization by the Spaniards in 1774 was followed by the settlement of thirty persons brought in 1788 by the missionary ship "Duff." Though befriended by Pomare I. (who lived till 1805), they had many difficulties, especially from the constant wars, and at length they fled with Pomare II. to Eimeo and ultimately to New South Wales, returning in 1812, when Pomare renounced heathenism. In 1815 he regained his power in Tahiti. For a time the missionaries made good progress—a printing press was established (1817), and coffee, cotton and sugar were planted (1819); but soon there came a serious relapse into heathen practices and immoralities. Pomare II. died of drink in 1824. His successor, Pomare III., died in 1827, and was succeeded by his half-sister Aimata, the unfortunate "Queen Pomare (IV.)." In 1828 a new fanatical sect, the "Mamai'a," arose, which gave much trouble to the missions. The leader proclaimed that he was Jesus Christ, and promised to his followers a sensual paradise.

In 1836 the French Catholic missionaries in Mangareva attempted to open a mission in Tahiti. Queen Pomare, advised by the English missionary and consul Pritchard, refused her consent, and removed by force two priests who had landed surreptitiously and to whom many of the opposition party in the state had rallied. In 1838 the French frigate Le Consul entered, under the command of Abel Dupetit-Thouars, and extorted from Pomare the right of settlement for Frenchmen of every profession. Pritchard opposed this, and caused Pomare to apply for British protection; but this was a failure, and the native chiefs compelled the queen, against her will, to turn to France. A convention was signed in 1843, placing the islands under French protection, the authority of the queen and chiefs being expressly reserved. Dupetit-Thouars now reappeared, and, alleging that the treaty had not been duly carried out, deposed the queen and took possession of the islands. His high-handed action was not countenanced by the French government; but while, on formal protest being made from England, it professed not to sanction the annexation, it did not retrace the steps taken. Two years were spent in reducing the party in the islands opposed to French rule; an attempt to conquer the western islands failed; and at length, by agreement with England, France promised to return to the plan of a protectorate and leave the western islands to their rightful owners. Pomare died in 1877, and her son Ariane (Pomare V.) abdicated in 1886, handing over the administration to France, and in the same year Tahiti, in closer ties with the mother country, was made an "elective compagnie," to "be governed as a public institution." On the death of Pomare V., the whole of the French establishments in the Eastern Pacific were declared one colony, and the then existing elective general council was superseded by the present administration.


TAHR, the native name of a shaggy-haired brown Himalayan wild goat characterized by its short, triangular and sharply keeled horns. Under the name of Hemitragus jemlahicus, it typifies a genus in which are included the wariatu, or Nilgiri ibex (H. hyloicrus), from the Nilgiri and Anamalai hills of Southern India, and a small species, H. javaheri, from South Arabia. Tah frequently the worst ground of almost all ruminants.

TAILLANDIER, SAINT-RÉNÉ (1817-1879), French critic, whose original name was René Gaspard Ernest Taillandier, was born in Paris on the 16th of December 1817. He completed his studies at Heidelberg, and then became professor of literature successively at Strasbourg, Montpellier and the Sorbonne, where he was nominated to the chair of French eloquence in 1868. Most of the articles included in his published volumes first appeared in the Revue des deux mondes. In January 1870 he became general secretary of the ministry of education, and continued in this office after the fall of the Empire. He became officer of the Legion of Honour in 1870, and was elected to the Academy in 1872, where he died on the 22nd of February 1873.

His works include:—Allemagne et Russie, études historiques et littéraires (1856), Le Poète du Caucaze . . . Michel Lermontoff (1886), Maurice de Saxe (2 vols. 1865), Thèques et Magyars (1860), Le Général Philippe de Ségur (1875).

TAILLE (from Fr. tailler, to cut or divide; late Lat. talare, said to come from talla, talus), the equivalent of the English word "tax," was in use in France in the 12th century, and has a very peculiar history. It is said that the word tailie was the generic term for an indirect tax. Other words used in certain districts in the same sense as taille were queste (questa, quisto), fouage (foragium), cote. The essence of the tax denoted by these names was that the amount was fixed en bloc for a whole group of persons, and afterwards divided among them in various ways. In ancient French law we find three forms of taille: the taille servile, taille seigneuriale, and taille royale.

Taille servile, properly termed a tax, was a tax which had degenerated into a source of profit for certain individuals. Every lord who possessed serfs could levy the taille on them, and originally this was done arbitrarily (a volonté) both to the crown and to his tenants. It caused much trouble and was used as a means of oppression among the people. In peace it was a battle of serfdom, but was limited and fixed, either by contracts or concessions from the lord (taille obonnaie), or by the customs. The taille seigneuriale was a true tax, levied by a lord on all his subjects who were neither nobles nor ecclesiastics. But according to opinion, when feudalism was established, the right of levying it did not belong to every lord, but only to the lord having the haute seigneurie. He levied it without the necessity for a legal contract between him and those who paid it. He fixed the sum to be paid by each group of inhabitants, who then had to see that it was assessed, collected, and paid to the lord, electing commissioners to this end. The taille seigneuriale was a fixed tax, not a variable one, and was one of the methods used by the state in the 19th century for reducing the administration of taxation to its simplest form. Custom, however, or an order of the lord generally fixed the principle upon which the division was made. It was often a "hearth tax" (fouage), when each house, i.e. each head of a family, paid the same amount, arrived at by dividing the local contingent of the taille by the number of fires. But this equality, which took no account of wealth or poverty, was felt to be unjust, and the assessment began to be made according to the resources of each family, "the strong bearing the weak, and the weak relieving the strong." The seigniorial taille, like the servile, had the character of a personal tax (taille d'abonné), and was levied from 1789 with the idea of having it paid according to his wages or other income. The king originally had only the right of levying the taille in places where he had retained the exercise of the haute justice. At that time there was no royal authority in French society, and the taille was levied by the local lord and paid to the crown, but it was one of the first taxes his right to levy which upon all the inhabitants of the domain of the crown, whether serfs or free men. The taille de la dîme was imposed for the first time in 1354. The nature of the idea began to prevail that it was fair for the king, in time of war, to levy a taille upon the subjects of the lords having the haute justice in various parts of the royal domain. Moreover, tailles were often granted him by the provincial estates or the states-general. Thus the general taille, raised for the benefit of the king, became more and more frequent, and naturally tended to become permanent.

This transformation was confirmed, rather than effected, by the ordinance of 1430. Its immediate object was, not the regulation of the taille, but the organization of the compagnies d'ordonnance, i.e. the heavy cavalry which the king from that time on maintained on a permanent footing. In the process of levying it was natural that the taille, the tax which had long been devoted to meeting the expenses of the royal wars, should also become permanent. This was contained implicitly in the ordinance that the taille which at the same time was not fixed in advance, was competing too closely with the royal taille by imposing a double burden on the taxpayer. A kind of seigniorial taille continued to exist besides the servile taille, but this kind presupposed a title, a noble, between the lord, or else immemorial possession, which amounted to a title. The royal taille naturally retained the distinctive characteristics of the seigniorial, and was in the end levied in a manner in which it was assessed and collected; the chief characteristic being that ecclesiastics and nobles, who were exempt from the seigniorial taille, were also exempt from the royal. The royal taille, though levied in the king's name, was not always put to his own use, and was a tax on the whole kingdom. The pays d'élection were subject to it, the pays d'états were not (see Francia: Law and Institutions).

Throughout the pays d'élection the taille was almost universal personal (taille personnelle), i.e. a tax on the whole income of the
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TAILEFER, the surname of a bard and warrior of the 11th century, whose exact name and place of birth are unknown. He accompanied the Norman army to England in 1066, and obtained permission from William to strike the first blow at the battle of Hastings. He fought with spirit and determination, and was killed in the battle. MENTION of Taillefer is made by Guido, bishop of Amiens, in his Carmen de bello Hastingensi, v. 931-44 (in Mon. Hist. Brit., 1848) and by Henry of Huntingdon in his Historia Anglorum (in Ker. Brit. med. oevi script., p. 763, ed. Arnold, London, 1879); and his prowess is depicted on the Bayeux tapestry. The statement of Wace in the Roman de Rou, 3rd part, v. 8935-62, ed. Andresen (Heilbronn, 1879), that he was killed by the Norman army singing of Charlemagne and of Roland and of the people of Normandy, has been considered important in demonstrating the existence of a comparatively early tradition and song of Roland.

See W. Spatz, Die Schlacht von Hastings (Berlin, 1896): Freeman, History of the Norman Conquest.

TAILOR (Fr. tailleur, from tailler, to cut, Lat. talea, a thin rod, a cutting for planting), one who cuts out and makes clothes. Formerly the tailor, or cisseur, made apparel for both men and women, and not merely outer garments, but also articles of linen and the padding and lining of armour—whence the style " Taylors and Linen Armourers " applied to the Merchant Taylors Company. In the Middle Ages, before the Norman army singing of Charlemagne and of Roland and of the people of Normandy, has been considered important in demonstrating the existence of a comparatively early tradition and song of Roland.

America, to include articles of good, though not of the first, quality. It probably first came into existence at seaport towns, where, to meet the convenience of sailors returning from long voyages and requiring their wardrobes to be replenished at short notice, the "outfitters" kept stocks of ready-made garments on sale; but it made no considerable progress until after the middle of the 19th century, when the introduction of the sewing-machine brought about the possibility of manufacturing in large quantities. Its development was attended with gradually increasing subdivision of labour and, to a less extent, with the disappearance of the tailor as a skilled craftsman.

The first step was for a garment, such as a coat, to be completed by the joint efforts of a family. Then followed the "task system," which in America was the result of the influx of Russian Jews that began about 1875. Under it a team of three men, with a "presser" and a girl to sew on the buttons, divided the work between them. Payment was made by the "task," i.e. a specified number of garments, the money being divided between the members of the team in certain proportions. Often several teams would be run by a contractor, who naturally aimed at the cheapest of all grades of clothing and, as full as possible; and when through stress of competition he had to accept lower prices the plan he adopted was to increase the number of garments to a task, leaving the pay unaltered. The result was the introduction of many of the worst features of the "sweating system," the workers having to work excessively long hours in order to finish the task, which in some cases meant as many as twenty coats a day. In the "factory" or "Boston" system the subdivision is still more minute, and as many as one hundred persons may be concerned in the production of one coat. The amount of tailoring skill required in a worker is even further reduced, but the promises come under the regulation of the factory laws. The factory system has also cheapened production in a legitimate way, because it has enabled mechanical power for driving sewing-machines, and also expensive labour-saving machinery, to be
TAIN—TAINE

introduced to an extent not possibly possible in small shops.

TAIN, a royal and police burgh of the county of Ross and Cromarty, Scotland. Pop. (1901) 2076. It is situated on rising ground within a mile of the southern shore of Dornoch Firth, 25°3 m. N.E. of Dingwall by the Highland Railway. The name, of which the Tene, Tayne and Thane are older forms, is derived from the Icelandic thing, "assembly" or "court."

Among the principal buildings are the town hall, court house, public hall, Easter Ross combination poolhouse, and the academy (opened in 1812). The industries include distilling, the making of aerated waters, and woollen manufactures, and the town has a distillery. It was a royal burgh from 1324.

The rainfall is one of the lowest in the kingdom. Duthac (locally called Duthus), a saint of the 11th century, is believed to have been a native, and the old ruined chapel near the station is supposed to have been his shrine. To the collegiate church of St Duthus, a Decorated building, founded by James III. in 1471, James IV. made several pilgrimages in penance for his father's death. The building was used as the parish church till 1815, when it fell into disrepair, but it was restored between 1871 and 1876. It has monuments to Patrick Hamilton, the lawyer, and Thomas Hope (1689–1702), Scotch church divine, for some time a prisoner on the Bass. Three and a half miles S.E. are the remains of the Early English abbey of Fearn, founded at Ederton in 1250 by Farquhar, 1st earl of Ross, and transferred thither in 1338. The chancel, nave and two side chapels exist, and it still serves as the parish church. Patrick Hamilton became titular abbot in 1517, and after his martyrdom the abbey was added to the bishopric of Ross.

TAINÉ, Hippolyte Adolphe (1828–1893), French critic and historian, the son of Jean Baptiste Taine, an attorney, was born at Vouziers on the 1st of April 1828. He remained with his father until his eleventh year, receiving instruction at home and attending at the same time a small school which was under the direction of M. Pierson. In 1839, owing to the serious illness of his father, he was sent to an ecclesiastical pension at Rethel, where he remained eighteen months. J. B. Taine died on the 8th of September 1840, leaving a moderate competence to his widow, his two daughters, and his son. In the spring of 1841 Taine was sent to Paris, and entered as a boarder at the Institution Mathé, where the pupils attended the classes of the Collège Bourbon. Madame Taine followed her son to Paris. Taine was slow to distinguish himself at school. When he was but fourteen years old he had already drawn up a systematic scheme of study, from which he never deviated. He allowed himself twenty minutes' playtime in the afternoon and an hour's music after dinner; the rest of the day was spent in work. In 1847, as étudiant de rhétorique, he carried off six first prizes in the general competition, the prize of honour, and three accessits; he won all the first school prizes, the three science prizes, as well as two prizes for dissertation. It was at the Collège Bourbon that he formed lifelong friendships with several of his schoolfellows who afterwards were to exercise a lasting influence upon him: among these were Prévost-Paradol, for many years his most intimate friend; Planat, the future "Marcelin" of the Vie Parisienne; and Cornélius de Witt, who introduced him to Guiot when the latter returned from England in 1846.

Public education was the career which seemed to lie open to Taine after his remarkable school successes. In 1848 he accordingly took both his baccalaureat degrees, in science and letters, and passed first into the École Normale; among his rivals, who passed in at the same time, were About, Sarcey, Libert, and Suckau. Among those of Taine's fellow-students who afterwards made a name in teaching, letters, journalism, the theatre and politics, &c., were Challeme-Lacour, Chassagny, Aubé, Perraud, Ferry, Weiss, Yung, Gaucher, Gréard, Prévost-Paradol and Levasseur. Taine made his influence felt among them at once; he amazed everybody not only by his erudition, but by his indefatigable energy; and not only by his prodigious industry, but by his facility both in French and Latin, in verse as well as in prose. He devoured Plato, Aristotle, the Fathers of the Church, and he analysed and classified all that he read. He already knew English, and set himself to master German in order to read Hegel in the original. His brief leisure was devoted to music. 'The teachers of his second and third years, Deschanel, Gérusez, Berger, Havet, Filon, Saisset and Simon, were unanimous in praising the nobility of his character, the vigour and the fertility of his intellect, the distinction of style with which his work was always stamped; they were equally unanimous in finding fault with his unmeasured taste for classification, abstraction and formula. The director of studies, M. Vacherot, gauged his capacity at the end of his second year with prophetic insight. He prophesied that Taine would be a great critic, and that his name would be added to that of Rethel on Spinoza's motto, "Vivre pour penser," would also be his. In the month of August 1851 he came forward as a candidate for the fellowship in philosophy (agrégation de philosophie) in company with his friends Suckau and Cambier. Taine was declared to be admissible, together with five other candidates; but in the end only two candidates were admitted, his friend Suckau and Aubé. This decision created almost a scandal. Taine's reputation had already spread beyond the college. Everybody had taken for granted that he would be admitted first. The fact that his examination showed considered his ideas to be absurd, his style and method of handling a subject dry and tiresome.

The Minister of Public Instruction, however, judged Taine less severely, and appointed him provisionally to the chair of philosophy at the college of Toulon on 6th October 1851; but he never entered upon his duties, as he did not wish to be so far from his mother, and on 13th October he was transferred to Nevers as a substitute. Two months later, on the 27th December, occurred the coup d'état, after which every university professor was regarded with suspicion; many were suspended, others were dismissed, and a few were imprisoned. In Taine's opinion it was the duty of every man, after the plébiscite of the 10th December, to accept the new state of affairs in silence; but the universities were not only asked for their submission, but also for their approbation. At Nevers they were requested to sign a declaration expressing their gratitude towards the President of the Republic for the measures he had taken. Taine was the only one to refuse his endorsement. He was at once marked down as a revolutionary, and in spite of his success as a teacher and of his popularity among his pupils, he was transferred on 2oth March 1852 to the lyceé of Potsiers as professor of philosophy, with the warning to be careful for the future. Here, in spite of an abrupt compliance with the stringent rules imposed upon him, he remained in disfavour, and on 25th September 1852 he was appointed assistant professor of the sixth class at the lyceé of Besançon. This time he could bear it no longer, and he applied for leave, which was readily granted him on 9th October 1852, and renewed every year till his decennial appointment came to an end. It was in this painful year, during which Taine worked harder than ever, that the fellowship of philosophy was abolished. As soon as Taine heard of this he at once began to prepare himself for the new respite in letters, and to work hard at Latin and Greek themes. On 10th April 1852 a decree was published by which three years of preliminary study were necessary before a candidate could compete for the fellowship, but by which a doctor's degree in letters counted as two years. Taine immediately set to work at his dissertations for the doctor's degree; on 6th June (1852) they were finished, and 150 pages of French prose on the Sensations and a Latin essay were sent to Paris. On the 15th July he was informed that the tendency of his Essay on the Sensations made it impossible for the Sorbonne to accept it, so for the moment he laid this work aside, and on 1st August he began an essay on La Fontaine. He then started for Paris, where an appointment which was equivalent to a suspension awaited him. His university career was over, and he was obliged to devote himself to letters as a profession. In a few months his two dissertations, De personis Platoniciis and the essay on La Fontaine's fables were finished, and on 30th May 1853 he took his doctor's degree. This was the last act of his
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university career; his life as a man of letters was now to begin. But sooner had he deposited his dissertations at the Sorbonne than he began to write an essay on Livy for one of the competitions set by the Academy. Here again the moral tendency of his work excited lively opposition, and after much discussion the competition was postponed till 1855; Taine toned down some of the censured passages, and the work was crowned by the Academy in 1855. The essay on Livy was published in 1856 with the addition of a preface setting forth determinist doctrines, much to the disgust of the Academy. In the beginning of 1854 Taine, after six years of uninterrupted efforts, broke down with consumption; his greatest wish was the rest of utilizing his enforced leisure; he let himself be read to, and for the first time his attention was attracted to the French Revolution; he acquired also a knowledge of physiology in following a course of medicine. In 1854 he was ordered for his health to the Pyrenees, and Hachette, the publisher, asked him to write a guide-book of the Pyrenees. Taine's book was a collection of vivid descriptions of nature, historical anecdotes, graphic sketches, satirical notes on the society which frequently watering-places, and underlying the whole book was a vein of stern philosophe. The year 1854 was an important one in the life of Taine. His enforced leisure, the necessity of mixing with his fellow-men, and of travelling, tore him from his cloistered existence and brought him into more direct contact with reality. His method of expounding philosophy underwent a change. Instead of employing the method of deduction, of starting with the most abstract idea and following it step by step to its concrete realization, henceforward he starts from the concrete reality and proceeds through a succession of facts until he arrives at the central idea. His style also became vivid and full of colour; he shows that he is acutely sensitive to the outward manifestations of things and depicts them in all their relief. Simultaneously with this change in his works his life became less self-centred and solitary. He lived with his mother in the Isle Saint-Louis, and now he once more associated with his old friends, Planat, Prévost-Paradol and About. He made the acquaintance of Renan, and through Renan that of Sainte-Beuve, and he renewed friendly relations with M. Havet, who for three months had been his teacher at the École Normale. These years (1855–56) were Taine's periods of greatest activity and happiness in productive work. On 17th November 1855 he published an article on La Bruyère in the Revue de l'Instruction Publique. In the same year he published seventeen articles in this review and twenty in 1856 on the most diverse subjects, ranging from Menander to Macaulay. On 1st August 1855 he published a short article in the Revue des Deux Mondes on Jean Reynaud. On 3rd July 1856 appeared his first article in the Débats on Saint-Simon, and from 1857 onwards he was a constant contributor to that journal. But he was seeking a larger field. On 17th January 1856 his history of English literature was announced, and from 14th January 1855 to 9th October 1856 he published in the Revue de l'Instruction Publique a series of articles on the French philosophers of the 19th century, which appeared in a volume at the beginning of 1857. In this volume he energetically attacked the principles which underlie the philosophy of Victor Cousin and his school with an irony which amounts at times to irreverence. The book closes with the sketch of a system in which the methods of the exact sciences are applied to psychological and metaphysical research. The work itself met with instantaneous success, and Taine became famous. Up till that moment the only important articles on his work were an article by About on the Voyage aux Pyrénées and two articles by Guizot on his Livy. After the publication of Les Philosophes Français, the articles of Sainte-Beuve in the Moniteur (9th and 16th March 1856), of Sherré in the Bibliothèque Universelle (1858), and of Planche in the Revue des Deux Mondes (1st April 1857) show that from this moment he had taken a place in the forefront of the new generation of men of letters. Caro published an attack on Taine and Renan, called "L'Élève de Dieu dans une Jeune École," in the Revue Contemporaine of 15th June 1857. Taine answered all attacks by publishing new books. In 1858 appeared a volume of Essais de Critique et d'Histoire; in 1860 La Fontaine et ses Fables, and a second edition of his Philosophes Français. During all this time he was persevering at his history of English literature up to the time of Byron. It was from that moment that Taine's influence began to be felt; he was in constant intercourse with Renan, Sainte-Beuve, Sherré, Gautier, Flaubert, Saint-Victor and the Goncourt brothers. He gave his last years to the study of literature; he was a member of the Académie des Sciences, and when in 1863 came forward as a candidate for the chair of literature at the Polytechnic School, but M. de Loménie was elected in his place.

The following year, however, in March, Marshal Randon, Minister of War, appointed him examiner in history and German to the military academy of Saint Cyr, and on 26th October 1864 he succeeded Viollet-le-Duc as professor of the history of art and aesthetics at the École des Beaux Arts. Renan's appointment at the Collège de France and Taine's candidature for the Polytechnic School had been attacked by Guizot and Dupanloup, who in 1853 issued an Avertissement à la Jeunesse et aux Pères de Famille, which consisted of a violent attack upon Taine, Renan and Littérés; Renan was suspended, and Taine's appointment to Saint Cyr would have been cancelled but for the intervention of the Princess Mathilde. In December 1863 his Histoire de la Littérature Anglaise was published, prefaced by an introduction in which Taine's determinist views were developed in the most uncompromising fashion. In 1864 Taine sent this work to the Academy to compete for the Prix Bordin. M. de Falloux and Mgr. Dupanloup attacked Taine with violence; he was warmly defended by Guizot; finally, after three days of discussion, it was decided that as the prize could not be awarded to Taine, it should not be awarded at all. This was the last time Taine sought the suffrages of the Academy save as a candidate, in which quality he appeared once in 1874 and failed to be elected, Mézières, Caro and Dumas being the rival candidates; and twice in 1878, when, after having failed in May; H. Martin being chosen, he was at last elected in November in place of M. Loménie. In 1866 he received the Legion of Honour, and on the conclusion of his lectures in Oxford on Corneille and Racine, the University conferred upon him (1871) its degree of D.C.L.

The period from 1854 to 1870 was perhaps the happiest of Taine's life. He derived pleasure from his employment at the Beaux Arts and Saint Cyr, which left ample leisure for travel and research. In 1864 he spent February to May in Italy, which furnished him with several articles for the Revue des Deux Mondes from December 1864 to May 1866. In 1865 appeared La Philosophie de l'Art, in 1867 L'Idéal dans l'Art, followed by essays on the philosophy of art in the Netherlands (1868), in Greece (1869), all of which short works were republished later (in 1880) as a work on the philosophy of art. In 1865 he published his Nouveaux Essais de Critique et d'Histoire; from 1863 to 1865 appeared in La Vie Parisienne the notes he had taken for the past two years on Paris and on French society under the sub-title of "Vie et Opinions de Thomas Frédéric Grandelier," published in a volume in 1867, the most personal of his books, and an epitome of his ideas. In 1867 appeared a supplementary volume to his history of English literature, and in January 1870 his Théorie de l'Intelligence. In 1868 he married Mademoiselle Denuelle, the daughter of a distinguished architect.

He had made a long stay in England in 1858, and had brought back copious notes, which, after a second journey in 1871, he published in 1872 under the title of Notes sur l'Angleterre. On 28th June 1870 he started to visit Germany, but his journey was abruptly interrupted by the outbreak of the war; his project had to be abandoned, and Taine, deeply shaken by the events of 1870, felt that it was the duty of every Frenchman to work solely in the interests of France. On 9th October 1870 he
published an article on "L’Opinion en Allemagne et les Conditions de la Paix," and in 1871 a pamphlet on Le Suffrage Universel; and it was about this time also that the immense ideas applied to literature and Taine's art of writing on the French Revolution returned in a new and definite shape. He determined to trace in the Revolution of 1789 the reason of the political instability from which modern France was suffering. From the autumn of 1871 to the end of his life his great work, Les Origines de la France Contemporaine, occupied all his time, and in 1884 he gave up his professorship in order to devote himself wholly to his task; but he succumbed before it was finished, dying in Paris on 5th March 1883. In the portion of the work which remained to be finished Taine had intended to draw a picture of French society and of the French family, and to trace the development of science in the 19th century. He had also planned a complementary volume to his Théorie de l'Intelligence, to be entitled Un Traité de la Volonté.

The Origines de la France Contemporaine, Taine’s monumental achievement, stands apart from the rest of his work. His object was to explain the existing constitution of France by studying the more immediate causes of the present state of affairs—the last years of what is called the Ancien Régime, the Revolution and the beginning of the 19th century, to each of which several volumes were devoted. He also had another object, although he was perhaps hardly conscious of it, which was to study man in one of his pathological crises; for Taine makes an investigation into human nature, and the historian checks and endorses the pessimism and misanthropy of Graindorge. The problem which Taine set himself was to inquire why the centralization of modern France is so great that all individual initiative is practically non-existent, and why the central power, whether it be in the hands of a man or of an assembly, is the sole and only power; also to expose the error underlying two prevalent ideas:—(1) That the Revolution destroyed liberty instead of establishing it; that France was less centralized before 1789 than after 1800. This also he shows to be untrue. France was already a centralized country before 1789, and grew rapidly more and more so from the time of Louis XIV. onwards. The Revolution merely gave it a new form.

The Origines differ from the rest of Taine's work in that, although he applies to a period of history the theories which he had already applied to literature and Taine's art of writing on the arts, he is unable to approach his subject in the same spirit; he loses his philosophic calm; he cannot help writing as a man and a Frenchman, and he lets his feelings have play; but what the work loses thus in impartiality it gains in life.

Taine was the philosopher of the epoch which succeeded the era of romanticism in France. The romantic era had lasted from 1820 to 1830. It had been the result of a reaction against the classical school, or rather against the conventionality and lifeless rules of this school in its decadence. The romantic school introduced the principle of individual liberty both as regards matter and style; it was a brilliant epoch, rich in men of genius and fruitful of beautiful work, but towards 1830 it had reached its decline, and a young generation, tired in turn of its conventions, its hollow rhetoric, its pose of melancholy, arose, armed with new principles and fresh ideals. Their ideal was truth; their watchword liberty; to get as near as possible to scientific truth became their object. Taine was the mouthpiece of this period, or rather one of its most authoritative spokesmen.

Many attempts have been made to apply one of Taine's favourite theories to himself, and to define his mind and the preponderant faculty. Some critics have held that it was the power of logic, a power which was at the same time the source of his weakness and of his strength. He had a passion for abstraction. "Every man and every book," he said, "can be summed up in three pages, and those three pages can be summed up in three lines." He considers everything as a mathematical problem, whether it be the universe or a work of art: "C'est beau comme un syllogisme," he said of a sonata of Beethoven. Taine's theory of the universe, his doctrine, his method of writing criticism and history, his philosophical system, are all the result of this logical gift, this passion for reasoning, classification and abstraction. But Taine's imaginative quality was as remarkable as his power of logic; hence the most satisfactory definition of Taine's predominating faculty would be one which comprehended the two gifts. M. Lemaitre gave us this definition when he called Taine a poète-poïeticien; M. Bourget likewise when he spoke of Taine's imagination philosophique, and M. Barrès when he said that Taine had the power of dramatizing abstractions. For Taine was a poet as well as a philosopher; and it is possible that the portion of his work which is due to his poetic and imaginative gift may prove the most lasting.

Taine's doctrine consisted in an inexorable determinism, a negation of metaphysics; as a philosopher he was a positivist. Enamoured as he was of the precise and the definite, the spiritualist philosophy in vogue in 1845 positively maddened him. He returned to the philosophy of the 18th century, especially to Condillac and to the theory of transformed sensation. Taine presented this philosophy in a vivid, vigorous and personal form. He was a universal philosopher, which made his works more accessible, and consequently more influential, than those of Auguste Comte. Hence to the men of 1860 Taine was the true representative of positivism.

Taine's critical work is considerable; but all his works of criticism are works of history. Hitherto history had been to criticism as the frame is to the picture; Taine reversed the process, and studied literary personages merely as specimens and productions of a certain epoch. He started with the axiom that the complete expression of a society is to be found in its literature, and that the way to obtain an idea of a society is to study its literature. The great writer is not an isolated being; he is the result of a thousand causes; firstly, of his race; secondly, of his environment; thirdly, of the circumstances in which he was placed while his talents were developing. Hence Race, Environment, Time—these are the three things to be studied before the man is taken into consideration. Taine completed this theory by another, that of the predominating faculty, the faculté maîtresse. This consists in believing that every man, and especially every great man, is dominated by one faculty so strong as to subordinate all others to it, which makes the character of that man its own. Taine's theory is not an isolated being; he is the result of a thousand causes; firstly, of his race; secondly, of his environment; thirdly, of the circumstances in which he was placed while his talents were developing. Hence Race, Environment, Time—these are the three things to be studied before the man is taken into consideration.

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Rapid changes among the fellows found him at the age of twenty-six "the senior and most responsible of the four Balliol tutors." The experience gained during this period stood him in good stead afterwards as a member of the first Oxford University Commission (1850–52). He never sympathized with the principles of the Tractarian movement, and on the appearance of Tract XC, in 1844, he denounced the "Four Tutors" against it; but this was his only important contribution to the controversy. On the other hand, although his sympathies were on the whole with the liberal movement in the university, he never took a lead in the matter.

In 1842 he became an undistinguished but useful successor to Arnold as headmaster of Rugby; and a serious illness in 1848, the first of many, led him to welcome the comparative leisure which followed upon his appointment to the deanship of Carlisle in 1849. His life there, however, was one of no little activity; he served on the University Commission, he was bishop and cathedral, and did much excellent pastoral work. There too he suffered the great sorrow of his life. He had married Catharine Spooner at Rugby in 1843; in the spring of 1856, within five weeks, five of their children were carried off by virulent scarlet fever. Not long afterwards he was consecrated bishop of London on the 22nd of November 1856, as successor to C. J. Blomfield. His translation to Canterbury in 1868 (he had refused the archbishopric of York in 1862) constituted a recognition of his work, but made no break in it. His last years were interrupted by illness and saddened by the death in 1878 of his only son, Edward, and his wife.

If Blomfield had almost remodelled the idea of a bishop's work, his successor surpassed him. Tait had all Blomfield's earnestness and his powers of work, with far wider interests. Blomfield had given himself zealously to the work of church-building; Tait followed in his steps by inaugurating (1862) the Bishop of London's Fund. He devoted a very large part of his time at London in actual evangelistic work; and to the end his interest in the pastoral side of the work of the clergy was greater than anything else. With his wife, he was instrumental in the work of Visitations, and had carried on the work of the London Missionary Society. His gift of literary expression was great, and he did not lack the attention to the healthful regulation of Anglican sisterhoods during the parochial period in which this was particularly necessary. Nor was he less successful in the larger matters of administration and organization, which brought into play his sound practical judgment and strong common-sense. He was constant in his attendance in parliament, and spared no pains in pressing on measures of practical utility. The modification of the terms of clerical subscription (1865), the new lectionary (1871), the Burials Act (1880) were largely owing to him; for all of them, and especially the last, he incurred much obloquy and loss of popularity. The Roman Catholics of the Ecclesiastical Courts (1881) were due to him, and he took a large part in the deliberations of both. Probably his successor (see Benson, E. W.) was brought into closer relations with the colonial churches than Tait was; but the healthy development of the Lambeth Conferences on the lines of mutual counsel rather than of a hasty quasi-synodical action was largely due to him.

On the other hand, Tait was not successful in dealing with matters which called for the higher gifts of a ruler, and especially in his relations with (a) the liberal trend in modern thought, (b) in the question of the University of Oxford, and (c) in the question of the Oxford Movement itself, though he himself not a little in sympathy with it. But although well-read, he was no scholar in the true sense, and had neither the knowledge to feel sure of his ground nor the theological insight to perceive the real point at issue. His object in dealing with questions of faith, as in dealing with the ritual question, was primarily a practical one: he wished to secure peace, and obedience to the law as he saw it. Consequently, after his sympathies had led him to express himself favourably towards some movement, he frequently found himself compelled to draw back. He expressed a qualified sympathy with some of the writers of Essays and Reviews, and then joined in the censure of it by the bishops (1861). The same kind of apparent vacillation was found in his action in other cases; e.g., in the Colenso case
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(1863), and in the controversy as to the use or disuse of the Athanasian symbol (1872). It was naturally and widely misunderstood. Some who did not know him thought, or pretended to think, that he was a Socinian or a free-thinker. The world at large knew better; but even Temple warned him, in the benefice of St. Alban's, Holborn, for you must keep the fact that you compel them to feel that in every crisis of life they must be on their guard against trusting you." (b) As regards the second point, Tait was concerned with it during the whole of his episcopate, and above all on the side of ritual, on which it naturally came into most direct conflict with the recognized ecclesiastical practice of the day. He had to deal with the St George's-in-the-East riots in 1859, and the troubles at St Alban's, Holborn, in their earlier stages (1867); he took part as assessor in the Privy Council judgment in the Ridsdale case (1877); he was more or less concerned with those who were bishop with the agitation against consecration in 1858, and again in 1877. His method throughout was the same: he endeavoured to obtain a compliance to the law as declared by the courts; failing this, he made the most earnest efforts to secure obedience to the ruling of the Ordinary for the sake of the peace of the Church; after this, he could do nothing. He did not perceive how much of reason the "ritualists" had on their side: that they were fighting for practices which, they contended, were covered by the letter of the rubric; and that, where rubrics were notoriously disregarded on all hands, it was not the earlier, earliest, or the most consistent. In fact, if others were inclined to ignore it altogether, Tait could hardly realize anything but the connexion between the Church and the State. From such a position there seemed to be no escape but in legislation for the deprivation of the recalcitrant clergy; and the Public Worship Regulation Act (1874) was the result. For this Tait was by no means responsible as a whole: some of the provisions which proved most irksome were the result of amendments by Lord Shaftesbury which the bishops were unable to resist; and it must be borne in mind that the most disastrous portion of the measure was contemplated by those who were instrumental in passing it. The results followed inevitably: clergy were cited before a new tribunal, and not only deprived but imprisoned. A widespread feeling of indignation spread not only among High Churchmen, but among many who cared little or nothing for the ritual practices involved; and it seemed impossible to foretell what the outcome would be. But the aged archbishop was moved as much as anybody, and tried hard to mitigate such a state of things. At length, when the Rev. A. H. MacKoonochie was on the point of being deprived of his benefice of St. Alban's, it was not fair to proceed against an archbishop, then on his deathbed at Addington, took steps which resulted in the carrying out of an exchange of benefices (which had already been projected), which removed him from the jurisdiction of the court. This proved to be the turning-point; and although the ritual difficulty by no means ceased, it was afterwards dealt with from a different point of view, and the Public Worship Regulation Act became practically obsolete. The archbishop died on the 3rd of December (Advent Sunday), 1882, leaving a legacy of peace to the Church.

Tait was a Churchman and a man of science, although the work of the latter was confined to all England, he remained a Scotman to the end. It was the opinion of some that he never really understood the historical position of the English Church and took no pains to learn. John Tilloston, one of his predecessors in the archbishopric, was a favourite hero of his, and in some ways the two men resembled one another. But Tait had none of Tilloston's gentleness, and he rode roughshod over the obstacles in his way. He cannot be called a great ecclesiastical statesman, but he administered his office well and was undoubtedly one of the foremost public men of his day.

See R. T. Davidson and D. Benham, Life of Archbishop Tait, 2 vols. (1894); A. C. Tait, Catherine and Crawford Tait (1880). (W. E. Co.)

TAIT, ARTHUR FITZWILLIAM (1819-1902), American artist, was born near Liverpool, England, on the 5th of August 1819. He emigrated to the United States in 1859, and was identified with the art life of New York until his death. In 1858 he was elected to full membership in the National Academy of Design, New York. He died at Yonkers, New York, on the 28th of April 1902. He painted barnyard swarms and such as sheep and deer, with great dexterity, and reproductions of his minute panels of chickens had an enormous vogue.

TAIT, PETER GUTHRIE (1831-1901), Scottish physicist, was born at Dalkeith on the 28th of April 1831. After attending the Academy at Edinburgh and spending a session at the University, he went up to Cambridge as a member of Peterhouse, and graduated as senior wrangler and first Smith's prize-man in 1852. As a fellow and lecturer of his college he remained in Cambridge for two years longer, and then left to take up the professorship of mathematics at Queen's College, Belfast. There he made the acquaintance of Thomas Andrews, whom he joined in researches on the density of ozone and the action of the electric discharge on oxygen and other gases, and by whom he was introduced to Sir W. R. Hamilton and quaternions. In 1860 he was chosen to succeed his old master, J. D. Forbes, as professor of natural philosophy at Edinburgh, and this chair he occupied till within a few months of his death, which occurred on the 4th of July 1901, at Edinburgh. The first scientific paper that appears under Tait's name only was published in 1851. His most important work was in the new calculus of quaternions (q.v.), of which he may be regarded as the leading exponent after their originator, Hamilton. He was the author of two text-books on them—one an Elementary Treatise on Quaternions (1867), written with the advice of Hamilton, though not published till after his death, and the other an Introduction to Quaternions (1873), in which he was aided by Professor Philip Kelland (1808-1879), who had been one of his teachers at Edinburgh. In addition, quaternions was one of the themes of his address as president of the British Association for the Year 1881, but he also produced original work in mathematical and experimental physics. In 1864 he published a short paper on thermodynamics, and from that time his contributions to that and kindred departments of science became frequent and important. In 1871 he emphasized the significance and promise of the principle of the dissipation of energy. In 1873 he took thermoelectricity for the subject of his discourse as Rede lecturer at Cambridge, and in the same year he presented the first sketch of his well-known thermoelectric diagram before the Royal Society of Edinburgh. Two years later researches on "On a Vacuum, or the true dynamical explanation of the Crookes radiometer in the large- ness of the free path of the molecule of the highly rarefied air. From 1879 to 1888 he was engaged on difficult experimental investigations, which began with an inquiry into the corrections required, owing to the great pressures to which the instruments had been subjected, in the readings of the thermometers employed by the "Challenger" expedition for observing deep-sea temperatures, and which were extended to include the compressibility of water, glass and mercury. Between 1886 and 1896 he published a series of papers on the application of the kinetic theory of gases, the fourth of which contained what was, according to Lord Kelvin, the first proof ever given of the Waterston-Maxwell theorem of the average equal partition of energy in a mixture of two different gases; and about the same time he carried out investigations into impact and its duration. Many other inquiries conducted by him might be mentioned, and some idea may be gained of his scientific activity from the fact that a selection only from his papers, published by the Cambridge University Press, fills three large volumes. This mass of work was done in the time he could spare from his professorial teaching in the university. In addition, he was the author of a number of books and articles. Of the former, the first, published in 1866, was on the dynamics of a particle; and afterwards there followed a number of concise treatises on thermodynamics, heat, light, properties of matter and dynamics,
together with an admirably lucid volume of popular lectures on Recent Advances in Physical Science. With Lord Kelvin he collaborated in writing the well-known Treatise on Natural Philosophy. "Thomson and Tait," as it is familiarly called ("T. and T." in their own formula), was planned soon after Lord Kelvin became acquainted with Tait, on the latter's appointment to his professorship in Edinburgh, and it was intended to be an all-comprehensive treatise on physical science, the foundations being laid in kinematics and dynamics, and the structure completed with the properties of matter, heat, light, electricity and magnetism. But the literary partnership ceased in about eighteen years, when only the first portion of the plan had been completed, because each of the members felt he could work to better advantage separately than jointly. The friendship, however, was renewed for the twenty-three years which yet remained of Tait's life.

Tait collaborated with Balfour Stewart in the Unseen Universe, which was followed by Paradoxical Philosophy. Among his articles may be mentioned those which he wrote for the ninth edition of this Encyclopaedia on Light, Mechanics, Quaternions, Radiation and Thermodynamics, besides the biographical notices of H. Newton and Clerk Maxwell.

TAJIK, or PARSIWAN, a subject race of Afghanistan. Underlying the predominant Pathan elements in the country, the Tajik (Tajak, or Tausik) represents the original Persian possessor of the soil, who still speaks his mother tongue and therefore calls himself Parsiwan. There are several Persians in Afghanistan, such as the Kizilbashas of Kabul and the Naoshirvans of Herat. The Tajiks are nomeans, that is, nomads, and their occupations were to be applied only to an admixture of original Arab and Persian stock, who are the slaves of the community—hewers of wood and drawers of water. Everywhere the Tajiks are the cultivators in rural districts, and the shopkeepers and clerks in the towns. They are a fine, athletic people, generally fair in complexion, and assimilate in aspect, in dress, and in much manner to the Afghans, but they are never nomadic. The Tajik is as much the slave of the Pathan in Afghanistan as is the Hindu (whose origin is similar) in the plains of the Indus. Yet the Tajik population of the richly-cultivated districts north of Kabul proved themselves to be of good fighting material in the Afghan war of 1879-80, and the few Kizilbashas that are to be found in the Indian army are brave soldiers. The number of the Tajiks in Afghanistan is estimated at 900,000.

The name itself originally occurs in the Pahlavi writings, and is explained to mean, first, the Abas in general, then their descendants born in Persia and elsewhere out of Arabia, and, lastly, the Persians in general and their descendants born in or out of Persia. Tajik thus came to be the collective name of all communities of Iranian stock and Persian speech wherever found in Central Asia and the new countries of Afghanistan and Persia. The Tajik language is a northward extension of the Persian empire; but, after the ascendency of the Turkic races, they became the subject element in Turkestan, Afghanistan, Bokhara, Khiva, Kashgaria, while still politically dominant in Badakshan, Wakhan, Darzaw, Kost and Karachob. In most of these places the Tajiks, with the kindred Gelaches, seem to form the bulk of the population, the distinction being that "Tajik" is applied rather to the settled and more civilized lowlanders of modern Persian speech, "Gelach" to the highlanders of Ferghana, Kohistan, Wakhan, &c., who speak either archaic forms of Persian or dialects intermediate between the Iranian and Mongolian languages and Indo-European linguistic forms.

But, although mainly of Iranian stock, with light complexion and regular features, the Tajiks claim Arab descent, regarding the district about Bagdad as their primateal home, and considering themselves the descendants of the authors of the Koran, was planned soon in the first century of the Hijra. At the same time, "it is evident that the inhabitants of the greater part of this region (Central Asia) must from an early period have come in contact with the successive waves of Turkish (Turk) and even Mongol population which broke over them; accordingly we find that, although the type is essentially Iranian, it has undergone a certain modification" (Capt. J. M. Thomson, The Tajiks of Afghanistan). It should be distinguished from the Sar, the latter simply meaning "trader" or "shepherd" and therefore being applied indiscriminately to the settled as opposed to the nomad element, and especially to the urban populations, of whatever race they may be. The Tajiks are known as Tats on the west side of the Caspian (Baku, Lenkoran, &c.).

TAKHTSINGJI (1838–1896), Maharaja of Bhaunagar, a Rajput chief of the Gohel clan, and the ruler of a state in Kathiawar, was born on the 6th of January 1838, and succeeded to the throne of Bhaunagar on the death of his father, Jaswant-singji, in 1875. During his minority, which ended in 1878, he was educated at the Rajkot college and afterwards under an English officer, while the administration of the state was controlled by the late J. H. Percival, a member of the Indian Civil Service, and Asam Government, which, however, was one of the foremost native statesmen of India, who had served the state in various capacities since 1822. At the age of twenty Takhtsingji found himself the ruler of a territory nearly 3000 square miles in extent. His first public act was to sanction a railway connecting his territory with one of the main trunk lines, which was the first enterprise of its kind on the part of a raja in western, if not in all, India. The commerce and trade, and the economic and even social development of the state, which came in the wake of this railway, confirmed Takhtsingji in a policy of progressive administration, the careful planning and establishment of hospitals and dispensaries, trunk roads, bridges, handsome edifices and other public works grew apace. In 1886 he inaugurated a system of constitutional rule, by placing several departments in the hands of four members of a council of state under his own presidency. This innovation, which had the warm support of the governor of Bombay, Lord Reay, provoked a virulent attack upon the chief, who brought his defamers to trial in the High Court of Bombay. The punishment of the ringleaders broke up a system of blackmailing to which it was used to be subjected, and the public spirit of Takhtsingji in freeing his brother and himself, this event, was widely acknowledged throughout India, as well as by the British authorities. In 1886 he was created G.C.S.I.; and five years later his hereditary title of thakore was raised to that of maharaja. In 1893 he took the occasion of the opening of the Imperial Institute by Queen Victoria to visit England in order to pay personal homage to the sovereign of the British Empire, on which occasion the University of Cambridge conferred on him the degree of L.L.D. He died in 1896. (M.M.Bt.)

TAKIN, the Mishmi name of a remarkable hollow-horned mammal (Budorcas taxes), the tusked wapiti, educational establishments, hospitals and dispensaries, trunk roads, bridges, handsome edifices and other public works grew apace. In 1886 he inaugurated a system of constitutional rule, by placing several departments in the hands of four members of a council of state under his own presidency. This innovation, which had the warm support of the governor of Bombay, Lord Reay, provoked a virulent attack upon the chief, who brought his defamers to trial in the High Court of Bombay. The punishment of the ringleaders broke up a system of blackmailing to which it was used to be subjected, and the public spirit of Takhtsingji in freeing his brother and himself, this event, was widely acknowledged throughout India, as well as by the British authorities. In 1886 he was created G.C.S.I.; and five years later his hereditary title of thakore was raised to that of maharaja. In 1893 he took the occasion of the opening of the Imperial Institute by Queen Victoria to visit England in order to pay personal homage to the sovereign of the British Empire, on which occasion the University of Cambridge conferred on him the degree of L.L.D. He died in 1896. (M.M.Bt.)

TAKLÁ MAKÁN, the Central Asian desert which lies between the N. foot of the Kuen-lun ranges and the wide curve of the Tarim river on the W., N., and E. It appears to be naturally divisible into two parts by the river Khotan-darya, and the name applied to the western part between that river and the Yarkand-darya (Tarim) is the desert of Takla Makan proper, while the part between the Khotan-darya and the line of the lower Tarim and the Cherchen-darya is known as the desert of Cherchen. The former is occupied almost entirely by sand-dunes. Sand mountains range in altitude from 60 ft. up to as much as 300 ft. The only breaks in this "sea of sand-waves" are a few small patches of alluvial clay. Often two distinct systems of dunes can be distinguished; one system, consisting of the larger concatenations, stretches from E. to W., while the secondary or transverse dunes run from N. to S., or from N.E. to S.W. The steeper faces of the dunes and of the dune accumulations for the most part turn towards the S.,
the S.W. and the E., that is, invariably away from the direction of the prevailing winds; but in some parts the steep faces are those fronting the E. and the S. In the desert of Charchen, however, where the general height of the dunes in the N.E. is uniformly greater than in the desert of Takla Makan proper, reaching up to 350 ft., the configuration of the dunes appears similar. A rough, parallel-walled, and steeply sloping plateau of level clay called bayirs, varying in size from half a mile to a dozen miles in length, barren and tinged with saline deposits in the middle, with scanty vegetation around, and lofty sand-dunes overpowering them on both sides. These elliptical, cauldron-shaped basins all stretch from N.E. or E.N.E. to S.W. or W.S.W., and are arranged in long curving chains, the successive depressions being parted by transverse ridges of sand. They owe their configuration in great part, perhaps entirely, to the prevailing wind.

On perfectly level ground the dunes are crescentic in shape, have a steep face towards the W., are highest in the centre, and slope away in each direction towards the two horns or cusps of the crescent. On the windward side they have a convex, spoon-shaped slope, regularly marked, but crumpled by tiny sand-waves or ripple-marks.

With regard to the large accumulations of sand (in the desert of Charchen) we have ascertained the following laws—(1) In the N. the desert they turn their steep faces towards the N.W., in the S. towards the S.W., and ascend in layers of sand; (2) their eastern slopes ascend rather slowly towards their crests; (3) on the other side their steep windward faces go down sheer at an angle of 45° or more, and dunes diminish towards the S.; (4) they are each built up of an innumerable number of individual dunes; (5) although their relief is influenced by winds from other quarters than the predominant, their mass is usually in a crescentic arrangement; (6) it is their varying breathings which give rise originally to the thresholds, and consequently to the formation of the bayirs" (Sven Hedin, op. cit. i. 352).

The bayirs become progressively rarer, less distinct, and smaller in size as one advances from E. to W. At the same time the arrangement of the sand-dunes grows more and more irregular, and the dunes themselves plunge steeply down towards the W., the S., and the S.W., and are drawn out in long parallel lines towards the N.W. and S.E. In that part of the desert two systems of dunes are distinguishable, intersecting or rather crossing over one another diagonally or at right angles. In the extreme west, at Ordan-Padshah, between Kashgar and Yarkand, the dunes travel annually some 13 ft. towards the S.E., not towards the S.W. The principal cause of the difference between the arrangement of the sand-dunes in the desert of Charchen and the arrangement of the sand-dunes in the desert of Takla Makan proper in the W. is the wind. In the latter, winds from several quarters cooperate to mould the relief of the desert into capricious and changing outlines; but in the E. the wind blows not only with greater regularity from one settled direction, the N.E. or E.N.E., but also with much greater violence. Indeed, it is in the open Lop country, where the mountains, the Kuruk-tagh, and the Astin-tagh on the N., and the Targin-Tagh on the S., are the nearest to each other, that the wind develops its greatest and most concentrated energy. In the E., where the sand waves are most exposed to the fiercest wind, they form elongated waves, distinctly outlined, corresponding to the breakers of the ocean. They disseminate themselves westwards over the desert in ever-widening concentric circles. The curving courses of the Tarim and the Koucheh-darya are the only check upon the invasion of the Takla Makan by the sand which is generated in the desert of Lop or further E. and N. in the mountains which girdle the desert of Gobi. But the former river is itself encroaching upon the N.E. margin of the desert, and pressing more and more towards the S.W.

With regard to the origin of the stupendous masses of sand that form the Tarim. K. Bogdanovich considers them to consist for the most part of the disintegrated products of the fine-grained alluvial clays of the desert itself. On the other hand, G. N. Potanin and V. A. Obruchev both seek for its origin in the harshest winds which work together with the disintegrated debris; but subject to certain modifications, Sven Hedin is disposed to agree. But he adds that the masses of sand themselves are derived from three separate sources, in part directly, in part indirectly, the direct being (1) the result of disintegration from the adjacent mountains, whether sandstones or crystalline rocks; (2) through the activity of the wind operative amongst the alluvial alluvia of the rivers and temporary lakes; (3) through the sand that was already present in the soil, and which became exposed in rings more or less concentric in proportion as the former (Central Asian Mediterranean) sea dried up. Of these agencies the river Tarim makes by comparison much the smallest contribution. The desert environed by the Tarim is of the area covered by sands in the desert of Takla Makan proper is estimated at nearly 116,000 sq. m., and the area covered by them in the desert of Charchen at 154,480 sq. m. (Central Asian Mediterranean) sea dried up. Of these agencies the river Tarim makes by comparison much the smallest contribution. The desert environed by the Tarim is of the

Vegetation and animal life are extremely scarce. The former is practically confined to various steppe plants, komisk (reeds), tamarisks (almost invariably growing on root-mounds), and poplars. The animals are hares and snakes or one or two other rodents, foxes, and in a few places the wild camel.

The climate is one of extremes. At Merket on the W. verge of the desert of Takla Makan proper the winters are cold, though the snowfall is small, while the summers are hot. In the desert of Charchen a temperature of —22° F. has been observed in the depth of winter, and there snow sometimes falls heavily. During the sandstorms which sweep over the region in spring, the thermometer drops as much as 10° or 12° F. below zero. On the other hand, a temperature as high as 86° has been recorded in the end of April (cf. Gobi). It is only in winter that this appalling desert can be crossed without great risk, and then only with great difficulty. It is in winter that the sandstorms in the desert and the dust-hazes, which often assume the aspect of a thick fog, are least frequent. Sometimes for days together the desert is enveloped in an impenetrable dust-haze, which chokes and destroys all living creature. In the 18th century A.D. Marco Polo left behind him a description of this desert and related legends associated with it (see the edition of his travels in English by Sir H. Yule, ed. 1903). The full extent of the area which is still inhabited by a people, and the nature of his Scientific Results of a Journey in Central Asia, 1809—1902 (Stockholm, vols. i. and ii. 1905—6); see also his Through Asia (London, 1898), vol. I. For archaeology, see Turkestan. (J. T. B.)

**TALAING,** more accurately called Mm, the name given to the remnant of the Peguan race, which for long stove with the race of Tartars for the ascendancy in the deserts; but it is now Bugia. In the middle of the 18th century the Peguans were masters of the country from the Gulf of Martaban to the north of Mandalay. Now, however, the Talaing population is practically confined to the Tenasserim and Pegu divisions of Lower Burma, and even there it seems to be dying out. According to the census of 1900 they numbered only 531,808 persons, of whom 154,458 spoke the Talaing language. The Talaiings are, historically, the most important representatives in Burma of the Môn-Annam linguistic family, who have left tokens of their presence from the Khasia Hills in Assam to the Gulf of Siam. The origin of the name Talaiings is remote. At Talavera, the city of Talavera in the province of Toledo, on the right bank of the river Tagus, and on the Madrid-Cáceres railway. Pop. (1900) 10,580. Talavera is of great antiquity, the Caesalpina of the Romans. Portions of the triple wall which surrounded it remain standing, and the Arco de San Pedro is one of its Roman gates restored. Among the ancient buildings are the Torres Albarranares, built by the Moors in the 10th century, the Gothic college church, and three secularized convents, one of which dates from the 11th century, but has twice been partially restored, and is now a factory. The bridge of thirty-five arches across the Tagus dates from the 15th century. The palace of the queen" was so named because, from the time of Philip IV. of Alphonso XL (1312—50), it was the property of the queens of Castile.

For the operations which culminated in the famous battle of Talavera, between the English and the French, and those which followed that engagement, see PENINSULAR WAR. Sir Arthur Wellesley (afterwards Duke of Wellington), the British commander, acting in co-operation with Lieutenant-General Guesda's Spanish army, took position on the 27th of July 1809 on the Upper Tagus,

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1 Sven Hedin, op. cit. i. 356.
protected by his advanced guard. His line, facing due east, ran north from the right bank of the river to a ridge running parallel to the Tagus, beyond which ridge, also running parallel to the Tagus and along with their right flank resting on the river held Talavera itself and the close country to the northward of it: Wellesley’s right connected with Cuesta’s left, and his line was in the form of a crescent. When this was more firmly fixed, the British advanced, and, by the 29th, were in line to the right of the Tagus. The battle was begun by the attack of two French divisions on the British advanced guard, which retired into the main position without loss. The centre of the British line was occupied by Marshal Sir John Moore, followed up by Wellesley’s line of battle. For some time the possession of the ridge (owing to the delay of Hill’s Division) was doubtful, and Rufane Donkin’s brigade handled it with skill, and on the 30th, the arrival of the troops under Commando Sir Edward Manchester secured this all-important point for the Allied left. Meanwhile the Spaniards (though there was at first a temporary panic amongst them) and the right divisions of the British repulsed an attack in the plain, and the day closed with the armies facing each other along the rivulet and on the ridge. The losses had been heavy on both sides. Early on the 28th the battle was renewed by a furious attack on Hill’s troops, whose left was now protected by the Allied cavalry and a division borrowed from Cuesta. King Joseph Bonaparte and Jourdan his chief of staff, who were present, were averse from fighting on this present ground, wishing to wait for a more propitious opportunity, and Wellesley, it was only after long discussion that the king gave a reluctant assent to Victor’s plan of attack. That Marshal’s divisions once more tried to out Hill from the ridge, and once more failed before the superior numbers and the British line of battle, which was firmly posted in this quarter (though, owing perhaps to defective ground- scouting, this nearly ended in disaster). At the same time General Sarrut attacked an allied centre. Surrounded by a body of troops, the French incautiously left the ridge, and the British, under Victor, followed them up sharply, and soon came upon Wellesley’s line of battle. This time Lapisse’s division of Victor’s corps attacked the Allies’ left centre, composed of the British Guards. The French columns were again checked by the British line, but here the counter- strokes of the Allies fell short, and the French left was carried. The British in the ardour of incautious pursuit were very severely handled and pushed back to the position by the French reserves; when Wellesley decided the day by a counter attack with the 48th regiment, made with great intrepidity and steadiness. The Guards, with splendid discipline, resumed their positions, and eventually the French, with their leader Lapisse mortally wounded, fell back. Failure all along the line, and heavy losses left King Joseph no alternative but to retire towards Madrid. The French lost 7268 men out of 46,138 present, the British 5363 out of 20,641; the Spanish losses were officially returned at 1201 out of some 36,000 present.

TALBOT (FAMILY) Apart from its achievements, this is one of the few families in the English aristocracy which traces alike its descent and its surname from the Norman conquerors of England; and it may be said that there has hardly been a time since the battle of Hastings when its members have not been of considerable account in public life. Yet in some periods they appear rather as a potential influence, while at certain marked epochs they stand out among the most prominent actors in English history. The name of Richard Talbot occurs in Domescay Book as the holder of nine hides of land in Bedfordshire under Walter Giffard. There is no evidence that he came over to England with the Conqueror himself; and, as he did not hold of the king in copite, it is clear that he was not a leader. Talbot being a personal nickname and not derived from a place, those who bore it were probably connected with him in some way, but not necessarily connected, and stretched as far as the west Lancashire coast. But a Geoffrey Talbot may be found in the pedigree connected with the empress Maud against King Stephen; and a Hugh Talbot held the castle of Plessis against Henry I. for Hugh de Gournay, and afterwards became a monk at Beaubeac in Normandy. Richard Talbot, with whom the proved pedigree begins, obtained from Henry II. on his accession the lordship of Linton in Herefordshire, and from Richard III. the custody of Ludlow Castle; and his descendants for some generations appear to have been wardens of various castles on the borders of Wales, and intermarried with the great families of this region. Under Edward I. and Richardson. George, Talbot was head of the house, and invaded Scotland in the king’s campaign, but afterwards took part with Thomas of Lancaster against the king. He, however, was pardoned, and obtained from Edward III. a confirmation of the grant of the manor of Linton and other lands, being summoned to parliament as a baron (1331).

His son Richard, who had married a daughter and co-heiress of John Comyn of Badenoch, laid claim to certain lands in Scotland in her right, and, when restrained from entering that country by land (Edward III. having then made an alliance with the English), was by the latter's capture in Gascogne invaded by it in sea in the interests of Edward Balliol. Three years later he was taken prisoner in Scotland, and redeemed for 2000 marks, after which the king made him governor of Berwick. He took part also in Edward’s wars against France, as did likewise his son Gilbert, who succeeded him. His wife had brought him the noble seat of Goodrich Castle on the Wye, and at this time the family possessed lands in the counties of Oxford, Gloucester, Hereford and Kent. Gilbert’s son Richard added to this inheritance by marrying the heiress of Lord Strange of Blackmere, and himself became under Richard II. one of the heirs of the earl of Pembroke, thus adding to his estates, lands in Berkshire, Wiltz, Salop and Essex. Another Gilbert Talbot, grandson of the last, claimed to carry the great spurs at the coronation of Henry V., and had a commission to receive the submission of Owen Glendower and his adherents. He also distinguished himself in the invasion of Normandy. He was twice married, his second wife being a Portuguese lady, but he left no male issue, and was succeeded by his brother John.

Hitherto the head of the house had borne the name of Lord Talbot; but this John, after obtaining by marriage the title of Lord Furnival, joined his name to it, and became Lord Talbot of Shrewsbury (see SHREWSBURY, JOHN TALBOT, 1st earl of). Besides his martial exploits, this John claims some attention for his family alliances. His first wife Maud, a granddaughter of Thomas, Lord Furnival, brought him the castle of Sheffield as part of her inheritance, and he was accordingly summoned to parliament in the days of Henry IV. as John Talbot of Hallamshire, otherwise Lord Furnival, more than thirty years before he was made earl of Shrewsbury. The property became a favourite residence of the family during the Tudor era; and, but for the death in 1616 of Gilbert, 7th earl of Shrewsbury, without male issue, Sheffield might have remained much longer a centre of feudal magnificence rather than of commerce and manufactures. The second wife of John, earl of Shrewsbury, was Margaret, the eldest of three daughters of Richard Beauchamp, earl of Warwick, by that earl’s second wife, a daughter of Thomas, Lord Berkeley. By her he obtained a third part of the Berkeley property; and, though she did not become the mother of a line of ears, her eldest son, John Talbot, was created Viscount Lisle, and it was he who fell along with his father at Shrewsbury. In 1588 he joined the expedition which under Sir John Gilbert, who inherited the title of Viscount Lisle, was slain at the early age of twenty-two in a feudal contest with Lord Berkeley, arising out of a dispute as to the possession of Berkeley castle, on the 20th of March 1470; and the title was afterwards conferred on Edward Grey, the husband of one of his two sisters.

John, the second earl of Shrewsbury, was the 1st earl’s son by his first wife. He had been knighted at Leicester in 1426 along with the infant king Henry VI., had served in the wars of France, and been made chancellor of Ireland during his father’s lifetime, when he was only Lord Talbot. Afterwards he was made lord high treasurer of England, and in 1450 was rewarded for his services to the house of Lancaster with a grant of 200 marks a year out of the lordship of Wakefield, forfeited by Richard, duke of York. But next year he and his brother Christopher were slain at the battle of Northampton, fighting in the cause of Henry VI. His son John succeeded him, and then his grandson George, who fought for Henry VII. at Stoke, and whom King Henry VIII. sent as his lieutenant against the rebels in the Pilgrimage of Grace. But perhaps the thing which most redounds to his credit is the humanity with which he received the fallen Cardinal Wolsey into his house at Sheffield when he was on his way up to London as a state prisoner.

Francis, the 3rd earl, took a leading part in the invasions of
TALBOT, M. A.—TALC

Scotland under Henry VIII. and Edward VI., and was one of the two peers who alone opposed the bill for abolishing the pope's jurisdiction under Elizabeth. His son George, who succeeded, was the earl to whom the custody of Mary Stuart was committed, his task being rendered all the more difficult for him by the intrigues of his second wife, Beatrice of Hardwick, the barren of Sir Gilbert's son. John married three husbands before her union with him. Two sons of this last earl succeeded one another, and the title then devolved, for want of male issue, on the lineal descendants of Sir Gilbert Talbot of Grafton in Worcestershire, third son of John, the 2nd earl. But the old baronies of Talbot, Strange of Blackmore, and Furnival had passed away in 1616 to the daughters of the 7th earl, of whom the youngest married Thomas (Howard) earl of Arundel, whose descendant, the Duke of Norfolk, has the valuable Furnival estates. The above Sir Gilbert had fought for Henry VII. at Bosworth, where he was severely wounded, was knighted on the field, and was throughout one of the first Tudor's most trusted councillors. He fought also at Stoke against the insurgents with Lambert Simnel, was made a knight banneret, governor of Calais, and lord chamberlain.

The 9th earl, George, descended from this Gilbert, died unmarried, and his nephew, who followed, was succeeded by his grandson Francis, chiefly memorable for his unhappy fate. His second wife, the "wanton Shrewsbury" of Pope, a daughter of the earl of Cardigan, was seduced by the duke of Buckingham, whom the outraged husband challenged to a duel. The courteous, it is said, was present at the scene, and held Buckingham's horse in the disguise of a page, saw her husband killed, and then clasped her lover in her arms, receiving blood-stains upon her dress from the embrace. Charles, the 12th earl, son of this unfortunate nobleman, was raised by William III. to the dignity of a duke, but as he left no son this title died along with him in 1718, and the earldom of Shrewsbury devolved on his cousin Gilbert, a Roman Catholic priest.

From this time the direct line of Sir Gilbert Talbot of Grafton began to fail. A nephew three times succeeded to an uncle, and then the title devolved upon a cousin, who died unmarried in 1836. On the death of this cousin the descent of the title was for a short time in dispute, and the lands were claimed for Lord Edmund Howard (now Talbot), an infant son of the Duke of Norfolk, under the will of the last earl; but the courts decided that, under a private act obtained by the Duke of Shrewsbury shortly before his death, the title and bulk of the estates must go together, and the true successor to the earldom was found in Earl Talbot, the head of another line of the descendants of Sir Gilbert Talbot of Grafton, sprung from a second marriage of his eldest son, Edward Talbot, from his mother, the heiress of the barony of Dunster.

All the titles just mentioned have been united in the line of the Earl Talbot who successfully claimed the Shrewsbury title as the 18th earl, the earldom of Shrewsbury (1442) being now the oldest existing that is not merged in a higher title. The family seats (Aston Towers and Ingelstall Hall) and the chief estates are in Staffordshire. The old badge of the family was a "tubot" or running hound. (J. GA; J. II. R.)

TALBOT, MARY ANNE (1775-1808), the "British Amazon," was born in London on the 2nd of February 1778. She believed herself to be the illegitimate child of the 1st Earl Talbot. Early in her career she married Sir John Talbot, from his mother, a captain. In 1792 she was a drummer in Flanders. In the capture of Valenciennes her lover was killed; and Mary Anne deserted and became cabin boy on a French lugger, which she asserted was captured by the British, who transferred her to the "Brunswick," where she served as a powder monkey, being wound in Lord Howe's victory of the 1st of June 1794. For this she later received a small pension. When the wound healed she again went to sea, was captured by the French, and imprisoned for a year and a half. Her son was not the eldest until shortly afterwards she was seized by a pressgang. She finally became a household servant to Robert Kirby, a London publisher, who included an account of her adventures in his Wonderful Museum (1804) and in Life and Surprising Adventures of Mary Anne Talbot (1809). She died on the 4th of February 1808.

TALBOT, WILLIAM HENRY FOX (1800-1877), English discoverer in photography, was the only child of William Davenport Talbot, of Lacock Abbey, Wiltshire, and of Lady Elizabeth Fox Strangways, daughter of the 2nd earl of Ilchester. He was born on the 11th of Feb. 1800, and was educated at Harrow and at Trinity College, Cambridge, where he gained the Pocon prize in 1820, and graduated as twelfth wrangler in 1821. From 1822 to 1872 he frequently communicated papers to the Royal Society, many of them on mathematical subjects. At an early period he had begun his optical researches, which were to have such important results in connexion with photography. To the Edinburgh Journal of Science in 1826 he contributed a paper on "Some Experiments on Coloured Flame," to the Quarterly Journal of Science in 1829 a paper on "Monochromatic Light," and to the Philosophical Magazine a paper of 1830 on "Chemical Changes of Colour." Before L. J. M. Daguerre exhibited in 1839 pictures taken by the sun, Talbot had obtained similar success, and as soon as Daguerre's discoveries became known communicated the results of his experiments to the Royal Society. In 1841 he made known his discovery of the calotype or talbotype process, and after the discovery of the collodion process by Frederick Scott Archer in 1851 he devised a method of instantaneous photography. For his discoveries, which are detailed in his Pencil of Nature (1844), he received in 1842 the Rumford medal of the Royal Society, while engaged in his scientific researches he devoted much time to archaeology. He published Hermes, or Classical and Antiquarian Researches (1838-39), and Illustrations of the Antiquity of the Book of Genesis (1839). With Sir Henry Rawlinson and Dr Edward Hincks he shares the honour of having been one of the first decipherers of the cuneiform inscriptions of Nineveh. He was also the author of English Etyymology (1846). He died at Lacock Abbey on the 17th of September 1877.

TALBOT OF HENSOl, CHARLES TALBOT, 1st Baron (1685-1737), Poet laureate and chancellor of England, was the eldest son of William Talbot, bishop of Durham, a descendant of the 1st earl of Shrewsbury. He was educated at Eton and Oriel College, Oxford, and became a fellow of All Souls College in 1704. He was called to the bar in 1711, and in 1717 was appointed solicitor-general to the prince of Wales. Having been elected a member of the House of Commons in 1720, he became solicitor-general in 1726, and in 1723 he was made lord chancellor and raised to the peerage with the title of Baron Talbot of Hensol. Talbot proved himself an equity judge of exceptional capacity and of the highest character during the three years of his occupancy of the Woolsack. He died on the 1st of January 1737. Among his contemporaries Talbot enjoyed the reputation of a wit; he was a patron of the poet Thomson, who in The Seasons commemorated a son of his to whom he acted as tutor; and Butler dedicated his famous Analogy to the lord chancellor. The title assumed by Talbot was derived from Hensol in Glamorganshire, which came to him through his wife.


TALC, a mineral which in its compact forms is known as steatite, or soapstone. It was probably the μαύροι νήσοι of Theophrastus, described as a stone of silvery lustre, easily
cut. The word talc, sometimes written talk, is said to come from the Arabic talq, and not to be connected, as has been fancifully suggested, with the Swedish talja, "to cut." Talc and mica were confused by the older writers, and even at the present day mica is sometimes known in trade as talc; whilst the term was formerly applied also to foliated gypsum.

Talc is found occasionally in small hexagonal and rhombic plates, with perfect basal cleavage, and they are supposed to be monoclinic. Talc often occurs in foliated masses, sometimes with a curved surface, readily separating into thin folia. The nearly transparent talc gives a six-rayed percussion-figure. Talc has a hardness of only about 1, and a specific gravity of from 2.6 to 2.8. Its extreme softness and its greasy feel are characteristic. The lustre on the cleavage face is pearly, or sometimes silvery, and one of the old names of the mineral was steatite, while German writers sometimes called it Kattensilber. The colour is white, grey, yellow or frequently green. The mineral has strong hire-fringence and a small optic axial angle.

Talc is a magnesium silicate H_{2}MgsSiO_{5}. It is generally regarded as a hydrous silicate, but the water is expelled only at about 400°. The water and magnesium oxide may be regarded as basic. By the action of heat the hardness of the mineral is greatly increased. Pseudomorphs are known after actinolite, pyroxene, etc., and the mineral has probably been generally formed by the alteration of ferro-magnesian silicates. Talc occurs chiefly in crystalline schists, usually associated with chlorite, serpentine and dolomite. Fine examples of apple-green colour are found at Mount Greiner, in the Zillerthal, Tirol. Talc-schist is a foliated rock composed chiefly of talc, generally associated with quartz and felspar; but all soapy schists are not necessarily talciferous. The nearly micaceous constituent of the Alpine protogine is a muscovite.

The "steatites" of Pliny was a stone resembling fat, but otherwise undescribed. Being easily cut, steatite has always been a favourite material with the carver: it was used for Egyptian scarabs and other amulets, which were usually coated with a blue vitreous glaze; and it was employed for Assyrian cylinders and for other ancient signets. By the Chinese steatite is largely used for ornamental carvings, but many of their "soapstone" figures are wrought in a compact pyrophyllite (q.v.), which is essentially different from talc. The name galatomite is given to a steatite from a deposit near Bideford, Devon, which is represented by a plate, engraved by a Mr. H. Klaproth from the Greek ἄγαλμα, "an image." Pagodite is an old name for Chinese figure-stone. Ancient steatite carvings are found among the ruins of Rhodesia.

Steatite is usually a white, grey, greenish or brown substance, occurring in veins or nodular masses or in lenticular bedded deposits. Pseudomorphs after quartz and dolomite occur near Wunsiedel in Bavaria. In some cases it is a product of the alteration of pyroxenic rocks, and the commercial mineral may be very impure. The ease with which steatite may be worked, coupled with its power of resisting heat, has led to its employment for vessels for household use, whence it is called "potstone"—the lapis albaris of old writers. Among the uses of steatite may be mentioned its employment, especially in America, for sinks, stoves, firebricks, foot-warriors, tips for gas-burners and electric switchboards: when ground it is used as a filler for paper, for leather-dressing, for covering steam-pipes, as an ingredient in soap, for toilet-powder, for certain paints and as a lubricant. A fine granular steatite is used by tailors for marking cloth under the name of "French chalk" or "Spanish chalk." Slate pencils are made of steatite and pyrophyllite; and in Burma steatite is much used for writing on black paper. In the oxyhydrogen flame, steatite has been fused and drawn out into threads, like quartz-fibres.

Steatite and talc-schists are widely distributed, and have occasionally been used as building stones. When first raised the stone is soft, but hardens on exposure. Soapstone from Gudbrandsdal is used in the cathedral of Trondheim in Norway. Veins of steatite occur in the serpentine of the Lizard district in Cornwall, and the mineral was used under the name of soap rock in the manufacture of the old Worcester porcelain. Among localities of steatite in the British Isles mention may be made of Croby Head and Garnet letterkenny in co. Donegal, Ireland; the Sheilds isles, the Hebrides (Harris) and Shiness in Sutherland. In North America the distribution of this mineral is very extensive; localities of economic importance are Gouverneur and St. Lawrence co., New York; at Francetown in New Hampshire; Stockbridge, Windsor co., Vermont; Lynnfield, Massachusetts; Granville, Peru, Amelia, Beacon, Fairfield and Fluavanna co.s, Virginia; Cherokee, Moore and Swain co.s, North Carolina; and in Murray co., Georgia.

A fibrous steatite from New York state, used in the manufacture of paper, is known as agalite. Renislerite is a wax-like talcose substance, passing into serpentine, from St. Lawrence co., New York; named by E. Emmons in 1837 after S. Van Rensselaer, of Rensselaer, N.Y. Binghamite is a steatite of Michigan, named by L. W. Hubbard. The term was first given by Dr. G. Nordenskiold to a mineral from Finland, which appears to be talc pseudomorphous after pyroxene. Talcold was K. F. Naumann's name for a white lamellar mineral from near Pressoff in Bohemia. A blue earthy mineral from near Silver City, New Mexico, known locally as "native ultramarine," is a magnesia silicate.


TALCA, a province of Chile, bounded N. by Curico, E. by Argentina, S. by Linares and Maule, and W. by the Pacific. Area 3840 sq. m. Pop. (1895) 128,981. In the E. the Andean slopes cover a considerable part of its territory, and in the W. another large area is covered by the coast range. Between these is the central valley of Chile in which the population and industries of the province are chiefly concentrated. The mountainous parts are well wooded. The intermediate plain, which is rolling and intersected by the many streams that flow to sea, is still largely given over to sheep and cattle. The chief ports are Valparaiso and Coquimbo. The capital of the province is Talca (pop. 1895, 33,423; 1902 estimated 42,766), on the Rio Clarco, a tributary of the Maule, 156 m. by rail S. of Santiago. It is one of the most important provincial towns and commercial centres of central Chile. There are woollen factories, especially for the universally worn "poncho." Talca has railway connexion with Santiago on the N., with Concepcion on the S., and with Constitucion at the mouth of the Maule.

TALCAHUANO, or TALCAHUANO, a seaport of the province of Concepcion, Chile, on the bay of Concepcion, 8 m. N.W. of the city of Talcahuano. Pop. (1900) 17,992; estimated (1902) 13,499. It is sheltered by the island of Quiriquina. It has the best harbour on the Pacific coast of South America, and is one of the most important ports of southern Chile, being connected by rail with Concepcion, Santiago and southern Chile. Its foreign trade is large and steadily increasing. The Chilean government has established its chief naval depot here.

TALE (O.Eng. talis, number, account, story; the word is common to many Teutonic languages; cf. Ger. Zahl, number, Erzählung, narrative, Du. taal, speech, language), a general term for the usual acceptance of the word, for fictitious narratives, long or short, ancient or modern (see Novel). In this article "tale" is used in a stricter sense, as equivalent to the German "Volks-märchen" or the French "conte populaire." Thus understood, popular tales mean the stories handed down by oral tradition from an unknown antiquity, among savage and civilized peoples. So understood, popular tales are a subject in mythology, and indeed in the general study of the development of man, of which the full interest and importance was long unrecognized. Popular tales won their way into literature, it is true, at a very distant period. The Homeric epics, especially the Iliad, are collections of tales (L. Fabulae, G. Κύκλος and the husband who returns in disguise) which are manifestly parts of the general human stock of popular narrative. Other examples are found in the Rigveda, and in the myths which were handled by the Greek dramatists. Collections of popular tales, more or less subjected to conscious literary treatment, are found in Sanskrit, as in the work of Somadeva, whose Kathā Sarit Sāgara, or "Ocean of the Streams of Story," has been translated by Mr Tawney (Calcutta, 1880). The THOUSAND
TALE

AND ONE Nights (q.v.) are full of popular tales, and popular tales are the staple of the medieval Gesta Romanorum, and of the collections of Straparola and other Italian conteurs. In all these and similar gatherings the story, long circulated from mouth to mouth among the people, is handled with conscious art, and little but the general outline of plot and character of incident can be regarded as original. In the *Histoires ou Contes du Temps Passé* of Perrault (Elsevier, Amsterdam, 1697; the Parisian edition is of the same date) we have one of the earliest and best known bibliographies of popular tales, with them in their natural shape as they were told by nurses to children. This at least seems probable, though M. Alfred Maury thinks Perrault drew from literary sources. Perrault attributed the composition to his son, P. Darmancour, at that time a child, and this pretexts enabled him to give his stories in a simple and almost popular guise. It seems that popular tales in many cases probably owe their origin to the desire of enforcing a moral or practical lesson. It appears that their irrational and "infantile" character—"dépourvus de raison"—is derived from their origin, if not actually among children, at least among childlike peoples, who have inherited it from "raison" that is, at the scientific and modern conception of the world and of the nature of man.

The success of Perrault's popular tales brought the genre into literary fashion, and the Comtesse d'Aulnoy invented, or in some cases adapted, "contes," which still retain a great popularity. But the precise and scientific collection of tales from the lips of the people is not much earlier than our century. The chief impulse to the study was given by the brothers Grimm. The first edition of their *Kinder- und Haus-Märchen* was published in 1812. The English reader will find a very considerable bibliography of popular tales, as known to the Grimms, in Mrs Alfred Hunt's translation, *Grimm's Household Tales*, with Notes (London, 1884). "How unique was our collection when it first appeared," they exclaim, and now merely to enumerate the books of such traditions would occupy much space. In addition to the märchen of Indo-European peoples, the Grimms became acquainted with some Malay stories, some narratives of Bechuanas, Negroes, American Indians, and Finnish, Estonian, and Magyar stories. Thus the Grimms' knowledge of non-European märchen was extremely slight. It enabled them, however, to observe the increase of refinement "in proportion as the worker develops himself," the monstrosities of Finnish and Red-Indian fancy gradually fading in the narratives of Germans and Italians. The Grimms notice that the evolution of popular narrative resembles the evolution of the art of sculpture, from the South-Sea idol to the frieze of the Parthenon, "from the strongly marked, thin, even ugly, but highly expressive forms of its earliest stages to those which possess external beauty of mould." Since the Grimms' time our knowledge of the popular tales of non-European races has been greatly enriched. We possess numbers of North-American, Brazilian, Zulu, Swahili, Eskimo, Samoan, Maori, Kaffir, Malagasy, Bushman, North African, Flott, New Caledonian, and even Australian märchen, and can study them in comparison with the stories of Hesse, of the West Highlands of Scotland, of Scandinavia.

While the popular romances of races of all colours must be examined together, another element in this subject is not less important. It had probably been often observed before, as by Lord Fountainhall (1670), but the fact was brought out most vividly by J. G. von Hahn (*Griechische und albanische Märchen*, Leipzig, 1864), that the popular tales of European races turn on the same incidents, and display the same succession of situations, the same characters, and the same plots, as are familiar in the ancient epic literature of Greece, India, Germany and Scandinavia. The epics are either fully-developed märchen evolved by the literary genius of poets and saga-men, or the märchen are degenerate and broken-down memories of the epics and sagas, or perhaps there may be examples of both processes. The second view,—namely, that the popular tales are, so to speak, the scattered grains of gold of which the epic is the original "pocket" or "place,"—the belief that the märchen are the detritus of the saga,—was for a long time prevalent. But a variety of arguments enforce the opposite conclusion, namely, that the märchen are essentially earlier in character than the epic, the final form to which they have been brought by the genius of Homer or of some other remote yet cultivated poet. If this view be accepted, the evolution of märchen and of certain myths has passed through the following stages:

(1) The popular tale, as current among the uncultivated peoples, such as Iroquois, Zulus, Bushmen, Samoans, Eskimo, and Samoyedes. This tale will reflect the mental condition of rude peoples, and will be full of monstrous and miraculous events, with an absence of reason proper, as Perrault says, "à ceux qui n'en ont pas encore." At the same time the tale will very probably enforce some moral or practical lesson, often the sanction of a taboo, and may even appear to have been invented with this very purpose, for man is everywhere impressed with the importance of conduct.

(2) The same tale—or rather a series of incidents and a plot essentially the same—as it is discovered surviving in the oral tradition of the illiterate peasantry of Europe. Among them the monstrous element, the ferocity of manners observed in the first stage, will be somewhat modified, but will be found most notable among the Slavonic tribes. Nowhere, even in German and Scottish märchen, is it extinct, cannibalism and cruel torture being favourite incidents.

(3) The same plots and incidents as they exist in the heroic epics and poetry of the cultivated races, such as the Homeric epics, the Greek tragedies, the Cyclic poets, the *Kalevala* of the Finns, certain hymns of the *Rigveda*, certain legends of the Brahmanas, the story of the Volsungs,—in these a local and almost historical character is given by the introduction of names of known places, and the adventures are attributed to national heroes,—Odysseus, Oedipus, Sigurd, Wainamöinen, Jason, Pururavas, and others. The whole tone and manners are nobler and more refined in proportion as the literary workmanship is more elaborate.

This theory of the origin of popular tales in the fancy of peoples in the savage condition (see *Mythology*), of their survival as märchen among the peasantry of Indo-European and other civilized races, and of their transfiguration into epics, is prevalent among savages (see *Mythology*). Other incidents and civilized popular tales are full of close resemblances. These resemblances, when only known to exist among Indo-European peoples, were explained as part of a common Aryan inheritance, and as the result of a malady of language. This system, when applied to myths in general, has already been examined (see *Mythology*). According to another view, märchen everywhere resemble each other because they all arose in India, and have thence been borrowed and transmitted. For this theory consult Benfey's *Panchatantra* and M. Cosquin's *Contes de Lorraine* (Paris, 1886). In opposition to the Aryan theory, and the theory of borrowing from India, the system which is here advocated regards popular tales as kaleidoscopic arrangements of comparatively few situations and incidents, which again are naturally devised by the early fancy. Among these incidents may be mentioned, first, kinship and intermarriage between man and the lower animals and even inorganic phenomena. Thus a girl is wooed by a frog, pumpkin, goat, bear, or elephant, in Zulu, Scotch, Walachian, Eskimo, Ojibway, and German märchen. This incident is based on the lack of a sense of difference between man and the things in the world which is prevalent among savages (see *Mythology*). Other incidents familiar in our nursery tales (such as "Cinderella" and "Puss in Boots") turn on the early ability in metamorphosis, in magic, in friendly or protecting animals (tortoise or beast manitous). Others depend on the early prevalence of cannibalism (compare Grimm, 47, "The Juniper Tree"). This recurs in the mad song of Gretchen in *Faust*, concerning which a distinguished student writes, "This ghost of a ballad or rhyme is my earliest remembrance, as crooned by an old East-Lothian nurse." (Compare Chamber's *Popular Rhymes of Scotland*, 1870, p. 49.) The
same legend occurs among the Bechuana, and is published by Casalis. Yet another incident springs from the taboo on certain actions between husband and wife, producing the story of Cupid and Psyche (see Lang's *Custom and Myth*, 1884, p. 64).

Once more, the custom which makes the youngest child the heir is illustrated in the märchen of the success, despite the jealousy of the elders, of Cinderella, of the Zulu prince (Callaway's *Nursery Tales of the Amazulu* (London, 1868)); Schoolcraft's *Algonquin Researches*; Gill's *Myths and Tales of the South Pacific*; Petitot's *Traditions Indiennes* (1886); Shortland's *Moari Religion and Mythology* (London, 1882); the *South African Folk Lore Record*; the *Folk Lore Record* (London, 1879-95, Malagasy stories); Rink's *Tales and Traditions of the Eskimo*; Bleek's *Hottentot Tales and Fabeks* (London, 1864); Castrèn's *Samuvidesiche Märchen*; Maspero's *Conte Egyptiens* (from ancient Egyptian MSS.); and Leland's *Algonquin Legends* (London, 1884). For European tales, the bibliography in the translation of Grimm already referred to may be used, and the Maisonneuve collection, *Les Littératures populaires*, may be recommended. The names of Liebrecht, Köhler, Dassen, Ralston, Nigra, Pitré, Cosquin, Anafase, Gardoz, Sébillot, many of the names thus encountered, is found among the inhabitants of almost the whole of Europe. Miss Cooze's *Cinderella* (Folk-Lore Society) is an excellent work on the subject, as is Sidney Hartland's *Legend of Perseus*, mainly concerned with myths of miraculous births. For Australia see *Browne's* *Pop. Australian Legends* (2 vols.) and *Howitt's* *Native Tribes of South-East Australia.* M. Sébillot has edited French tales, and Mr. Dennett has given *Folk-Lore of the Pont.* There are abundant materials and discussions in *Folk-Lore of the Germanic South.*

**TALFORD, SIR THOMAS NOON** (1795-1854), English judge and author, the son of a brewer in good circumstances, was born on the 26th of May 1755 at Reading (not, as is sometimes stated, at Doxey, near Stafford). He received his early education at Hendon, and at the Reading grammar-school. At the age of eighteen he was sent to London to study law under Joseph Chitty, the special pleader. Early in 1821 he joined the Oxford circuit, having been called to the bar at the middle Temple in the same year. When, fourteen years later, he was created a serjeant-at-law, and when again he in 1849 succeeded Mr. Justice Colman as judge of the court of common pleas, he attained these distinctions more perhaps for his laborious care in the conduct of cases than on account of any forensic brilliance. At the general election in 1835 he was returned for Reading. This seat he retained for close upon six years, and he was again returned in 1847.

In the House of Commons he introduced an International Copyright Bill; his speech on this subject was considered the most telling made in the House during that session. The bill was only passed in the Lords, under which Talford had the satisfaction of seeing it pass into law in 1842, albeit in a greatly modified form. Dickens dedicated the *Pickwick Papers* to him.

In his early years in London Talford was dependent—in great measure, at least—upon his literary exertions. He was at this period on the staff of the *London Magazine*, and was an occasional contributor to the *Edinburgh and Quarterly Reviews*, the *New Monthly Magazine*, and other periodicals; while, on joining the Oxford circuit, he acted as law reporter to the *Times*. His work was generally received with great success, and he had gained any position among men of letters until the production of his tragedy *Ilen*, which was privately printed in 1835, and produced in the following year at Covent Garden theatre. The tragedy was also well received in America, and was reprinted at Sadler's Wells in December 1861. This dramatic poem, its author's masterpiece, turns upon the voluntary sacrifice of Ilen, king of Argos, in response to the Delphic oracle, which had declared that only with the extinction of the reigning family could the prevailing pestilence incurred by the deeds of that family be removed. Two years later, at the Haymarket theatre, *The Athenian Captive* was acted with moderate success. In 1859 Glencoe, or *The Fate of the Macdonalds*, was privately printed, and in 1840 it was produced at the Haymarket; but this home drama is inferior to his two classic plays. *The Castilian* (1833) did not excite a tenth part of the interest called forth by *Ilen*. Before this he had produced various other prose writings, among them his "History of Greek Literature," in the *Encyclopaedia Metropolitana*. Talford died in court during the performance of his judicial duties, at Stafford, on the 13th of March 1854.

In addition to the writings above-mentioned, Talford was the author of the *Letters of Charles Lamb*, with a Sketch of his Life (1837); *Recollections of a Visit to the Alps* (1841); *Vacation Rambles and Thoughts*, comprising recollections of three Continental tours in the vacations of 1841, 1842, and 1843 (2 vols., 1844); and *Final Memorials of Charles Lamb* (1849-50).

**TALGARTH, a decayed market town in Breconshire, South Wales, situated on the Emnig near its junction with the Llynp (a tributary of the Wye), with a station on the joint line of the Cambrian and Midland companies from Brecon to Three Cocks Junction (2 m. N.N.E., but in Talgarth parish). The population of the whole parish (which measures 12,294 acres) was 1466 in 1901. The church of St Gwендole, restored in 1873, is in Perpendicular style, with an embattled tower restored in 1858. The Baptists, Congregationalists and Calvinistic Methodists have each a chapel in the town, and there is also a Congregational church at Tredwesstan, founded in 1602. About 1 m. S.W. is Treworca, where Howell Harris, one of the founders of Welsh Methodism, was born in 1713, and where in 1752 he established a communistic religious "family" of about a hundred persons; their representatives in 1842 handed over the property to the Welsh Calvinistic Methodist connexion, who in that year opened there a theological college, and in 1854 added to it a Harris memorial chapel. In 1900 the college was removed.
to Aberystwyth, and the buildings are now used by the Con-
nection as a preparatory school for ministerial students.

The fortified station of Dinzas occupies the summit of a hill abut
2 m. E. of Talgarth, but the construction that it is usually
attributed to Crickhowell and the eastern part of the vale of Usk.
Its castle, built on the site of an earlier British fortress, was destroyed
(according to Leland) by the inhabitants to prevent its falling
into the hands of Glendower. The town was in the manor of
English Talgarth, there being also a manor of Welsh Talgarth,
in which Welsh laws prevailed.

TALIENWAN, an open bay or roadstead on the east side of
the Liohutung peninsula, Manchuria. It was leased to Russia by
China in 1868 with the naval fortress of Port Arthur, from which it is
about 40 m., the lease being transferred to Japan in 1905. The
Russian town of Dalny (now Taires) was built upon the
west side of the bay, known as Port Victoria. Being ice-free all
the year round, it has an advantage over Nuiuchang, which is
frozen up for four months in the year. Niuchwang, however,
is lies much nearer to the great producing and consuming districts
of Manchuria. Taliewan is in railway connexion with Nui-
uchang and Peking and via the Siberian railway with Europe. It
was the rendezvous of the British fleet during the Anglo-China
war of 1860, whence the names Port Arthur and Port Victoria.

TALIESSIN, the name of a late 6th century British bard,
often confused with Taliesin syn.) or Taliesin (Gr."

TALISMAN, a minor talisman, plural of talisman, an adaptation of Gr.
τέλεσωμα, payment, outlay (from τελείω, to accomplish), used in Late Gr.
of an initiation or mystery and in Med. Gr. of a charm.

TALLADEGA, a city and the county-seat of Talladega county,
Alabama, U.S.A., 35 m. E. of Birmingham. Pop. (1890) 3056
(1910) 5834. It is served by the Southern, the Louisville & Nashvillle and other railways. Talladega is situated at the mouth of the Tallapoosa river, where the rapids are
usually interpreted as a part "cut off" from the property taxed, or as derived from the tally (q.v.), first appears in the reign of Henry II. as a synonym for the auxilium burgi,
which was an occasional payment exacted by king and barons
over and above the annual firma burgi from burgage tenants,
since all barons after the Norman Conquest came to be re-
garded as in some lord's demesne. The tax displaced the
danegeld so far as the towns and demesne lands of the Crown
were concerned in the second half of the 12th century, and
gradually the barons were deprived of the right of tallowing
their respective demesnes without royal authorization. The imposi-
tion of tallow continued under the immediate successors of
Henry II.; the barons failed to secure its prohibition or even
limitation at Runnymede, and Henry III. levied it frequently.
The amount to be paid was determined during this time by
of officials of the exchequer in special fiscal circuits through
separate negotiations with the various tax-paying communities,
the towns usually raising their quota by means of a capitation
or poll tax. Its imposition practically ceased by 1283 in favour
of a general grant made in parliament, and the king's retention
of tallow seemed particularly unnecessary and illogical after
burgage was introduced for the baron's demesnes. The objection
to be held that tallow was forbidden by the Conformatio car-
taram, but the Latin version of that document which bears the
title De tallowo non concedendo, although cited as a statute in the
preamble to the Petition of Right in 1627 and in a judicial
decision of 1637, was merely a chronicler's summary of the
purposes of the official French document, which did not mention
tallow by name. After 1297, however, there were only three
levies of the tax: one by Edward I. in 1304; again in 1312 by
Edward II. despite the protests of London and Bristol; and
finally in 1332, when Edward III. enacted such opposition from
parliament that he withdrew the commutation and accepted
in its place a grant of a tenth-and-fifteenth. The last time that
the king granted leave to the barons to tallow their demesnes
was in 1305. The second statute of 1340 formally enacted that
the nation should thenceforth not " make any common aid or sus-
tain charge," including tallow, without consent of parliament.

sect. 161, vol. ii. sect. 275; D. J. Medley, English Constitutional
History in ed. (London, 1881); L. H. B. de la Rue and Matthait, History
of English Law, vol. i., 2nd ed. (London, 1847); S. J. Low and F. S. Pulling.
Dictionary of English History.

TALLAHASSEE, the capital of Florida, U.S.A., and the
county seat of Leon county, in the W. part of the state, about
40 m. E. of the Apalachicola river and 20 m. from the Gulf
of Mexico, about midway by railway between Jacksonville and
Pensacola. Pop. (1900) 2081 (1755 negroes) (1910) 5018;
in 1900 the population of the county was 19,887, of whom
16,000 were negroes. Tallahassee is served by the Seaboard
airroad and the Great Southern railway. The town is
a mile or two from the sea, and the streets are wide and well-shaded.
The principal buildings are the State Capitol, Grecian in architecture, the Federal
Building, and the County Court House. In the Episcopal
cemetery two monuments mark the graves of Charles Louis
Napoleon Achille Murat (1801-1847), the eldest son of Joachim
Murat, and of his wife Catherine (1805-1867), the daughter of
Col. Bird C. Willis of Virginia and a grand-niece of George
Washington. Tallahassee is the seat of the Florida Female
College, co-ordinate with the State University for men, and the
State Normal and Industrial School (for negroes), an agricultural
and mechanical college. Above 17 m. S. of Tallahassee, in
 Wakulla county, is the Wakulla Spring, about 160 ft. deep,
one of the largest of the remarkable springs of Florida.
Tallahassee's name is of Seminole origin, and means, it is
said, " tribal land." During a war with the Apalachee Indians
in 1638 the Spaniards, according to tradition, fortified a hill
W. of the city, where the Fort St Louis Place, a plantation
mansion, now stands. About 1818 most of the Indians were expelled from the vicinity, and a settlement was made by the whites. In 1834 Tallahassee, then virtually uninhabited, was formally chosen by the United States Government as the capital of the Territory of Florida, and it continued as the capital after the admission of Florida as a state in 1845. It was a residential centre for well-to-do planters before the Civil War, and Belleair, 6 m. S., now in ruins, was a fashionable pleasure resort. On the 10th of January 1861 a state convention adopted at Tallahassee an Ordinance of Secession.

TAILBOY (partly a translation and partly a corruption of the French hautbois), a double chest of drawers. Whereas the chest of drawers in its familiar form (sometimes in the 18th century called "a lowboy") contains three long and two short drawers, the tailboy has five, six, or seven long drawers, and two short ones. It is a very late 17th-century development of the smaller chest. The early examples are of walnut, but by far the largest proportion of the many that have survived are of mahogany, that being the wood most frequently employed in the 18th century for the construction of furniture, especially the more massive pieces. Occasionally the walnut at the beginning of the vogue of the tailboy was inlaid, just as satinwood varieties were inlaid, depending for relief upon carved cornice-mouldings or gadrooning, and upon handsome brass handles and escutcheons. The tailboy was the wardrobe of the 18th century, but it eventually gave place to the modern-type wardrobe. After the drawers were removed, the cabinet usually found to be not only as capacious as its predecessor but more convenient of access. The topmost drawers of the tailboy could only be reached by the use of bed steps, and the disappearance of high beds and the consequent disuse of steps exercised a certain influence in displacing a characteristic piece of furniture which was popular for at least a century.

TALLEMAND, GÉRÔME, SIEUR DES RÉAUX (1619-1692), French author, was born at La Rochelle on the 7th of November 1619. He belonged to a wealthy middle-class family of Huguenot persuasion; the name des Réaux he derived from a small property purchased by him in 1630. When he was about eighteen years of age he was sent to Italy by his brother François, abbé Tallemant. On his return to Paris, Tallemant took his degrees in civil and canonical law, and his father secured for him the position of conseiller au parlement. The profession was distasteful to him, and he decided to ensure himself a competence by marriage with his cousin Élisabeth de Rambouillet. His half-brother had married a d'Angennes, and this connexion secured for Tallemant an introduction to the Hôtel de Rambouillet. Madame de Rambouillet was no admirer of Louis XIII., and she gratified Tallemant's curiosity with stories of the reigns of Henry IV. and Louis XIII. of real historical value. But the society of the Hôtel de Rambouillet itself opened a field for his acute and somewhat malicious observation. In his Historiettes he gives finished portraits of Voiture, Balzac, Malherbe, Chapelain, Valentin Conrat and many others; Blaise Pascal and Jean de la Fontaine appear in his pages; and he chronicles the scandals of which Ninon de l'Enclos and Angélique Paulet were centres. They are invaluable for the literary history of the time. It has been said that the malicious intention of his work may be partly attributed to his bourgeois extraction and that the consequent slights he received are avenged in his pages, but independent testimony has established the substantial correctness of his statements. In 1658 he was converted to Catholicism. It seems that the change was not entirely disinterested, for Tallemant, who had suffered considerable pecuniary losses, soon after received a pension of 2000 livres. He died in Paris on the 6th of November 1692.

Des Réaux was a poet of some merit and contributed to the Guirlande de Julie, but it is by his Historiettes that he is remembered. The work remained in manuscript until it was edited in 1834-6 by M. de Chateauroux, Jules Tascherou and L. J. N. de Monmerqué, with a notice on Tallemant by Monmerqué. A third edition (6 vols. 1872) contains a notice by Paulin Paris. Tallemant had begun Mémôtres pour la régence d'Anne d'Autriche, but the manuscript has not been found.

TALLEYRAND-PÉRIGORD, CHARLES MAURICE DE (1754-1838), French diplomatist and statesman, was born at Paris on the 13th of February 1754, though some accounts give the date as the 2nd of February. His father was Lieutenant-General Charles Daniel de Talleyrand-Périgord, and his mother was Alexandrine (née) de Duras Amiguy. His parents descended from ancient and powerful families, were in constant attendance at the court of Louis XV., and (as was generally the case then in their class) neglected the child. In his third or fourth year, while under the care of a nurse in Paris, he fell from a chest of drawers and injured his foot for life. This accident darkened his prospects; for though by the death of his elder brother he should have represented the family and entered the army, yet he forfeited the rights of primogeniture, and the profession of arms was thenceforth closed to him. Entrusted to the care of his grandmother at Châssaines, Talleyrand, he there received the only kind treatment which he experienced in his early life, and was ever grateful for it. He was removed at the age of eight to the Collège d'Harcourt at Paris (now the Lycée St Louis), where his rich intellectual gifts enabled him to make good by private study the defects of the training there imparted. At the age of twelve he fell ill of smallpox, but his parents showed little or no interest in his recovery. Destined for the church by the family council which deprived him of his birthright, he was sent when about thirteen years of age to St Sulpice, where he conceived a dislike of the doctrines and discipline thrust upon him. After his studies at St Sulpice he returned to Paris, where he was to remain, and in 1772 he entered the business of the church, but in his spare time he read the works of Montesquieu, Voltaire, and other writers who were beginning to undermine the authority of the ancien régime, both in church and state. As subdeacon he witnessed the coronation of Louis XVI. at Reims, but he did not take priest's orders until four years later. Recent researches into his early life discredit most of the stories that have been told respecting his profligacy and his contempt for the claims of the church; and it is admitted that, while rejecting her authority in the sphere of dogma and intellect, he observed the proprieties of life (particularly being then scarcely looked on as a vice) and respected the outward observances of religion.

During his life at Paris he had opportunities of mixing in the circles of the philosophers and of others who frequented the salon of Madame de Genlis, and he there formed those ideas in favour of political and social reform which he retained through life. After taking his licence in theology in March 1778, he gave little more attention to theological studies. Nevertheless the acuteness of his powers, added no doubt to his social position, gained for him in the year 1780 the position of agent-general of the clergy in France, and he was made a member of several important administrative duties respecting the relations of the clergy to the civil power. The growing claims of the state on the exchequer of the clergy made his duties responsible, his colleague as agent-general being of little use. At the extra-ordinary assembly of the clergy in 1782 he made various proposals, by one of which he sought, though in vain, to redress the most glaring grievances of the underpaid curés. Though the excellence of his work as agent-general in the years 1780-86 was fully acknowledged, and earned him a special gift of 31,000 livres, yet he did not gain a bishopric until the beginning of the year 1759, probably because the king disliked him as a free-thinker. He now became bishop of Autun, with a stipend of 22,000 livres, and was installed on the 15th of March.

The first rumblings of the revolutionary storm were making themselves heard. The elections for the States General were soon to take place; and the first important act of the new bishop was to draw up a manifesto or programme of the reforms which he desired to see carried out by the States General of France. It comprised the following items: the formation of a constitution which would strengthen the monarchy by calling to it the support of the whole nation, the drafting of a scheme of local self-government, the handing over of the administration of justice, and of the criminal law, and the
abolition of the most burdensome of feudal and class privileges. This programme was adopted by the clergy of his diocese as their “cabinet,” or book of instructions to their representative at the States General, namely Talleyrand himself.

His influence in the estate of the clergy, however, was cast against the union of the three estates in a single assembly, and he voted in the minority of his order which in the middle of June opposed the merging of the clergy in the National Assembly. The folly of the court, and the weakness of Louis XVI. at that crisis, probably convinced him that the cause of moderate reform and the framing of a bicameral constitution on the model of that of England were hopeless. Thereafter he inclined more and more to the democratic side, though for the present he concerned himself mainly with financial questions. In the middle of July he was chosen as one of the committee to prepare a draft of a constitution; and in the session of the Assembly which Mirabeau termed the “orgie of the abolition of privileges” (4th of August) he intervened in favour of discrimination and justice.

On the 9th of October, that is, four days after the insurrection of women and the transference of the king and court to Paris, he proposed to the Assembly the confiscation of the lands of the church to the service of the nation, but on terms rather less rigorous than those in which Mirabeau (q.v.) carried the proposal into effect on the 2nd of November. He identified himself in general with the Left of the Assembly, and supported the proposed departmental system which replaced the old provincial system early in 1790. At the federation festival of the 14th of August he declared that the king was not above the laws, and he was arrested at the 3rd of September in the middle of the Champ de Mars. This was his last public celebration of mass. For a brilliantly satirical but not wholly fair reference to the part then played by Talleyrand, the reader should consult Carlyle’s “French Revolution,” vol. ii., bk. i., ch. 12.

The course of events harmonized with the ant Clerical views of Talleyrand, and he gradually loosened the ties that bound him to the church. He took little part in, though he probably sympathized with, the debates on the measure known as the Civil Constitution of the Clergy, whereby the state enforced its authority over the church to the detriment of its allegiance to the pope. When the Assembly sought to impose on its members an oath of obedience to the new decree, Talleyrand and three other bishops complied out of the thirty who had seats in the Assembly. The others, followed by the greater number of the clergy throughout France, refused, and thenceforth looked on Talleyrand as a schismatic. He did not long continue to officiate, as many of the so-called “constitutional” clergy did; for, on the 21st of January 1791, he resigned the see of Autun, and in the month of March was placed under the ban of the church by the pope.

On the 2nd of April he had been elected, with Mirabeau and Sieyès, a member of the department of Paris; and in that capacity did useful work for some eighteen months in seeking to support the cause of order in the turbulent capital. Though he was often on strained terms with Mirabeau, yet his views generally coincided with those of that statesman, who is said on his death-bed (2nd of April 1791) to have communicated to him his opinions on domestic and international affairs, especially advising a close understanding with England. Talleyrand’s reputation for immorality, however, was as marked as that of Mirabeau. While excelling him in suppleness and dexterity, he lacked the force of character possessed by the great “tribune of the people”; and his influence was gradually eclipsed by that of the more ardent and determined champions of democracy, the Girondins and the Jacobins. In the closing days of the first or Constituent Assembly, Talleyrand set forth (10th of September 1791) his ideas on national education. Education was to be free, and to lead up to the university. In place of dogma, the elements of religion were alone to be taught.

Debarred from election to the second National Assembly (known as the Legislative) by the self-denying ordinance passed by the “constituents,” Talleyrand, at the close of 1791, sought to enter the sphere of diplomacy for which his mental qualities and his clerical training furnished him with an admirable equipment. The condition of affairs on the continent seemed to French enthusiasts to presage an attack by the other Powers on France. In reality those Powers were far more occupied with the Polish and Eastern questions than with the affairs of France; and the declaration of Plütsch, drawn up by the sovereigns of Austria and Prussia, which appeared to threaten France with intervention, was recognized by all well-informed persons to be “a loud-sounding nothing.” The French foreign minister, Delessart, believed that he would checkmate all the efforts of the émigrés at the continental courts provided that he could confirm Pitt in his intention of keeping England neutral. For that purpose Delessart sent Talleyrand, well known for his Anglophile tendencies, to London, but in the unofficial or semi-official capacity which was rendered necessary by the decree of the Constituent Assembly referred to above. Talleyrand arrived in London on the 24th of January 1792, and found public opinion so far friendly that he wrote off to Paris, “Believe me, a raprochement with England is no chimera.” Pitt received him cordially; and to Grenville the envoy stated his hope that the two free nations would enter into close and friendly relations, each guaranteeing the other in the possession of its existing territories, India and Ireland being included on the side of Britain. After some delay the British government decided to return no definite answer to this proposal, a result due, as Talleyrand thought, to the Gallophobe views of King George and of the ministers Camden and Thurlow. Talleyrand, however, was convinced that Great Britain would not intervene against France. The latter was his constant watchword, as well as promising to the men of Talleyrand’s party at home.

He returned to Paris on the 10th of March to persuade the foreign minister (Dumouriez now held that post) of the need of having a fully accredited ambassador at London. The ex-Marquis Chauvelin was appointed, with Talleyrand as adviser. The situation became more complex after the 15th of April, when France declared war against Austria and prepared to invade the Austrian or Belgic Netherlands Owing to certain indiscretions of Chauvelin and the growing unpopularity of the French in England (especially after the disgraceful day of the 20th of June at the Tuileries), the mission was a failure; but Talleyrand had had some share in confirming Pitt in his policy of neutrality, even despite Prussia’s overtures for an alliance against France. After Talleyrand’s return to Paris early in July (probably in order to sound the situation there) matters went from bad to worse. The overthrow of the monarchy on the 20th of August and the September massacres rendered hopeless all attempts at an entente cordiale between the two peoples; and the provocative actions of Chauvelin, undertaken in order to curry favour with the extremists now in power at Paris, undid all the good accomplished by the tact and moderation of Talleyrand. The latter led Madame de Staël to call him the Great Dictator of Paris, where events were becoming intolerable; and after some unsuccessful attempts to obtain a passport to leave Paris, he succeeded on the 14th of September and landed in England on the 23rd, avowedly on private business, but still animated by the hope of averting a rupture between the two governments.

In this he failed. The provocative actions of the French Convention, especially their setting aside of the rights of the Dutch over the estuary of the Scheldt, had brought the two nations to the brink of war, when the execution of Louis XVI. (21st of Jan. 1793) made it inevitable. Talleyrand was expelled from British soil and made his way to the United States. There he spent thirty months in a state of growing uneasiness and discontent with his surroundings.

The course of events after the Thermidoran reaction of July 1794 favoured his return to France. Thanks to the efforts of Daunou and others his name was removed from the list of émigrés, and he set sail for Europe in November 1795. Landing at Hamburg in the January following, he spent some time there in the company of his friends Madame de Genlis and Reinhard; and when party rancour continued to abate at Paris, he returned thither in September. After a time marked by some pecuniary embarrassment, he was recommended by Madame de Staël to the Director Barbas for the post of minister of foreign affairs.
His claims on the attention of the Directors had been strengthened by his reading two papers before the French Institute, the first on the commercial relations between England and the United States (in the sense referred to above), and the second on the advantages to be derived from new colonies. In the latter there occurred the suggestive remarks that, whereas revolutions made men prematurely old and weary, the work of colonization tended to renew the youth of nations. France, he observed, needed the spur to practical energy which the Americans had at hand to subdue the difficulties placed in their way by nature. Similar efforts would tend to make France a formidable child at the same time supply an outlet for the poor and discontented. The practical statesmanship contained in these papers raised Talleyrand in public estimation; and, thanks to the efforts above named, he gained the post of foreign minister, entering on his duties in July 1797.

Bonaparte by his victories over the Austrians in Italy and Styria had raised the French republic to heights of power never dreamed of, and now desired to impose on the emperor terms of peace, to which the Directors demurred. Talleyrand, despite the weakness of his own position (he was as yet little more than the chief clerk of his department), soon came to a proper understanding with the general, and secretly expressed to him his satisfaction at the terms which the latter dictated at Campo Formio (17th of October 1797). The coup d'état of Fructidor (September 1797) had perpetuated the Directory and led to the exclusion of the two "moderate" members, Carnot and Barthélemy; but Talleyrand saw that power belonged really to the general who had brought about the coup d'état in favour of the Jacobinical Directors headed by Barras.

After the rupture of the peace negotiations with England, which resulted from the coup d'état of Fructidor, the policy of France became more warlike and aggressive. The occupation of Rome and of Switzerland by the French troops and the events of Bonaparte's Egyptian expedition (see NAPOLEON I.) brought about a renewal of war on the continent, but with these new developments Talleyrand had little or no connexion. His powers as minister were limited, and he regretted the extension of the area of war. Moreover, in the autumn of 1797 his reputation for political morality (never very bright) was overclouded by questionable dealings with the envoys of the United States sent to arrange a peaceful settlement of certain disputes with France. The investigations made soon came to a point, and Talleyrand was able to show that the charges made against him of trafficking with the envoys have been overdrawn; but all his apologists admit that irregularities occurred. Talleyrand refused to clear himself of the charges made against him as his friends (especially Madame de Staël) urged him to do; and the incident probably told against his chances of admission into the Directory, which were discussed in the summer of 1798.

A year later he resigned the portfolio for foreign affairs (20th of July 1799), probably because he foresaw the imminent collapse of the Directory. If so, his premonitions were correct. Their realization was assured by the return to France of the "Conqueror of the East" in October. The general and the diplomatist soon came to an understanding, and Talleyrand tactfully brought about the alliance between Bonaparte and Sieyès (q.v.) (then the most influential of the five Directors) which paved the way for the coup d'état of Brumaire (see FRENCH revolution and NAPOLEON I.).

Talleyrand's share in the actual events of the 18th, 19th Brumaire (9th, 10th of November) 1799 was limited to certain dealings with Barras on the former of those days. About midday he took to Barras a letter, penned by Roederer, requesting him to resign his post as Director. By what means Talleyrand brought him to do so, whether by persuasion, threats or bribes, is not known; but on that afternoon Barras left Paris under an escort of soldiers. With the more critical and exciting events of the 19th of Brumaire at St Cloud Talleyrand had no direct connexion; but he had made all his preparations for flight in case the blow failed. His reward for helping on the winning cause was the ministry for foreign affairs, which he held from the close of December 1799 on to the summer of 1807.

In the great work of reconstruction of France now begun by the First Consul, Talleyrand played no unimportant part. His great aim was to bring about peace, both international and internal. He had a hand in the pacific overtures which Bonaparte, early in the year 1800, sent to the court of London; and, whatever may have been the motives of the First Consul in sending them, it is certain that Talleyrand regretted their failure. After the battle of Marengo an Austrian envoy had come to Paris in response to a proposal of Bonaparte, and Talleyrand persuaded him to sign terms of peace. These were finally rejected by the emperor, but they led to a pause between the two Powers at Lunéville on the 9th of February 1801.

As regards French affairs, Talleyrand used his influence to help on the repeal of the vexatious laws against emigrés, non-juring priests, and the royalists of the west. He was also in full sympathy with the policy which led up to the signature of the Concordat of 1801–2 with the pope (see Concordat); but it is probable that he had had a hand in the questionable intrigues which accompanied the closing parts of that complex and difficult negotiation. At the end of June 1802 the pope removed Talleyrand from the ambassadorship to Rome, which he had held in 1801, but it was only to prevent the concordat from being annulled. In the fall of 1802 Talleyrand again became ambassador in Rome, and in the winter of 1802–3 he concluded the Treaty of Amiens (March 1802) which is so variously referred to as the Napoleonic treaty of 1802, the Treaty of Commerce, and the Treaty of Peace. The Treaty of Commerce was signed on the 9th of September 1802, owing to pressure put on him by Bonaparte, he married Madame Grand, a divorcée with whom he had long been living.

During the meeting of Italian notables at Lyons early in 1802 Talleyrand was serviceable in manipulating affairs in the way desired by Bonaparte, and it is known that the foreign minister suggested to them the desirability of appointing Bonaparte president of the Cisalpine Republic, which was thenceforth to be called the Italian Republic. In the negotiations for peace with England which went on at Amiens during the winter of 1801–2, Talleyrand had no direct share; these (like those at Lunéville) being transacted by Napoleon's eldest brother, Joseph Bonaparte (q.v.). On the other hand he helped the First Consul in assuring French supremacy in Switzerland, Italy and Germany. In Germany the indemnification of the princes who lost all their lands west of the Rhine was found by secularizing and absorbing the ecclesiastical states of the empire. This unscrupulous proceeding, known as the Secularizations (February 1803), was carried out largely on lines laid down by Bonaparte and Talleyrand; and the latter is known to have made large sums of money from the proceeds of the sales of ecclesiastical properties, and also from the charges of duplicity or treachery made against the foreign minister by Napoleon's apologists are in nearly all cases unfounded. This is especially so in the case of the execution of theduc d'Enghien(March 1804), which Talleyrand disapproved. The evidence against him rests on a document which is now known to have been forged. On the assumption of the imperial title by Napoleon in May 1804, Talleyrand became grand chamberlain of the empire, and received close on 500,000 francs a year.

Talleyrand had rarely succeeded in bending the will of the First Consul. He altogether failed to do so with the Emperor Napoleon. His efforts to induce his master to accord lenient terms to Austria in November 1805 were futile; and he looked on helplessly while that Power was crushed, the Holy Roman Empire swept away, and the Confederation of the Rhine set up in central Europe. In the bargains which accompanied this last event Talleyrand is believed to have reaped a rich harvest from the German princes most nearly concerned. On the 6th of July 1806 Napoleon conferred on his minister the
title of prince of Benevento, a papal fief in the Neapolitan territory.

In the negotiations with England which went on in the summer of 1806 Talleyrand had not a free hand; they came to nought, as did those with Russia which had led up to the signature of a Franco-Russian treaty at Paris by d'Oubrill which was at once disavowed by the tsar. The war with Prussia and Russia was ended by the treaties of Tilsit (7th and 9th of July 1807). Talleyrand had a hand only in the later developments of these negotiations; and it has been shown that he cannot have been the means of revealing to the British government the secret arrangements made at Tilsit between France and Russia, though his private enemies, among them Fouche, have charged him with acting as traitor to this affair. Talleyrand had long been weary of serving a master whose policy he more and more disapproved, and after the return from Tilsit to Paris he resigned office. Nevertheless Napoleon retained him in the council and took him with him to the interview with the Emperor Alexander I. at Erfurt (September 1808). There Talleyrand secretly advised that potenate not to join Napoleon in putting pressure on Austria in the way desired by the French emperor; but it is well known that Alexander was of that opinion before Talleyrand tendered the advice. Talleyrand disapproved of the Spanish policy of Napoleon, which was opened at Bayonne (May 1808); and while the stories to the contrary may in all probability be dismissed as idle rumours. It is also hard to believe the statement in the Talleyrand Memoirs that the ex-foreign minister urged Napoleon to occupy Catalonia until a maritime peace could be arranged with England. On Talleyrand now fell the disagreeable task of entertaining at his new mansion at Valenciay, in Touraine, the Spanish princes virtually kidnapped at Bayonne by the emperor. They remained there until March 1814. At the close of 1808, while Napoleon was in Spain, Talleyrand entered into certain secret negotiations with the Spanish minister to which aroused the solicitude of the emperor and hastened his return to Paris. He subjected Talleyrand to violent reproaches, which the ex-minister bore with his usual ironical calm.

After the Danubian campaign of 1809 and the divorce of Josephine, Talleyrand used the influence which he still possessed in the imperial council on behalf of the choice of an Austrian consort for his master, for, like Metternich (who is said first to have mooted the proposal), he saw that this would safeguard the interests of the Habsburgs, whose influence he felt to be essential to the welfare of Europe. He continued quietly to observe the course of events during the disastrous years 1813-15; and even at the beginning of the Moscow campaign he summed up the situation in the words, "It is the beginning of the end." Early in 1814 he saw Napoleon for the last time; the emperor upbraided him with the words: "You are a coward, a traitor, a thief. You do not even believe in God. You have betrayed and deceived everybody. You would sell even your own father." Talleyrand listened unmoved, but afterwards sent in his resignation of his seat on the council. It was not accepted. He had no share in the negotiations of the congress of Châtillon in February-March 1814. On the surrender of Paris to the Allies (30th of March 1814), the Emperor Alexander I. took up his abode at the hotel Talleyrand, and there occurred the conference wherein the statesman persuaded the victorious potentate that the return of the Bourbons was the only possible solution of the French problem, and that the principle of legitimacy alone would guarantee Europe against the aggrandizement of any one state or house. As he phrased it in the Talleyrand Memoirs: "The house of Bourbon alone could cause France nobly to conform once more to the happy limits indicated by policy and by nature. With this house of Bourbon France could be gigantic in order to be great." These arguments, reinforced by those of the royalist agent de Vitrolles, convinced the tsar; and Talleyrand, on the 1st of April, convened the French senate (only 64 members out of 140 attended), and that body pronounced that Napoleon had forfeited the crown. Ten days later the fallen emperor recognized the inevitable and signed the Act of Abdication at Fontainebleau. The next effort of Talleyrand was to screen France under the principle of legitimacy and to prevent the Valencey revolution on which several of the German statesmen were bent. Thanks mainly to the support of the tsar and of England these schemes were foiled; and France emerged from her disasters with frontiers which were practically those of 1792.

At the congress of Vienna (1814-15) for the settlement of European affairs, Talleyrand, as the representative of the restored house of Bourbon in France, managed adroitly to break up the league of the Powers (framed at Chaumont in February 1814) and assisted in forming a secret alliance between England, Austria and France in order to prevent the complete absorption of Poland by Russia and the Treaty of San Ildefonso by Prussia. The new triple alliance had the effect of lessening the demands of those Powers, and of leading to the well-known territorial compromise of 1815. Everything was brought into a state of uncertainty once more by the escape of Napoleon from Elba; but the events of the Hundred Days, in which Talleyrand had no share—he remained at Vienna until the 10th of June—brought in the Bourbons once more; and Talleyrand's plea for a magnanimous treatment of France under Louis XVIII. once more prevailed in all important matters. On the 9th of July 1815 he became foreign minister of the ex-empire; and later that year his diplomatic and other difficulties led him to resign his appointment on the 23rd of September 1815, Louis, however, naming him high chamberlain and according him an annuity of 100,000 francs. The rest of his life calls for little notice except that at the time of the July Revolution of 1830, which unseated the elder branch of the Bourbons, he urged Louis Philippe, duke of Orleans (q.v.), to take the throne offered to him by popular acclaim. The new sovereign offered him the portfolio for foreign affairs; but Talleyrand signified his preference for the embassy in London. In that capacity he took an important part in the negotiations for Poland; the march of his diplomacy and other difficulties led him to resign his appointment in 1815. A man of breadth, Talleyrand dominated his country. His memoirs, first published in 1838, are the most voluminous and important of his time. Talleyrand's career showed his independence and his statesman-like qualities; and the influence which his memoirs have had upon posterity is due to the frankness of his exposition of the political features of his time. His Memoirs were not published until after the lapse of thirty years from the time of Talleyrand's death. For various reasons they did not see the light until 1893. This is not the place in which to discuss so large a question as that of the genuineness of the Memoires, which, indeed, is now generally admitted. There are, however, several suspicious circumstances which tell against them as documents of the first importance, notably these: first that Talleyrand is known to have destroyed many of his most important papers, and secondly that
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M. de Bacourt almost certainly drew up the connected narrative which we now possess from notes which were in more or less of confusion. It has been printed in three articles by M. Chouquet in the Revue d'histoire et de littérature, 25th of May 1891 (Paris); also articles by others in the Revue historique, vols. xlvi. and xlix. (Paris); also in the TALLIEN, Jean Lambert (1767-1820), French Revolutionary leader, was the son of the maître d'hôtel of the marquis de Berry, and was born in Paris. The marquis, perceiving the boy's ability, had him well educated, and got him a place as a lawyer's clerk. Being much excited by the first events of the Revolution, he gave up his desk to enter a printer's office, and by 1791 he was overseer of the printing department of the Moniteur. While thus employed he conceived the idea of the journal-affiche, and after the arrest of the king at Varennes in June 1791 he placarded a large printed sheet on all the walls of Paris twice a week, under the title of the Ami des Citoyens, journal fraternel. This enterprise, of which the expenses were defrayed by the Jacobin Club, made him well known to the revolutionary leaders; and he made himself still more conspicuous in organizing the great "Fêtes de la Liberté" on the 15th of April 1792, in honour of the released soldiers of Château-Vieux, with Collot d'Herbois. On the 8th of July 1792, he was the spokesman of a deputation of the section of the Place Royale which demanded from the legislative assembly the reinstatement of the mayor, Jérôme Pétion, and the procureur, P. L. Manuel, and he was one of the most active popular leaders in the attack upon the Tuileries on the 10th of August, on which day he was arrested by the mob and sent to the prison of the Temple in Paris. In this capacity he exhibited an almost feverish activity; he perpetually appeared at the bar of the assembly on behalf of the commune; he announced the massacres of September in the prisons in terms of apology and praise; and he sent off the famous circular of the 3rd of September to the provinces, recommending them to do likewise. He had several persons imprisoned in order to save them from the fury of the mob, and protected several suspects himself. At the close of the month he resigned his post on being elected, in spite of his youth, a deputy to the Convention by the department of Scine-et-Oise, and but one of the very few defensive leaders of the commune during the massacres. He took his seat upon the Mountain, and showed himself one of the most vigorous Jacobins, particularly in his defence of Marat, on the 26th of February 1793; he voted for the execution of the king, and was elected a member of the Committee of General Security on the 21st of January 1793. After a short mission in the western provinces he returned to Paris, and took an active part in the coup d'état of the 31st of May and the 2nd of June, which resulted in the overthrow of the Girondists. For the next few months he remained comparatively quiet, but on the 23rd of September 1793, he sent an emissary, Yalive, (1754-1831) to his mission to Bordeaux. This was the month in which the Terror was organized under the superintendence of the Committees of Public Safety and General Security.

Tallien showed himself one of the most vigorous of the pro-consuls sent over France to establish the Terror in the provinces; though with but few adherents, he soon awed the great city of Bordeaux. It was at this moment that the romance of Tallien's life commenced. Among his closest friends was the wife of the comte de Fontenay, and daughter of the Spanish banker, François Cabarrus, one of the most fascinating women of her time, and Tallien not only spared her life but fell in love with her. Suspected of "Moderatism" on account of this incident, especially when he was recalled to Paris, Tallien increased, in appearance, his revolutionary zeal, but Therése abated his revolutionary ardour, and from the lives she saved by her entreaties she received the name of "Our Lady of Thermidor," after the 9th of Thermidor. Tallien was even elected president of the Convention on the 24th of March 1794, but the Terror could not be maintained at the same pitch; Robespierre began to see that he must strike at many of his own colleagues in the committees if he was to carry out his theories, and Tallien was one of the men condemned with them. They determined to strike first, and on the great day of Thermidor it was Tallien who, urged on by the danger in which his beloved lay, opened the attack upon Robespierre. The movement was successful; Robespierre and his friends were guillotined; and Tallien, as the leading Thermidorian, was elected to the Committee of Public Safety. After the Committee of Public Safety was dissolved, Tallien, as the leading Thermidorian; he was instrumental in suppressing the Revoluntary and the Jacobin Club; he attacked J. B. Carrier and Joseph Lebon, the représentants en mission of Nantes and Arras; and he fought bravely against the insurgents of Prairial. In all these months he was supported by Therése, whom he married on the 26th of December 1794, and who became the leader of the social life of Paris. His last political achievement was in July 1795, when he was present with Hoche at the destruction of the army of the émissés at Quiberon, and ordered the executions which followed. After the close of the Convention he was appointed a deputy to the new National Assembly, and was sent to the Council of Five Hundred. The moderates attacked him as a terrorist, and the extreme party as a renegade. Madame Tallien also tired of him, and became the mistress of the rich banker Ouvrard. Bonaparte, however, who is said to have been introduced by him to Barras, took him to Egypt in his great expedition of June 1798, and after the capture of Cairo he edited the official journal there, the Décade Egyptienne. But General J. F. Menou sent him away from Egypt, and on his passage he was captured by an English cruiser and taken to London, where he spent a few months, and was eventually received by Fox. On returning to France in 1802 he obtained a divorce from his wife (who in 1805 married the comte de Caraman, later prince de Chinchay), and was left for some time without employment. At last, through Fouche and Talleyrand, he got the appointment of consul at Alicante, and remained there until he lost the sight of one eye from yellow fever. On returning to Paris he lived on his half-pay until 1815, when he received the favour of not being exiled like the other regicides. His latter days were spent in poverty; he had to sell his books to get bread. He died in Paris on the 16th of November 1820.

Tallien left an interesting Discours sur les causes qui ont produit la Résolution française (Paris, 1791, in 8vo) and a Mémoire sur l'administration de l'Égypte à l'arrivée des Français. See Tallien and l'Expédition d'Égypte, in La Révolution française: Revue d'histoire moderne et contemporaine, t. iii. p. 269. On Madame Tallien see Arène Houssaye, Notre Dame de Thermidor (Paris, 1866); J. Turquan, Souvenirs et grandes Dames: La citoyenne Tallien, témoignages des contemporains et documents inédits (Paris, 1898); and Louis Gastine, La belle Tallien (1909).

TALLYS (TALLYS, Talys, or Tallisius), Thomas (c. 1575-1598), justly styled "the father of English cathedral music," was born about 1575. It has been conjectured that, after singing as a chorister at Christ Church, Oxford, Tallis migrated to England to become among the children of the choir royal. He is known to have become organist at Waltham abbey, where,
on the dissolution of the monastery in 1540, he received, in compensation for the loss of his preferment, 20s. for wages and 20s. for reward. In the library of the British Museum there is preserved a volume of MS. treatises on music, once belonging to the abbey, on the last page of which appears his autograph, "Thomas Tallis'—the only specimen known.

Not long after his dismissal from Waltham, Tallis was appointed a gentleman of the chapel royal; and thenceforward he laboured so zealously for the advancement of his art that the English school owes more to him than to any other composer of the 16th century.

One of the earliest compositions by Tallis to which an approximate date can be assigned is the well-known Service in the Dorian Mode, consisting of the Venite, Te Deum, Benedicite, Kyrie, Nicene Creed, Sanctus, Gloria in Excelsis, Magnificat and Nunc Dimittis, for four voices, together with the Preces, Responses, Paternoster and Litany, for five, all published for the first time, in the Rev. John Barnard's First Book of Selected Church Music, in 1614, and reprinted in the 1615 volume of Venite and Paternoster, in Boyce's Cathedral Music in 1766. That this work was composed for the purpose of supplying a pressing need, after the publication of the second prayer-book of King Edward VI. in 1552, there can be no doubt. Written in the style known among Italian composers as lo stile famigliare, i.e. in simple countertext of the first species, not contra notam, with no attempt at learned complications of any kind—it adopts itself with equal dignity and clearness to the expression of the verbal text it is intended to illustrate, bringing out the substance of the words so plainly that the listener can interpret them aright, while its pure rich harmonies tend far more surely to the excitement of devotional feeling than the marvellous combinations by means of which too many of Tallis's contemporaries sought to astonish their hearers, while forgetting all the loftier attributes of their art. In self-restraint the Litany and Responses bear a close analogy to the Improperia and other similar works of Palestrina, wherein, addressing himself to the heart rather than to the ear, the princeps musicae produces the most thrilling effects by means which, to the superficial critic, appear almost puerile in their simplicity, while those who are able to look beneath the surface discover in them a sublunary style such as none but a highly cultivated musician can appreciate. Of this profound learning Tallis possessed an inexhaustible store; and it enabled him to raise the English school to a height which it had never previously attained, and which it continued to maintain until the death of its last representative, Orlando Gibbons, in 1625. Though this school is generally said to have been founded by Dr Tye, there can be no doubt that Tallis was its greatest master, and that it was indebted to him alone for the infusion of new life and vigour which prevented it from degenerating, as some of the earlier Flemish schools had done, into a mere vehicle for the display of fruitless erudition. Tallis's ingenuity far surpassed that of his most erudite contemporaries; and like every other great musician of the period, he produced occasionally works confessedly intended for no more exalted purpose than the exhibition of his stupendous skill. In his canon Misere nostris (given in Hawkins's History of Music) the intricacy of the contrapuntal devices seems little short of miraculous; yet the resulting harmony is smooth and normal, and only the irregular complexity of the rhythm betrays the artificiality of its structure. The famous forty-part motet, Spem in alium, written for eight five-part choirs, stands on a far higher plane, and the lour de force of handling freely and smoothly so many independent parts is the least remarkable of its qualities. An excellent modern edition of it was produced by Dr A. H. Mann in 1888 (London, Weckes & Co.); and, when the reader has overcome the difficulty of reading a score that runs across two pages, he finds himself in the presence of a living classic. The art with which the climaxes are built up shows that Tallis's object in writing for forty voices is indeed to produce an effect that could not be produced by thirty-nine.]

These tours de force, however, though approchable only by the greatest contrapuntists living in an age in which counterpoint was cultivated with a success that has never since been equalled, serve to illustrate one phase only of Tallis's many-sided genius, which shines with equal brightness in the eight psalms—tunes (one in each of the first eight modes) and unpretending little Veni Creator, printed in 1567 at the end of Archbishop Parker's A Briefe and True Description of the Anglicane and Catholic Religion, and many other compositions of like simplicity.

In 1575 Tallis and his pupil William Byrd—as great a contrapuntist as himself—obtained from Queen Elizabeth royal letters patent granting them the exclusive right of printing music and ruling music-paper for twenty-one years; and, in virtue of this privilege, they issued, in the same year, a joint work, entitled Cantiones quae, ab argumento Sacrae vocantur, quinque et sex partium, containing sixteen motets by Tallis and eighteen by Byrd, all of the highest degree of excellence. Some of these motets, adapted to English words, are now sung as anthems in the Anglican cathedral service. But no such translations can be said to have been made during Tallis's lifetime; and there is strong reason for believing that, though both he and Byrd outwardly conformed to the new religion, and composed music expressly for its use, they remained Catholics at heart.

Tallis's contributions to the Cantiones Sacrae were the last of his compositions published during his lifetime. He did not live to witness the expiration of the patent, though Byrd survived it and published two more books of Cantiones on his own account in 1580 and 1591, besides numerous other works. Tallis died November 23, 1585, and was buried in the parish church at Greenwich, where a quaint rhymed epitaph, preserved by Sprey, and reprinted by Burney and Hawkins, recorded the fact that he served in the chapel royal during the reigns of Henry VIII., Edward VI., Mary, and Elizabeth. This was destroyed with the old church about 1710, but a copy has since been substituted. Portraits, professedly authentic, of Tallis and Byrd, were engraved by Vandergucht in 1730, for Nicolas Haym's projected History of Music, but never published. One copy only is known to exist.

Not many works besides those already mentioned were printed during Tallis's lifetime; but a great number are preserved in MS. It is to be feared that many more were destroyed, in the 17th century during the spoliation of the cathedral libraries by the Puritans.

TALLOW (M.E. talugh, talg, cf. Du. talg, L. Ger. talz; the connexion with O.E. taelu, dye, or Goth. tulgus, firm, is doubtful), the solid oil or fat of ruminant animals, but commercially obtained almost exclusively from oxen and sheep. The various methods by which tallow and other animal fats are separated and purified are dealt with in the article Oil. Ox tallow occurs at ordinary temperatures as a solid hard fat having a yellowish-white colour. The fat is insaluble in cold alcohol, but it dissolves in boiling alcohol, in chloroform, ether and the essential oils. The hardness of tallow and its melting-point are to some extent affected by the food, age, state of health, &c., of the animal yielding it, the firmest ox tallow being obtained in certain provinces of Russia, where for a great part of the year the oxen are fed on hay. New tallow melts at from 42°-5° to 43° C., old tallow at 43°-5°, and the melted fat remains liquid till its temperature falls to 33° or 34° C. Tallow consists of a mixture of two-thirds of the solid fatty substances and one-third of the liquid fat olein. Mutton tallow differs in several respects from beef tallow, and is obtained from oxen. It is whiter in colour and harder, and contains only about 30 per cent. of olein. Newly rendered it has little taste or smell, but on exposure it quickly becomes rancid. Sweet mutton tallow melts at 46° and solidifies at 36° C.; when old it does not melt under 49°, and becomes solid on reaching 44° or 45° C. It is sparingly soluble in cold ether and in boiling alcohol.

TALLOW TREE, in botany, the popular name of a small tree, Stillingia sebifera, belonging to the family Euphorbiaceae, a native of China, but cultivated in India and other warm countries. The seeds are thickly coated with a white greasy
substance—so-called vegetable tallow—from which candles are made, and which is also used in soap-making and dressing cloth. The butter tree or tallow tree of Sierra Leone is *Pendesmus butyracea*, a member of the family Guttiferae. The fruit, which is 4 to 5 in. long and about 3 in. in diameter, has a thick fleshy rind abounding in a yellow greasy juice.

**TALLY**, an old device, now obsolete, formerly used in the English exchequer for the purpose of keeping accounts. The tally was a willow or hazel stick about one inch in depth and thickness, and roughly shaped like a thick knife-blade (see Fig. 1). Notches (see Fig. 2) were cut on it showing the amount paid, a gauged width of 1½ inches representing £1000, 1 inch £100, ½ inch £10, half a notch of this size representing £1; ¼ inch ½s, and the smallest notch ½d.; half-pennies were represented by small holes. The account of the transaction was written on the two opposite sides, the piece of wood being then split down the middle through the notches; one half, called the tally, being given as a form of receipt to the person making the payment, while the other half, called the counter-tally, was kept in the exchequer. Payments made into the exchequer were entered into an account-book, from which they were transferred to a strip of parchment, or teller's bill; this was then thrown down a pipe into the tally-court, a large room directly under the teller's office. In the tally-court were officers of the clerk of the "pells"1 and of the auditor as representing the chamberlain of the exchequer. The teller's bill was then entered in the introitus or receipt-book by the officer of the clerk of the pells, and in another book, called the bill of the day, by the auditor's clerk. A tally was then made of the teller's bill, and it was given on application, generally on the following day, to the person paying in the money. At the end of the day, the bill of the day was passed on to the clerk of the cash-book, by whom all the day's receipts were entered (see the "Great Account of Public Income and Expenditure", part ii, app. 13, July 1860, by H. W. Chisholm).

The practice of issuing wooden tallies was ordered to be discontinued by an act of 1782; this act came into force on the death of the last of the chamberlains in 1826. The returned tallies were stored in the room which had formerly been the Star-chamber. This room was completely filled by them, so that in 1834, when it was desired to use the room, the tallies were ordered to be destroyed. They were used as fuel for the stoves which warmed the houses of parliament. On the 16th of October 1834 the houses of parliament were burnt down by the overheating of the stoves through using too many of the tallies.

The so-called *tally-trade* was an old system of dealing carried on in London and in the manufacturing districts of England, by which shopkeepers furnished certain articles on credit to their customers, the latter paying the stipulated price for them by weekly or monthly instalments (see Mc'Cutloch, *Dictionary of Commerce*)—the precursor, in fact, of the modern installment system.


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1 So called from the pells or sheepskins (Lat. *pellis*, skin) on which the records were written. The clerk of the pells was originally the private clerk of the treasurer. His duty was to keep separate records of all monies entering and leaving the exchequer. These records were kept on two rolls, the *pellis introitus*, or pells receipt roll, and the *pellis exitus*, or pells issue roll. The office gradually became a sinecure, its duties being discharged by deputy. Previously to 1783 the salary of the office was derived from fees and percentages, but in that year parliament settled the salary at £1500 a year. The office was abolished in 1834.
The Mishnah is a more or less careful arrangement of the extant Oral Law (see § 2). It forms the foundation of the Gemara, and is divided into six parts (Sederot), each containing a number of Masssekhoth ("weavings," cf. the English word "text") or Tractates. These are subdivided into Pirqot ("sections") or chapters, and these again into paragraphs or sentences.

I. Że’rōt ("seeds"), the first Order, on agriculture, is introduced by (1) Bērākot ("blessings"), on daily and other prayers and blessings. (2) Pēḏah ("corner"), deals with Lev. xix. 9, seq., Deut. xv. 19, and xxv. 1-5; or rather Dammat ("doubtful"), on doubtful cases relating to the tithing of fruit offerings. (4) Kûḏāyim ("of two sorts"), on forbidden mixtures (Lev. xix. 19; Deut. xxii. 9-11). (5) Shēḇiḥot ("checks"), on the establishment of tithes (Deut. xvi. 1 sqq.). (6) Têrômedōth ("heave offerings"), in the laws in Num. xviii. 8 sqq., Deut. xvii. 4. (7) Ma’asërōth ("tithe") or the "first tithe" (from reference to the Levites, Num. xix. 21-24. (8) Ma’asēr Shĕdôn ("second tithe"), with reference to the tithe eaten at Jerusalem, Deut. xiv. 22-26. (9) Ḥallōl ("coat"), on Num. xvi. 18-21. (10) Ṭorah ("foreskin") and the defilements (Lev. xx. 23-25. (11) Bikkurîm ("first-fruits"), on Ex. xxiii. 19, Deut. xxvi. 1 sqq. The fourth chapter of this treatise, printed in most editions, is properly a Baraitha.

II. Mō ed ("festival"). (1) Shabbōth, on the Sabbath as a day of rest (Gen. ii. 2, xxvi. 5, xxvii. 1-3, 18, 19; 1 Sam. xiv. 20). (2) Ḥārāmīm ("mixtures" or amalgamations), on legitimate methods of avoiding inconvenient restrictions on the Sabbath. (3) Pēlē, on the "seven small M" or "seven days," and the "seven great days," on the ritual of the week and the week after. (4) Ḥarōd ("harmony"), on the festivals in the year (Lev. xxiii. 26-32, useful edition by H. L. Strack, Brooklyn, 1904). (6) Sukkōth or Sāḇkōth ("booths"), on Lev. xxiii. 34 sqq., Num. xxi. 12 sqq., Deut. xvi. 15-16. (7) Bēḏōt ("camps"), on the opening of their camp on the 1st of Ḥeshvan. (8) Ḥesdā-Shānāh ("New Year festival"), on the calendar, and more particularly on the first of the Seventh Month (cf. Num. x. 10, xxvii. 11 sqq., &c.). (9) Ta’antōth or Ta’antōth Torah, the special days for the Jewish people; the calendar, and public fasts appointed in time of drought. (10) Mīṣgâr ("roll" of Esther), the reading of it at Purim, &c. (11) Mi’ēḏ qōṭ ("the small M"), the tabernacles festival of this order, &c. (12) Māshāk ("the first word"), regulations for the intermediate festivals at Passover and Tabernacles. (12) Ḥaggâdî ("festival"), on the three principal festivals, Deut. xvi. 16, the duty of pilgrims to be avoided (tranl. by Bab. Talm. by A. W. Streane, Camb., 1891).

III. Nēzīm ("women"). (1) Yêḇēmōth ("sisters-in-law"), on the levirate, &c. (2) Kōḏēhōth ("marriage contracts"), rights of daughter-in-law (Gen. xxxvii. 4, 5, 7, 20, 21 antiquity, etc.). (3) Nâzîr ("Nazrite"), on Num. vi. (4) Gīṭîn ("documents"), on divorce and separation. (5) Sēḇiḥ ("the faithless wife") on Num. v. (6) Yadim ("the first and second sacrifices") of marriage, on the contraction of legal marriage.

IV. Nēḏēqin ("damages"), also known as Yēḇādōth ("deeds of help"). (1) Bēḏōṯ gōmēṯ (Aram. the first gift), on injuries and dedicated animals (cf. Lev. xvi. 18, B. Midr. 437) Aḥarōn ("the little gift"), on sales, leases, lost property. (3) B. Bēṭād (Aram. the last gift), on real estate, succession, &c. (4) Saḥēḥrōn (awkwlaw), on procedure and criminal law. (5) Māḥēhōth, "blows," on the oner or to be indicted (Deut. xxv. 1-5), and for what offence, &c. (6) Šēḇaṭōth ("oaths"), on Lev. v. 4 sqq. (7) Edūyūt ("testimonies," viz. of later teachers regarding their predecessors, on the schools of Hillel and Shammai, &c., &c. (8) Ḥēḏeḥōth ("decisions," on judicial and other errors (Lev. iv. 1 sqq.).

V. Qōdēshim ("holy things"). (1) Zēḇēōshād ("sacrifices"), the first-horn, &c. (2) Mēbārēḵōth ("meat-offerings"), on Lev. ii. 5, 11-13, vi. 7-16, xiv. 10-20, &c. (3) Ḥullīn or Shebēṭēh H. ("the sacrifice of common things"), on non-sacrificial meat. (4) Yeḥidōth, on the first-born, &c. (5) Shehīrāh ("cutting off"), on Excommunication, &c. (6) Mēbārēḵ ("trespas"), on Lev. v. 15 sqq. (7) Yāḏ ("battle") on Num. v. 6-8. (8) Tāmāh, on the continual or
perpetual (daily burnt offering)," Ex. xxix. 28-42; Num. xxviii. 2-8. (10) Midrash ("measures"), an important tractate on the temple (measurements, gates, halls, &c.). (11) Qumran ("nest on the side") for the support of doves for the poor (cf. Lev. l. 14-17, v. 1 seq.; xii. 8). VI. Toḥerath or Ṭeh., "purifications," an euphemism for things which are ritually or ceremonially "unclean." (1) Kilum ("inactivity of the uncumstained"), the uncumstained state (Num. xic. 14 seq.; xiv. 20 seq.). (2) Olot Ṭeh ("tents"), defilement through a corpse (Num. xix. 14-20), &c. (3) Negidim ("plagues," i.e. leprosy), on Lev. xii. seq. (4) Parshah (the [red] "heifer"), on Num. xix. (epurificatory ceremony in the expansion of the "teh" defilements). (5) Miqvaṭ (ritual baths), bathing for the defiled (cf. Lev. xiv. 8, xv. 5 seq.; Num. xxii. 23; also Mark vii. 4). (6) Niddah (female impurity), on Lev. xv. 19-33. (7) Mekhilath (same as "miknah"). (8) Mikneh (defilement of wet, unclean things (cf. Lev. vii, 14 seq.; Num. xii. 8), and those who have taken a ritual bath and must not confess the sinnett before becoming circumcised, see Lev. xv. 15 seq.; Num. xix. 6 seq.; Num. xiii. 19). (11) Yadāyim, "hands," their purification (cf. Matt. xv. 2, 20; Mark vii. 2-4, &c.). (12) Ḫṭin ("stems"), on the relation between fruit and the stems and stalks as regards defilement, &c. To Order IV. The Babylonian recension of the Talmud adds seven treatises, which are of later origin and are regarded as more as less extra-canonical. (1) Ḫṭib al Ṭeh Ṣahibin, an expansion of IV. 9, attributed to a second-century Rabban, but post-Talmudic (ed. S. Schechter, 1887). (2) Sopherim ("scribes"), on the writing of the scroll. (3) Šabath ("sabbath"), the day of rest. (4) later addition) on the liturgy (ed. J. Müller, Leipzig, 1878). (5) Bezä Rabbah ("great weeping"), or, euphemistically, Semahōth ("joy"), on mourning customs and rules. (6) Ṣalebat (betrothed, bridegroom, &c.), on chassidic and eschatological questions. (7) Ḫer ("a large," &c.), and "a small," treatise on various rules of conduct and social life. (8) Pérshe ha-Ṣahibon, a "chapter on peace," (peacefulness). In addition to these seven, other small treatises are still reckoned (edited by R. Kirchheim, Frankfurt-on-Main, 1890). These deal with (1) the writing of the rolls of the Law; (2) Ḫin (Deut. vi. 9, xi. 20); (3) Tephethim (prayers, phylacteries); (4) the Ḫinim (Num. xxv. 38); (5) slaves; (6) the Samaritans (cf. H. A. Montgomery, The Samaritans, pp. 196 seq.); and (7) proselytes. The Mishnah itself contains 63 tractates, or, since IV. 1-3 originally form a single tractate, 64 of which are unitary. A further number is also given as 70 (cf. 2 Esd. xiv. 44-46), perhaps by including seven or smaller treatises appended to IV. There are 513 chapters (or 525, see l. 11, IV. 9). 2. The Origin of the Mishnah. —A careful distinction was drawn between the Written Law, the Mosaic Toraḥ, and the rest of the Scriptures (יָדוֹתָן, παπαία) and the Oral Law, or Toraḥ, by mouth (יֵדָעָה נַפְתָּלָה). The origin of the latter, which has become known as the Mishnah or Ḫṭin, is unknown. It was supposed that it had been handed down by Ezra; that it was indebted to Joshua, David or Solomon; that it was as old as Moses, to whom it had been communicated orally or in writing, complete or in its essence. The traditional view is well illustrated in the words ascribed to R. Simeon Lakish, 3rd century a.d.1 "What is that which is written, I will give thee the tables of stone, and the Law and the Commandment, which I have written, that thou mayest teach them (Ex. xxiv. 12)? 'Tables,' these are the Ten Words (the Decalogue); the 'Law' is the Scripture; 'and the commandment' is the Mishnah: 'which I have written,' these are the Tractates and Writings (i.e. the Halakhot), 'to teach them,' that is the Gemara—thus instructing us that all these were given to Moses from Sinai.' Literary and historical criticism places the discussion on another basis when it treats the Mosaic Toraḥ in its present form as a post-exilic composition (about 5th century B.C.) from sources differing in date, origin and history. There is no a priori reason why other legal enactments should not have been current when the compilation was first made; the Pentateuchal legislation is incomplete, and covers only a small part of the affairs of life in which legal decisions 1 For the sake of convenience Ben ("son") and Rabbi are, as usual, abbreviated to b. and R. For the quotation which follows, see Oesterley and Box, The Religion and Worship of the Synagogue (London, 1907) p. 51; and, on the subject, S. Schechter, Studies in Judaism (London, 1898), ch. viii. —"the history of Jewish tradition" —E. L. Hamburger (Leipzig, 1911), p. 35 seq., Strack, op. cit., p. 8 seq.; W. Boussuet, Relig. d. Judéismes (Berlin, 1906), pp. 176 seq., and Jew. Ency., iv. 423 seq.; see also G. B. Gray's art. "Law Literature" in The Ency. Bib. might be needed. There must have been a large body of usage to which Jewish society subscribed; customary usage is one of the most binding of laws even among modern Oriental communities where laws in writing are unknown, and one of the most interesting features is the persistence in the East of closely-related forms and principles of custom from the oldest times to the present day. Laws must be adjusted from time to time to meet changing needs, and new necessities naturally arose in the Greek and Roman period for which the older codes and usages may be insufficient; therefore, a system of uniform Jewish law was derived from the Twelve Tables, the Jewish written laws were used as the authority for subsequent modifications, and the continuity of the religious-legal system was secured by a skilful treatment of old precedents.2 In the article Midraṣ it will be seen that new teaching could justify itself by a re-inter-pretation of the old writings, and that the traditions of former authoritative figures could become the framework of a teaching considerably later than their age. It is probable that this process was largely an unconscious one; and even if conscious, the analogy of the conventional "legal fiction" and the usual anxiety to avoid the appearance of lawlessness is sufficient to show that it is not to be condemned. By the help of a tradition —a "haggadic" or "halakic" Midrash (g.v. 1)—contemporary custom or ideals could appear to have ancient precedents, or by means of an exegetical process they could be directly connected with old models. In the Old Testament many laws in the Mosaic legislation are certainly post-Mosaic and the value of not a few narratives lies, not in their historical or biographical information, but in their treatment of law, ritual, custom, belief, &c. Later developments are exemplified in the pseud-epigraphical literature, notably in the Book of Jubilees, and when we reach the Mishnah and Talmud, we have only the first of a new series of stages which it may be said, culmi-nate in the 16th-century Shulḥan Arakh, the great compendium of the then existing written and oral law. Thus, the problem of the origin or antiquity of the unwritten Oral Law, a living and fluid thing, lies outside the scope of criticism; of greater utility is the study of the particular forms the laws have taken in the written sources which from time to time embody the ever-changing legacy of the past. The course of development between the recognition of the supremacy of the Pentateuch and the actual working-down the Mishnah and Gemara can be traced only in broad lines. It is certain that a great mass of oral tradition was current, and there are a number of early references to written collections, especially of haggadah. These, together with the long-hand (cf. IV. 5), gives a strong opposition to writing down the Oral Law. It is possible, therefore, that written works were in circulation among the learned, and that these contained varying interpretations which were likely to be due to the efforts to make the written laws fit the changing needs of men of his people. Also the Book of Jubilees knows of secret written traditions containing regulations regarding sacrifices, &c., and Jacob hands over "all his books and the books of his fathers to Levi his son that he might preserve them and renew them for his children (i.e. the priestly caste) unto this day" (xiv. 16). 3. Growth of the Mishnah and Gemara.—According to the traditional view the canon of the Old Testament closed with the work of Ezra. He was followed by the Sopherim,3 "scribes" (or the Men of the great Synagogue), to the Maccabean age, and these again by the "Pairs" (צָהָאָה, גֵּרֵוהוּ), the reputed heads of the Sanhedrin, down to the Herodian age (150-30 B.C.). The last culminates in Hillel (q.e.) and Shammai, the founders of two great rival schools, and to this famous pair the work

2 See W. R. Smith, Old Test. in the Jewish Church, p. 51 seq., 160.
of collecting halakhah ("legal decisions") has been ascribed. The ensuing period of the Tannaiti", "teachers" (about A.D. 10–220), is that of the growth of the Mishnah. Among the best known representatives of the schools are Rabban (a title given to Hillel's descendants) Gamaliel, the Phil-Hellenic and teacher of the apostle Paul (Acts xxii. 3) and his son Simeon (Josephus, Life, § 38 seq., Wars, iv. 3, 9), and Rabban Johanan b. Zakai, founder of the seat of learning at Jamnia (Jabneh). A little later (about 90–130 A.D.) are the famous Gamaliel II, Eleizer b. Hyrqunos (at Lydda), and Ishmael b. Elisha, the last of whom founded the school at Usha and is renowned for his Judeo-Greek knowledge and for his sermons by Hillel. With Rabbi Agaba (q.v.) and the scribes of Jamnia (about 90 and 118 A.D.) a definite epoch in Judaism begins. At Jamnia, under the presidency of Gamaliel II and Eleazar b. Azariah, a collection of traditional halakhah was formed in the tractate Edwyoth (larger than and not to be identified with IV., 7 above). Here, too, was discussed the canonicity of the Song of Songs and of Ecclesiastes, and it is probable that here Agaba and his colleagues fixed the official text of the canonical books. Agaba had an important share in the early development of the Mishnah (Strack, pp. 19, 86); and, in the collecting of the period was followed notably by the school of Ishmael (about 130–160 A.D.), which has left its mark upon the early halakic Midrashim (see Midrash, §§ 5–3). The more interesting names include R. Meir, a well-known haggadist, R. Simeon b. Yoḥai, R. Joseph b. Ḥalapha and R. Jehudah b. Elai. But, as collections of decisions were made by prominent teachers from time to time, confusion was caused by their differences as regards both contents and teaching (Sotah, 22a; Shabb. 138b). Consequently, towards the close of the second century a thoroughly comprehensive effort was made to reduce the halakhah to order. Judah, grandson of Gamaliel II, known as the Prince or Patriarch (nasi'at), as Robbenu ("our teacher"), or simply as "Rabbi" par excellence, was the editor. He gathered together the material, using Meir's collection as a basis, and although he did not write the Mishnah as it now is, he brought it into essentially its present shape. His method was not free from arbitrariness; he would attribute to "the wise" the opinion of a single authority which he regarded as correct; he would ignore conflicting opinions or those of scholars which they themselves had afterwards retracted, and he did not scruple to use his own opinions. In the period of the 'Amora'i-, "speakers, interpreters," (about 220–500 A.D.), witnessed the growth of the Gemara, when the now "canonical" Mishnah formed the basis for further amplification and for the collecting of old and new material which bore upon it. In Palestine learning flourished at Caesarea, Sephoris, Tiberias and Usha; Babylonia had famous schools at Nehardea (from the 2nd century A.D.), Sura, Pumbeditha and elsewhere. Of their teachers (who were called Rabbi and Rab respectively) several hundreds are known. R. Ḥiyya was redactor of the Sifra on Leviticus (Midrash, § 5, 2); b'hm and to R. Hoshaiya the compilation of the Ta'asephah is also ascribed. Abbā Arīka or Rab, the nephew of the first mentioned, founded the school of Sura (215 A.D.). Rab and Shemuel (Samuel) "the astronomer" (died 254 A.D.) were pupils of "Rabbi" (i.e. Judah, above), and were famed for their knowledge of law; so numerous were their points of difference that the Talmud will emphasize certain decisions by the statement that the two were agreed. The Gemara is much indebted to this pair and to Johanan b. Nappāh (190–279). The latter, founder of the great school of Tiberias, has indeed been venerated, on the authority of Maimonides, as the editor of the Palestinian Talmud; but the presence of later material and of later names, e.g. Mani b. Jona and Jose b. Abin (Abun), refute this view. The Babylonian Rabbbah b. Ḡamnāni (d. c. 330) had a dialectical ability which won him the title "uprooter of mountains." His controversies with R. Joseph b. Ḥiyya (known for his learning as "Sinai"), and those between their disciples Abayi and Raba are responsible for many of the minute discussions in the Babylonian Gemara. Meanwhile the persecutions of Constantine and Constantius brought about the decay of the Palestinian schools, and, probably in the 5th century, their recension (which the Talmud calls "the redaction of Nahmanides") having, however, learning still flourished, and with Rab Ashi (352–427) the arranging of the present framework of the Gemara may have been taken in hand. Under Rabba Toseph'a (died 470) and Rabina, i.e. Rab Abina (died 499), heads of the academy of Sura, the Babylonian recension became practically complete.

Finally, the Sabbā'ēt, "explaners, opiners" (about 500–550), made some additions of their own in the way of explanations and new decisions. They may be looked upon as the last editors of the now unwieldy thesaurus; less probable is the view, often maintained, that in the 12th century, that it was first compiled in that age.

4. The Two Talmuds.—The Palestinian recension of the Mishnah and Gemara is called "the Talmud of the Land of Israel," or "T. of the West"; a popular but misleading name is "the Jerusalem Talmud." It is an extremely uneven compilation. "What was reduced to writing does not give us a work carried out after a preconcerted plan, but rather represents a series of jottings answering to the needs of the various individual writers, and largely intended to strengthen the memory" (Schechter). Political troubles and the unhappy condition of the Jews in the last centuries of the Roman Empire are the main causes of Palestinian haggadic literature in the Midrashim, whose "words of blessing and consolation" appealed more to their feelings than did the legal writings. The Pal. Talmud did not attain the eminence of the sister recension, and survives in a very incomplete form, although it was perhaps once fuller. It now extends only to Orders I–IV., with the omission of IV. 7 and 9, and with the addition of part of VI. 7. The Babylonian Talmud (or Tal. Bab.) contains the Gemara to 356 tractates, but the material is relatively very full, and it is about three times as large as the Pal., although the Gemara there extends to 90 tractates. In the latter the Gemara follows each paragraph of the Mishnah; in the former, references are usually made to the leaves (the two pages of which are called a and b), the enumeration of the editio princeps being retained in subsequent editions. The Mishnah is written in a late literary form of Hebrew; but the Gemara is in Aramaic (except the Baraithas), that of the Bab. T. being an Eastern Arama. dialect (akin to Mandartic), that of the Pal. T. being Western Arama. (akin to Biblical Aram. and the Targums). Greek was well understood in cultured Palestine; hence the latter recension uses many Greek terms which it does not explain; whereas in the Bab. T. they are much less common, and are sometimes punningly interpreted.

The Pal. Tal. is the more concise, but it is remarkable for the numerous repetitions of the same passages; these are useful for the criticism of the text, and for the light they throw upon the incompleteness of the work of compilation. The Bab. Tal., on the other hand, is diffuse and freer in its composition, and it is characterized by the exuberance of Halakah, which is usually rather subtle and far-fetched. Both Talmuds offer a good field for research (see below). Especially interesting are the Bab. Middoth, which are preserved in the Gemara in Hebrew; they are "external" decisions not included in the more authoritative:

4 See Strack, p. 16 seq. The view has little in its favour, although memory played a more important part than now. For early mnemonic aids to the Mishnah, see Strack, p. 68, Jew. Ency., xii. 19.

4 The Mishnah was first critically edited by W. H. Low (Cambridge, 1883).

Mishnah, but they differ and are sometimes older than the Mishnic material, with which they sometimes conflict (so in particular as regards the rejected decisions of the school of Shammai). They usually begin: "our Masters taught," "it is taught," "the teacher taught," the verb "אָמַר (cf. Tanhûm, "teachers") being employed (see further Jew. Ency., ii. 513 seq.). Parallel to the Mishnah is the Tosephîth, an independent compilation associated with R. Nehemiah (a contemporary of Meir and Simeon b. Yoḥai). R. Hisya b. Abba and others; it is arranged according to the Mishnic orders and tractates, but lacks IV. 9 and V. 9–11. The halakhoth are fuller and sometimes older than the corresponding decisions in the Mishnah, and the treatment is generally more haggadic. The method of making the discussions part of an interpretation of the Old Testament (halakic Midrash), as exemplified in the Tosephîth, is apparently older than the abstract and independent decisions of the Mishnah—which presuppose an acquaintance with the Pentateuchal basis—and, like the employment of narrative or historical Midrash (e.g. in the Pentateuch, Chronicles and Jubilees), was more suitable for popular exposition than for the academies. For other halakic literature which goes back to the period of the Tanna'im, see the Meḥîlat, Sîphrî and Sîphrê, Art. Mîdrash, § 5, 1–3.

The Palestinian Talmud, although used by the Qaraites in their controversies, fell into neglect, and the Babylonian recension became, what it has since been, the authoritative guide. With the Čîonîm, the heads of Sura and Pumbeditha (about 580 A.D.) the two great collections of the Mishnah and Gemara were now the objects of study, and the scattered Jews appealed to the central bodies of Judaism in Babylonia for information and guidance. The Geonim in their "Responses" or "Questions and Answers" supplied authoritative interpretations of the Old Testament or of the Talmud, and regulated the application of the teaching of the past to the changed conditions under which their brethren now lived. The legal, religious and other decisions formulated in the pontifical communications of one generation usually became the venerated teaching of the next, and a new class of literature thus presupposed an acquaintance with the Tanna'im. As the Babylonian schools decayed, Talmudic learning was assiduously pursued outside its oriental home, and some Babylonian Talmudists apparently reached the West. However, the fortunes of the Talmud in a hostile world now become part of the history of the Jews, and the many interesting vicissitudes cannot be recapitulated here. (See Jews, §§ 44 seq.) To the use of the Pal. Talmud by the Qaraites in their controversies with the Rabbis we owe the preservation of this recension, incomplete though it is. To the intolerance of Christians are no doubt due the exaggerated MSS., and the impure state of the text of both Talmuds. At the same time, the polemical value results since the literary controversy in the 16th century (when Johann Reuchlin took the part of the Jews) led to the editio princeps of the Babylonian Talmud (Vienna, 1520–23). A change shows itself in the second edition (Basil, 1578–81), when the "Abbâdîh Zârûîh (above, § 1. IV. 8) was omitted, and passages which offended the Christians were modified or deleted.

Owing to the nature of its contents the Talmud stood sorely in need of aids and guides, and a vast amount of labour (of varying value) has been devoted to it by Jewish scholars. Of the many commentaries in force place must be given to that of R. Solomon b. Izhak of Troyes (see Rashi); his knowledge of contemporary tradition and his valuable notes make it a new starting point in the interpretation of the Talmud. To Rashi's disciples are due the Tosephîth "additions," which, with the commentary of "the Commentator," as he was styled, are often reproduced in printed editions of the Talmud. This school (France and Germany, 12th to 13th century) developed a casuistical and over-ingenious interpretation in contrast to that of the Spanish Talmudists who were interested in simplification and codification—and it drew upon it the saying of Naḥmanides (13th cent.): "They try to force an elephant through the eye of a needle." Important also are the introduction to and commentary upon the Mishnah by Malmendy (c. 1600), and the translation of its six remaining tractates of R. Moses ben Samuel b. Judah Alfazi (1635). The Mikraôth Yevîl (Mishneh Torah, otherwise called Sepher ha-Ḥadôd) has been revised by S. H. Schâkin (1823). The latter is a presentable summary of all Jewish religious and ethical teaching. The Talmud is presented in a standardized and modern form from the 16th century onwards based their studies—and also their criticisms—of early Rabbinism. Jacob b. Asher b. Yebiel in his Târîm ("rows") presented a well-arranged collection of those laws which had not been included in the midrash. This is the work of many hands, of new ones. Most important of all, however, is Joseph Caro's Shûbalân A'rûk ("prepared table"), which came in the age of printing (1565), and has remained the chief work of this kind. Its numberless editions, translations, and new forms of expression have made it the most popular one. It has been, in its turn, the subject of many commentaries and reading-books. This great work develops Talmudic law in all its developments, ancient and modern, written and oral. (I. Abrahams, Jew.Lit., London, 1916, p. 147 seq.; see also Jew. Ency., iii., 58 seq.) The lengthy history of the written and oral law thus reached its last stage in a work which grew out of the Talmud but had its roots in a more distant past. It was at the dawn of a period when the ancient codes which had been continuously reinterpreted or readjusted were to be re-examined under the influence of newer ideas and methods of study. The haggadic portions of the Talmud were collected: (a) from the Babylonian, in the Codex Constantiopolitanus, 1511 and in Jacob ibn Habîb's Ep (eye, well of) Jacob b. Ḥasdai, the Islamic authorities. (b) from the Talmud of Jerusalem (see MiDrash, §§ 9). These are superseded by the English translation made by A. Wünsche (J. T., Zürich, 1880; Bab. T., Leipzig, 1886–9).

The standard lexicon was the Arekh by Nathan b. Yebiel of Rome (c. 1190) which underlies all subsequent works, notably the great German dictionary Completum Ter. (Leipzig, 1878–1910), and also the excellent work of W. Bacher's Exeget. Terminologie d. jüd. Traditions-üll. (Leipzig, 1905).

The grammatical aids are modern. For Mishnic Hebrew, see A. J. Buber, Exposition of the Old Testament (Breslau, 1905) and (Paris, 1908). For the Tosephîth, R. Luzzatto's Ter. (Venice, 1784, 1785) and M. H. Sella's essay on the relation between Mishnic and Biblical Hebrew (Jew. Quart. Rev., xx. 467–73); for Western Aramaic, especially G. Dalman, Jüd. Pal. Aron. (Leipzig, 1905); for Eastern Aramaic, E. S. M. Augustin, Dialektdicke Aramäisch (Cincinnati, 1900), M. L. Margolis (London, 1910), and also T. Noldeke's Mandäische Gramm. (Halle, 1875).

The text of the Talmud has been badly reserved; much useful critical work has been done by R. Rabinovitsch. Various Lexicones (Munich, 1870–86) for the Bab. T., and by B. Rattner, Ahavath Zion (in Heb., Wilna, 1901–2) for the Jer. T. As regards translations, E. A. Cowden's English translation (Leipzig, 1889) and M. Cohen's (Eng., 1905) are the best. The standard editions, covering the whole work, are the one of 1845 (for the Rabbinic Talmud), the other of 1843); and that of C. H. Keil and J. Weiss (Completum Ter., New York, 1882) see also Jew. Ency., iv. 580 seq. Modern dictionaries of the older Rabbinical writings have been made by Levy (Leipzig, 1878), M. R. Morrow (London and New York, 1886), G. Dalman (Frankfort-on-Main, 1901); and also, B. S. Wacher's Exeget. Terminologie d. jüd. Traditions-üll. (Leipzig, 1905).

Features of Interest and Value.—Although the Midrashim do not hold the authoritative position which the Talmud enjoys, the two groups cannot be kept apart in any consideration of the interesting or valuable features of the old Rabbinic writings. Viewed as a whole they have the characteristics of other Palestinian literature, the merits and defects of other oriental works. As regards the Talmud, neither the Mishnah nor the subsequent Gemara are in any sense a digested corpus of law. It is really a large collection of opinions and views, a remarkably heterogeneous mixture of contents, for which the history of its growth is no doubt largely responsible. It appeals the reader with its irregularity of treatment, its variations of style, and its abrupt transitions from the spiritual to the crude and trivial, and from superstition to the purest insight. Like the Koran it is often concise to obscurity and cannot be translated literally;

1 Lat. transl. of Orders I–III., V, by Ugolino, Tesh., xvii.–xx., recent ed. by M. S. Zuckermandel (Pasewalk, 1880); see Jews Ency., xii. 207 seq.

2 The censorship and burning of the Talmud, see Jew. Ency., iii. 642 seq., xii. 22; Strack, 71 seq., 78 seq.
it presupposes a knowledge which made commentaries a necessity even, as we have seen, to the Jews themselves. The opening of Order II. 6, for example, would be unintelligible without a knowledge of the law in Levit. xxiii. 42: "A booth (the interior of which is) about 20 cubits high is disallowed. R. Judah allows it. One which is not ten hands high, one which has not three walls, or which has more sun than shade is disallowed." 2 An old booth? (made of eucalyptus wood) be supposed. The school of Shammai disallows it; but the school of Hillel allows it," &c. In the Gemara, the decisions of the Mishnah are not only discussed, explained or developed, but all kinds of additional matter are suggested by them. Thus, in the Bab. Gem. to III. 5, the reference in the Mishnah to the Zealots (צלאט) is the occasion for a long romantic account of the wars preceding the destruction of the Second Temple. In IV. 3 the incidental prohibition of the cutting up of a roll of Scripture leads to a most valuable discussion of the arrangement of the Canon of the Old Testament, and other details including some account of the character and date of Job. There are numerous haggadic interpolations, some of considerable interest. Prose mingles with poetry, wit with wisdom, the good with the bad, and as one thing goes on to suggest another, it makes the Talmud a somewhat rambling compilation. It is scarcely a law-book or a work of divinity; it is almost an encyclopedia in its scope, a store-house reproducing the knowledge and the thought, both unconscious and speculative, of the first few centuries of the Christian era.

A good idea of its heterogeneity is afforded by the English translation of the Talmud and other commentaries by P. L. Hershon (London, 1880-5). For miscellaneous collections of excerpts, see H. Polano (in the Chandos Classics); Henchery, Legends from the Midrash; I. Myers, Gems from the Talmud; S. Rapport, Tales and Analogies from the Talmud (New York, 1894); M. W. E. van de Velde, Zanen voor het Talmud. A valuable general introduction to the Rabbinical literature (with numerous excerpts) is given by J. Winter and A. Wünsche, Gesch. d. Jud.-Heiligen u. Talm. Literatur (Tübingen, 1894). The Talmud is still the focal point of the various branches of antiquarian research. On the animal fables, most of them found also in Indian and in classical collections, see J. Jacobs, Fables of Assop (London, 1886); for myth, superstition and folklore, see D. Joel, Aberglave (Breslau, 1881), and M. Grünbaum, Semi. Sagenbude (Leiden, 1893), Ges. Aufsätze (Berlin, 1901); for mathematics, see B. Zuckermann (Breslau, 1878); for medicine, J. Bergel (Leipzig, 1889), &c. For these subjects, and for law, zoology, geography, &c., &c., see the full and classified bibliographies in M. L. Rodkinson, Hist. of Talmud (New York, 1903), vol. ii. ch. vii., and Stracke's Einleitung, pp. 164-175.

Ordinary estimates of the Talmud are often influenced by the attitude of Christianity to Judaism and Jewish legalism, and by the preponderating interest which has been taken in the religious-legal side of the Rabbinical writings. The canonization of the Mishnah by the Masoretes is held by the majority of writers to be an advantage and the disadvantages of a legal religion, and controversialists have usually seen only one side. The excessive legalism which pervades the Talmud was the scholarship of the age, and the Talmud suffers to a certain extent because accepted opinions and isolated views are commingled. To those who have no patience with the minutiae of legislation, the prolix discussions are as irksome as the arguments appear arbitrary. But the Talmudical discussions were often merely specialist and technical—they were academical and ecclesiastical debates which did not always touch every-day life; sometimes they were for the purpose of reconciling earlier conflicting views, or they even seem to be mere exhibitions of dialectic skill (cf., perhaps, Mk. xii. 18-23). It may be supposed that this predilection for casuistry stimulated that spirit which impelled Jewish scholars of the middle ages to study or translate the learning of the Greeks. Once again it was—from a modern point of view—old-fashioned scholarship; yet one may now recognize that in the development of European science and philosophy it played a necessary part, and one can now realize that again the benefit was for common humanity rather than for the Jews alone. It may strike one as characteristically Jewish that extravagant and truly oriental encomiasts were passed upon such legalists and Talmudists as Isaac Alfazi, Rashi or Maimonides; none the less the medieval Jews were able to produce and appreciate excellent literature of the most varied description. In any case, the Talmud must be judged, like other authoritative, religious literature, by its place in history and by its survival. From age to age groups of laws were codified and expanded—the Priestly law of the Old Testament, the Mishnah, the complete Talmud, the subsequent codifications of Alfazi, Maimonides, and finally Joseph Caro. Thus, the Talmud occupies an intermediate place between the older sources and its later developments. At each step disintegration was arrested, but not Jewish genius; and the domination of the Law in Judaism did not as a matter of fact have the petrifying results which might have been anticipated. The explanation may be found partly in the intense feeling of solidarity uniting the Deity with his worshippers and his worshippers among themselves. No distinction was drawn between secular and religious duties, between ceremonial, ethical or spiritual requirements. Modern distinctions of moral and ceremonial being unknown, ancient systems must be judged in the light of those modes of thought which could not view religion apart from life. The Talmud discusses and formulates rules upon points which other religions leave to the individual; it sets down the conditions and the spiritual life of man with such up most lofty ethical standards. The bonds, rigorous and strange as they often appear to others, were a sacrament enshrined in the imagination of the lowest follower of the Talmud. Some of the keenest legalists (e.g. the Babylonian Rab) are famous for their ethical teaching, and for their share in popular exposition; one of the best ethical systems of medieval Judaism (by Bahya ibn Pekuda) is founded upon the Talmud; the last exponent of Rabbinical legalism, Joseph Caro, was at the same time a mystic and a pietist; and the combination of the poetical with the legal temperament is frequent. The Talmud outlived the reactionary tendencies of the Qaraite (q.v.), and of the Kabbalah (q.v.), and fortunately, since these movements, important though they undoubtedly were for the evolution of thought, had not within them the power to be of lasting benefit to the rank and file of the community. Finally, no religion has been without exhibitions of fanaticism and excess on the part of its followers, and if the Old Testament itself was the authority for witch-burning among Christians, it is no longer profitable to ask whether the Talmud was responsible for offences committed by or alleged against those whose lives were regulated by it. In the other hand, Judaism has never been without its heroes, martyrs or saints, and the fact that it still lives is sufficient to prove that the mechanical legalism of the Talmud has not hindered the growth of Jewish religion.

Apart from the general interest of the literature for history and of its contents for various departments of research, the exegetical methods of the Talmud are especially instructive. There were rules of interpretation, and they give expression to one dominant idea: there is an infinite potentiality in the words of the Old Testament, none is fortuitous or meaningless or capable of only a single interpretation, they were said for all time, "for our sake also" and "for our learning" (cf. Paul in Romans iv. 24, xv. 4). This was not conducive to critical inquiry; questions of the historical background of the biblical passage or of the trustworthiness of the text scarcely found a place. The interpretation itself is markedly subjective; by the side of much that is legitimate exegesis, there is much that appears arbitrary in the extreme. The endeavour was made to interpret, not necessarily according to the letter, but according to individual conceptions of the spirit and underlying motive. Thus, the same evidence could give rise to widely differing conflicting interpretations, which may not be directly deducible from or justified by the Scripture. Hence the value

1 The whole subject of Jewish legalism should be compared with Islam, where again law and religion are one; as regards the legal aspect, see the extremely suggestive and instructive study, "The Bukhari Style of the Medina Talmud," by J. Bryce, Studies in History and Jurisprudence (1901), ii. No. xii.
2 Some of the most influential of the Greek works in the middle ages had passed through Syriac, Arabic and Hebrew translations before they appeared in their more familiar Latin dress.
of the teaching, whether halakic or aggadist, rests upon its intrinsic worth, and not upon the exegetical principles which were the tools common to the age. Moreover, it was also considered necessary that teaching should be authenticated, as it was, by its association with older authority whose standing guaranteed its genuineness. For this reason anonymous writings were attributed to famous names, and traditions were judged (as in Islam), not so much upon their merits, as by the chain of authorities which traced them to their supposed source. All evidence that has already been pointed out in the article Midrash, it may be noticed that the familiar penalty of the "forty stripes save one" (2 Cor. xi. 24; Josephus, Ant., iv. 8, 23) is discussed in the Mishnah (Makkoth, iv. 5), and is subsequently explained by an extremely artificial interpretation of Deut. xxv. 2–3 (as though " to the number 40"). But the penalty is obviously older than, and entirely independent of, the arbitrary explanation by which it is supported. Again, the rending of clothes on the occasion of a charge of blasphemy (Matt. xxvi. 65) is actually connected with Joseph b. Qobhah of the New Testament original (Sanhedrin, vii. 5), although elsewhere this halakah is anonymous. Here the effort was made to substantiate a practice, but the tradition was not unanimous; and it often happens that the Talmud preserves different traditions regarding the same teaching, different versions of it, or it is ascribed to different authorities (see Jев. Ency., xii. p. 15, col. 2). The fact that certain teaching is associated with a name may have no real significance for its antiquity, even as a law ascribed to the age of Moses—the recognized law-giver—may prove to be of much earlier or of much later inception. This nature naturally complicates all questions affecting record and originality, and cannot be ignored in any study of the Talmud in its bearing upon the New Testament. Similar or related forms of interpretation and teaching are found in the Talmud, in Hellenistic Judaism, in the New Testament, in early Church Fathers and in Syriac writers. As regards the New Testament itself, the points of similarity are many and often important. It has been asserted that "the writings of recent Jewish critics have tended on the whole to confirm the Gospel picture of external Jewish life, and where there is discrepancy these critics tend to prove that the blameworthy is not the biblical writer but the interpreter." The Talmud also makes "creditable details which many Christian expositors have been rather inclined to dispute. Most remarkable of all has been the cumulative strength of the arguments adduced by Jewish writers favourable to the authenticity of the discourses in the Fourth Gospel ..." The points of contact between the phraseology in the Gospel of John and the early Midrashim are especially interesting. The popularity of the parable as a form of didactic teaching finds many examples in the Rabbinical writings, and some have noteworthy parallels in the New Testament. It is known that there were theological controversies between Jews and Christians, and in the Midrash Bereshith Rabbah (Midrash, § 5, 5) is a passage (translated in Jев. Ency., viii. 558) directed against the Christian view which found support for the doctrine of the Trinity in Gen. i. 26. But it is uncertain how far the doctrines of Judaism were influenced by Christianity, and it is even doubtful whether the Talmud and Midrash may be used to estimate Jewish thought of the 1st or 2nd century A.D. Much valuable work has been done by modern Jewish scholars on the "higher criticism" of these writings, which, it must be remembered, range over several centuries, but it still remains difficult to date their contents. Moreover, in endeavouring to sketch the theology of early Judaism it has been easy to find in the heterogeneous and conflicting ideas a system which agreed with preconceived views, and to reject as late or exceptional whatever told against them. Nevertheless, considering the evidence it is a delicate task to avoid confusing its meaning for all generations; there is no longer any natural or appropriate one to subsequent interpreters (whether Jewish or Christian) who have been necessarily influenced by their environment and by contemporary thought. At all events, if these writings have many old elements and may be used to illustrate the background of the New Testament, they illustrate not only the excessive legalism and ritualism against which early Christianity contended, but also the more spiritual and ethical side of Judaism. Upon this latter phase the pseudigraphical and apocryphal writings have shed much unexpected light in linking the Old Testament with both Christian and Rabbinical theology. The various problems which arise are still under discussion, and are of great importance for the study of Palestinian thought at the age of the parting of the ways. They touch, on the one hand, the absolute originality of Christianity and its attitude to Jewish legalism, and, on the other, the true place of the pseudepigrapha in Jewish thought and the antiquity of the Judaism which dominates the Talmud. They do not, however, exclude the possibility that by the side of the scholasticism of the early Jewish academical writer, the modern speculative thought which, forming a link between Jews and Christians, ultimately fell into neglect as Judaism and Christianity formulated their theologies.

On the close relation between the thought of the age, see B. Ritter, Pflüge u. d. Halaicha (Leipzig, 1879); M. Grünwald in Königseger's Monatsblätter (Berlin, 1890); N. I. Weinstein, Zur Genesis d. Agada (Frankfort-on-Main, 1901); W. Boussert, Relig. Intelligenz, ed. H. Graffin (Paris, 1894), p. xiii, seq.; S. Funk on the haggadic elements in Apocrypha (Vienne, 1891); and art. Midrash, § 4. In this respect the pseudepigraphic lit. is frequently of the greatest interest; thus Mark, iv. 24 finds a close parallel in "the Testament of Zebulun," viii. 3 (R. H. Charles, Test. of xii. Patriarch., p. 117), and does not differ essentially from the saying ascribed to Gamaliel II. (Shabb. 51b) and others. A close parallel to Matt. vii. 3 is ascribed to R. Tarpon, latter half of 1st century A.D. (Arab. 16b: "If one says, take the mote from thy eye, he answers, take the beam from thy eye"); it seems to have been a popular saying (see BDB s.v. Pflüge). See further W. Bittel, Die Talmudische Sprache in Bezug auf das Ubertragen der lateinischen Sprache in das Hebräische (Leipzig, 1890); with Schechter's essay in his Studies (1896), pp. 283–305; H. Loeb, Jesus Christus im Talmud (Berlin, 1891); R. T. Herford, Christianity in Talmud and Midrash (London, 1903; with W. Bacher's review in Jев. Quart. Ren., xvii. 171–183); R. G. Price (1890); Boussert, op. cit.; Oesterley and Box, op. cit. (with C. G. Montefiore's review in Jев. Quart. Ren., 1908, pp. 347–357); I. Abrahams in Swete's Jev. Bibli. Essays (1909), pp. 193–192; C. G. Montefiore, Synoptic Gospels (1909); H. L. Strack, Die Häretiker u. die Christen (1910).

The Talmud itself is still the authoritative and practical guide of the mass of the Jews, and is too closely connected with later Rabbinical and earlier Palestinian history to be neglected by Christians. With the progress of modern research the value of this and of the other old Rabbinical writings is being re-evaluated, and criticism has forced a modification of many old views. Thus, an early reference to the title of a work does not prove that it is that which is now current; this applies, for example, to the tractate 3 Edryyyoth (see Jев. Ency., viii. 611), and to the Midrash Siphre, which frequently differs from that as known to the Talmud (ib., xi. 331). It has been found that a tradition, however

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Results of criticism.

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1 There are many details in the Talmud which cannot be dated; if some are obviously contemporary, others find parallels in Ancient Babylonian, for example the code of Hammurabi. L. N. Dembitz, Jев. Quart. Ren., xix. 109–126, and the literature on the code (see Babylonian Law). Numerous miscellaneous examples of the intimate relationship between the Rabbinical and older oriental material will be found in H. Pick, Assyriisten u. Talmudisches (Berlin, 1903); A. Jeremias, Bab. im N. Test. (Leipzig, 1905). Alle Test. im Lichte d. Altert Orientis (ib., 1906); E. Bischoff, Babylonische und Persische Texte i. Talmud u. Midrash (ib., 1897).


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XXVI. 13

5
talukdar—tamarisk

TAMUKTDAR—TAMARISK

tenacious or circumstantial, is not necessarily genuine, and that too in spite of the chain of authorities by which its antiquity or genuineness appeared to be confirmed. Implicit reliance can no longer be necessarily placed upon the reputed authorship or editorship of a work; yet, although many of the works were made by Jews in this region, they prove to be erroneous (e.g. on the authorship of the Zohar; see KABBALAH), they may sometimes preserve the recollection of a fact which only needs restatement (e.g. R. Johanan as the editor of the Pal. Talmud).

Finally, the Talmud comes at the end of a very lengthy development of Palestinian thought (see PALESTINE: HISTORY). It is in the direct line of descent from the Old Testament—intervening literature having been lost—the essence of which it makes its own. Forced by the events of history, this legacy of the past was subjected to successive processes and adapted to the needs of successive generations and of widely different historical and social conditions. Legal compendiums and systems of philosophy served their age and gave place to later developments; and the elasticity of interpretation which characterizes it enabled it to outlive Karaites and Kabbalists. It also escaped the classicism of the Renaissance with its insistence upon the text—either fact or fiction. As an oriental work among an oriental people the moral and spiritual influence of the Talmud has rested upon its connexion with a history which appealed to the imagination and with its heterodox character of all moods and minds, and upon the unifying and regulative effects of its legalism. The relationship of Talmudism to the Old Testament has been likened to that of Christian theology to the Gospels; the comparison, whether fitting or not, may at least enable one to understand the varying attitudes of Jewish thinkers to their ancient sources. With closer contact to the un-oriental West and with the inevitable tendencies of modern western scholarship the Talmud has entered upon a new period, one which, though it may be said to date from the time of Moses Mendelssohn (see JEWS, § 48), has reached a more distinctive stage at the present day. In the weakening of that authority which had been ascribed almost unanimously to the Talmud, and invariably to the Old Testament, a new and greater stress has been laid upon Judaism to reinterpret its spirit once more to answer the diverse wants of its adherents. This is part of that larger and pressing psychological problem of adjusting the "authority" ascribed to past writings to that of the collective human experience; it does not confront Judaism alone, and it must suffice to refer to the writings of "Reformed Judaism"; see e.g. C. G. Montefiore, Liberal Judaism (London, 1903); The Talmud (1907); I. Abrahams, Judaism (1907), and the essays of S. Schechter.


The writer desires to express his indebtedness to Mr Israel Abrahams for bibliographical and other assistance. (S. A. C.)

TALUKDAR (Hind. from taluk, district, and dar, holding), the name of (1) an official in the state of Hyderabad, India, equivalent to magistrate and collector, and (2) a landholder with peculiar tenures in various parts of India, particularly in Ceylon.

TALUS (Lat. for the "ankle-bone"), in architecture, the slope of an embankment wall, which is thicker at the bottom than at the top, to resist the pressure of the earth behind it.

TAM, JACOB BEN MEIR (1100-1171), a grandson of Rashi (q.v.), was the most famous French glossator (josefist) on the text of the Talmud. In 1147 he was attacked and injured by a disorderly band who had attacked themselves to the Crusaders. He escaped to the neighbouring Tropes, where about 1150 was held the first of the Jewish Synods, for which the Rhinefolds became celebrated. At this meeting it was laid down that disputes between Jew and Jew were not to be carried to a Christian court, but were to be settled by fraternal arbitration. New conditions of life had arisen owing to the closer terms on which Jews and Christians lived, and Jacob Tam was foremost in settling the terms which were to govern the relations, from the Jewish side. Many others of his practical ordinances (Tukkanot), connected with marriage and divorce, trade and proselytism, as well as with synagogal ritual, had lasting influence, and bear invariably the stamp of enlightened independence within the limits of recognized authoritative tradition and law. Of his legal work the most important was collected in his Sefer ha-yashar. He was also a poet and grammarian.

See Gross, Gallia Judaica (Index); M. Schloessinger in Jewish Encyclopedia, vii. 36-39. (A. L.)

TAMAQUA, a borough of Schuylkill county, Pennsylvania, U.S.A., on the Tamaqua (Little Schuylkill) river, about 20 m. above its junction with the Schuylkill, about 17 m. E.N.E. of Pottsville, and about 98 m. N. of Philadelphia. Pop. (1890) 6054; (1900) 7267, (625 foreign-born); (1910) 9462. Tamaqua is served by the Central railroad of New Jersey, by the Philadelphia and Reading railroad, and by an electric line connecting with Mauch Chunk, Pottsville, and other places. Tamaqua is in a rich anthracite coal district, and coal-mining is its chief industry. Among manufactures are foundry and machine-shop products, powder, stoves, furniture, hosery, &c. The borough owns the water-works. The first settlement here was made in 1799 and anthracite coal was discovered in 1817. In 1829 Tamaqua was laid out and received its present name, an Indian word meaning "running water." It was incorporated as a borough in 1833. Between 1860 and 1875 the Molly Maguires were active here.

TAMARIND. This name is popularly applied to the pods of a leguminous tree, which are hard externally, but within filled with an acid juicy pulp containing sugar and various acids, such as citric and tartaric, in combination with potash. The acid pulp is used as a laxative and a refrigerant, the pods being largely imported both from the East and the West Indies. The tree is now widely distributed in tropical countries, but it is generally considered that its native country is in eastern tropical Asia, and that Aysonian and Abyssinian (meaning in Arabic "Indian date") shows that it entered medieval commerce from India, where it is used, not only for its pulp, but for its seeds, which are astrigent, its leaves, which furnish a yellow or a red dye, and its timber. The tree (Tamarindus indica) attains a height of 70 to 80 ft., and bears elegant pinnate foliage and purplish or orange veined flowers arranged in terminal racemes. The flower-tube bears at its summit four sepals, but only three petals and three perfect stamens, with indications of six others. The stamens, with the stalked ovary, are held away from the part of their base, but are directed towards them at their apices. The anthers and the stigmas are thus brought into such a position as to obstruct the passage of an insect attracted by the brilliantly-coloured petal, the inference of course being that insect visits are necessary for transference of pollen and the fertilization of the flower.

TAMARISK. The genus Tamarix gives its name to a small group of shrubs or low trees constituting the tamarisk family Tamaricaceae. The species of tamarisk and of the closely allied genus Myricaria grow in salt-deserts, by the sea-shore, or in other more or less sterile localities in warm, temperate, and tropical regions of the earth's hemisphere. Their long slender branches bear very numerous small appressed leaves, in which the evaporating surface is reduced to a minimum. The flowers are minute and numerous, in long clusters at the
ends of the branches or from the trunk. Each has 4-5 free sepals, and as many petals springing with the 4-10 stamens from a fleshy disk. In Tamarix the stamens are free, while in Myricaria they are united into one parcel. The free ovary is one-celled, with basal placentas, and surmounted by 3-5 styles. The fruit is capsular, and contains numerous seeds, each with a long tuft of hairs at one end. The great value of these shrubs or trees lies in their ability to withstand the effects of drought and a saline soil, in consequence of which they grow where little else will flourish. On this account the Tamarisk, *T. gallica*, is planted on sea-coasts, and affords shelter where none other could be provided. Some species produce galls, valued for their tannin, while the astringent bark of others has occasionally been used for medicinal purposes. The ashes of the plant, when grown near the sea, are said to contain soda. For tamarisk manna, see Manna.

**TAMATAVE** (called by the natives Toamánina), the chief seaport of Madagascar, situated nearly on the centre of the eastern coast in 18° 10' S., 40° 32' E. It owes its importance to the existence of a coral reef, which forms a spacious and fairly compact barrier. There is also a service railway partly by railway and partly by steamer, along the coast lagoons, connecting the port with Antsânârîvô. Pop. about 4600.

**TAMAYO Y BAUS, MANUEL** (1829-1898), Spanish dramatist, was born at Madrid on the 15th of September 1829. He came of a family connected with the theatre, his mother being the eminent actress Joaquina Baus. It is interesting to note that she appeared as Geneviève de Brabant in an arrangement from the French made when he was in his twelfth year. Through the influence of his uncle, Antonio Gil y Zárate, minister of education, Tamayo's independence was secured by his nomination to a post in a government office. The earliest of his printed plays was *La Comedia de los Inocentes*, which appeared in 1847, and has been printed under the title of *Una Aventura de Richelieu*, which the author has not himself preserved, is said to be an imitation of Alexandre Dvau. The general idea of his *Angela* (1852) was derived from Schiller's *Kabale und Liebe*, but the atmosphere is Spanish, the situations are original, and the phrasing is Tamayo's own. His first great success was *Virgina* (1853), a dramatic essay in Alfieri's manner, remarkable for its ingenuity and noble diction. In 1854 Tamayo was expelled from his post by the new Liberal government, but was restored before long by Cándido Nocedal, a minister who had been struck by the young man's talent. He collaborated with Aureliano Fernández-Guerra y Orbe in writing *La Richa- hembra* (1854), a historical drama which recalls the vigour of Lope de Vega. *La Locura de Amor* (1855), in which Juana la loca, the passionate, love-sick daughter of Isabel the Catholic, figures as the chief personage, established Tamayo's reputation as Spain's leading playwright. *Hijo y Madre* (1855) is a failure, and *La Bola de Nieve* (1856) is notable solely for its excellent workmanship. It is unfortunate that Tamayo's straitened means forced him to put original work aside and to adapt pieces from the French. Examples of this sort are fairly numerous. *La Passiva* (1862), imitated from Adrien-Augustín-Léon Laya's *Duc Job*, is well-nigh forgotten, though the Spanish version is a dexterous piece of stagecraft and contains some elements of original value. *Del dicho al hecho* (1864) is from *La Pierre de touche* of Jules Sandeau and Émile Augier, and a pleasing proverb, *Más vale Muerta que Fuerza* (1866) is a great improvement upon Mme Caroline Berton's *Diplomatie du Ménage*. The revolution of 1868, which cost Tamayo his post at the San Isidro Library, is indirectly responsible for *No hay mal que por bien no venga* (1868), a clever arrangement of *Le Feu au Courant*, by Henri Murger's friend, Théodore Barrière. During these seven years Tamayo wrote a terminal piece, *Lances de Honor* (1865), which turned upon the immorality of dulling, and led to a warm discussion among the public. Written in prose, the piece is inspired by a breath of medieval piety which had not been felt in the Spanish theatre since the 17th century. This renaissance of an old-world motive has induced many critics to consider *Lances de Honor* as Tamayo's best work, but that distinction should be accorded rather to *Un Drama nuevo* (1867), a play in which the author has ventured to place Shakespeare and Yorick upon the scene. *Los Hombres de bien* (1870) was
Tambov's final contribution to the Spanish stage. His last years were spent in recasting his *Virginia*, and the result of his efforts may be read in the posthumous edition of his *Obres* (Madrid, 1898-99). In 1858 Tamayo was elected a member of the Spanish Academy, to which he afterwards became permanent secretary; and in 1884 the Conservative minister, Alejandro Pidal y Mon, appointed him director of the National Library. He died on the 20th of June 1898. (J. F.-K.)

**TAMBOUR** (Fr. for “drum”), the term in architecture given to the inverted bell of a Corinthian capital round which were carved the acanthus leaves decorating it: applied also to the wall of a circular structure, whether on the ground or raised aloft on pendentives and carrying a dome; and to the drum of a column which is built in several courses.

**TAMBOUTINE** (Fr. tambour de Basque; Ger. baskische Trommel, Tambourin, or Schellen-trommel), a popular instrument of percussion of indefinite musical pitch, used for marking the rhythm in dance or bacchanalian music. The tambourine consists of a flat wooden or metal ring, over one end of which is stretched a parchment or vellum head; in the circumference of the ring are fixed nine or ten metal disks or small bells which jingle as the tambourine is struck by the hand, or merely waved through the air. A tremolo effect is obtained by stroking the head of the instrument lightly with the thumb and forefinger. (Cf. Sloane 3083, fol. 13) a tambourine of modern appearance with a snare bears the inscription “Tympanum.” The tambourine is of the highest antiquity, and was known at different times under the names of *timbrel* or *tabel*, *tympanon* or *tympanum*, and *symphonia*. (K. S.)

**Tambov**, one of the largest and most fertile governments of central Russia, extending from N. to S. between the basins of the Oka and the Don, and having the governments of Vladimir and Nizhni-Novgorod on the N., Penza and Saratov on the E., Voronezh on the S., and Orel, Tula and Ryazan on the W. Tambov is 203 sq. m. on an undulating plain intersected by deep ravines and broad valleys, ranging 450 to 800 ft. above sea-level. Cretaceous and Jurassic deposits, thickly covered with boulder-clay and loess, are widely spread over its surface, concealing the underlying Devonian and Carboniferous strata. These last crop out in the deeper ravines, and seams of coal have been noticed at several places. Iron ore (in the north-west), limestone, clay and gypsum are obtained, and traces of petroleum have been discovered. The mineral waters of Lipetsk, similar to those of Franzensbad in their alkaline character, are also much esteemed. (Cf. *Pallone* and Sloane 3083, fol. 13) are well known in Russia. The Oka touches the north-west corner of the government, but its tributaries, the Moksha and the Tsna, are important channels of traffic. The Don also merely touches Tambov, and of its affluents none except the Voronezh and the Khoper and the Vorona, a tributary of the Khoper, are at all navigable. As a whole, it is only in the north that Tambov is well drained; in the south, which is exposed to the dry south-east winds, the want of moisture is much felt, especially in the district of Borisoglyebsk. The climate is continental, and, although the average temperature is comparatively cool (January, 13°F; July, 68°F), the rivers remain frozen for four months and a half. Forests occupy about 72 per cent. of the total area, and occur chiefly in the west; in the south-east wood is scarce, and straw is used for fuel. The soil is fertile throughout; in the north it is clayey and sometimes sandy, but the rest of the government is covered with a sheet, 2 to 3 feet thick, of black earth, of such richness that in Borisoglyebsk cornfields which have not been manured for eighty years still yield good crops.

The estimated population in 1906 was 3,205,500. The government is divided into twelve districts, the chief towns of which are Tambov, Borisoglyebsk, Yelatma, Kisranov, Kozev, Lebedyan, Lipetsk, Morshansk, Shatsk, Spask, Ternikov and Usman. The inhabitants are Great Russians in the centre, but there is a notable admixture of Mordvinians and Meshcheryaks in the west and north-west, as also of Tatars. The Mordvinians are rapidly becoming Russified. Nonconformity has a relatively strong hold in the government. Notwithstanding a high birth-rate (45 in the thousand), the annual increase of population is but slow (0.5 per cent. annually). The prevailing occupation is agriculture, modern machinery being used on the arable farms. More than two-thirds of the area is arable, and of this proportion 53 per cent. belongs to the peasant communities, 36 per cent. to private individuals, and 11 per cent. to the crown. The principal crops are rye, wheat, oats, barley and potatoes.

Grain is exported to a considerable extent from the south, although the yield is deficient in the north. Hemp and linseed are also cultivated, and the production of tobacco is yearly increasing.

Beetroot is extensively grown for sugar. Live- stock breeding, though less extensively carried on than formerly, is still important. Excellent breeds of horses are met with, not only on the larger estates, but also in the hands of the wealthier peasants, those of the Bityug river being most esteemed. Manufacturers are represented chiefly by distilleries, tallow-melting works, sugar factories, flour-mills and woolen-cloth mills. Commerce is brisk, owing to the large grain export—Kozlov, Morshansk, Tambov and Borisoglyebsk being the chief centres for this traffic, and Lebedyan for the trade in horses and cattle. This government is backward educationally. A distinctive feature is its large villages of crown peasants. The government was settled by Russians during the earliest centuries of the principality of Moscow, but until the end of the 17th century the fertile tracts in the south remained too insecure for settlers. In the following century a few immigrants began to come in from the steppe, and landowners who had received large grants of land from the tsars began to bring their serfs from central Russia. (P. A. K.; J. T. Be.)

**Tambov**, a town of Russia, capital of the government of the same name, 300 m. by rail S.E. from Moscow, on the Tsna river, and on the railway to Saratov. Pop. (1884) 34,000; (1899) 40,000. The town is almost wholly built of wood, with broad unpaved streets, lined with low houses surrounded by gardens; but it is an archiepiscopal see of the Orthodox Greek Church. Woolens, tobacco, oil and various other commodities are manufactured. The trade in grain, and in cattle purchased in the south and sent to Moscow, is far less important than that of Morshansk and Kozlov.

**Tamburello** (called in Piedmont *Tabasso*), a court game popular in Italy, particularly in the northern provinces. It is a modification of the ancient game of *Pallone* (p.e.), bearing the same general name as the modern Italian game of *Tamburello*. It is usually played in the open air, on a large field divided by a rope (cordino) into two equal spaces, the *batteuto* and the *rimessa*. Three players regularly form a side, each carrying in one hand an implement called *tamburello*, resembling a tambourine (whence the name), which is a round frame of wood upon which is tightly stretched a cover of horse-hide. A rubber ball about the size of a lawn-tennis ball is used. One of the players opens the service (*batteuto*), which is made from a small square called *transpolino*, situated at one corner of the *batteuto* but outside the court. The service must be over the middle line. The ball must then be hit from side to side over the line, the side failing to return it or sending it out of court losing a point. The game is scored like lawn-tennis, four points constituting a game, counting 15+15+10+10. Tamburello, a less expensive game than Pallone, is popular with the lower classes, who use it as a medium for betting.

**Tamils.** The word *Tamil* (properly Tamil) has been identified with Dravida, the Sanskrit generic appellation for the south Indian peoples and their languages; and the various stages through which the word has passed—Dravida, Dramila, Damila—have been mainly discussed by Bishop Caldwell in his *Comparative Grammar of the Dravidian Languages* (2 ed., 1875, p. 10 seq.). The identification was first suggested by Dr Graul (Reise nach Ostindien, vol. III., 1854, p. 349), and then adverted to by Dr G. U. Pope (*Tamil Handbook*, 1859, Introduction) and Dr Gundert (*Malayalama Dictionari*, 1872, i.e.). Dr Pope
however, believed Tamil to be a corruption of tenmott, southern speech, in contradistinction to yawggu, the northern, i.e., Telugu language. As in the case of the Kaïr, Turkish, Tagala and other typical languages, the term Tamulic or Tamilian has occasionally been employed as the designation of the whole class of Dravidian peoples and languages, of which it is only the most prominent member. The present article deals with Tamil in its restricted sense only. The Tamils proper are smaller and of weaker build than Europeans, though graceful in shape. Their physical appearance is described as follows:—a pointed and frequently hooked pyramidal nose, with conspicuous nares, more long than round; a marked sinking in of the orbital line, producing a strongly defined orbital ridge; hair and eyes black; the latter, varying from small to middle-sized, have a peculiar sparkle and a look of calculation; mouth large, lips thick, lower jaw not heavy; forehead well-formed, but receding, inclining to flattat, and seldom high; beard considerable, and often strong; colour of skin very dark, frequently approaching to black (Manual of the Administration of the Madras Presidency, Madras, 1885, vol. i., Intro., p. 36; see also Caldwell, Comparative Grammar of the Dravidian Languages, 1875, pp. 538–70).

The Tamils have many good qualities—frugality, patience, endurance, politeness—and they are credited with astounding memories; their worst vices are said to be lying and lasciviousness. Of all the South-Indian tribes they are the least sedentary and the most enterprising. Wherever money is to be earned, there will Tamils be found, either as merchants or in the lower classes of domestic service. The tea and coffee districts of Ceylon are peopled by about 65,000; Tamils serve as coolies in the Mauritius and the West Indies; in Burma, the Straits, and Siam the so-called Klings are all Tamils (Graul, Reise nach Ostindien, Leipzig, 1855, vol. iv. pp. 113–22).

**Language.**—The area over which Tamil is spoken extends from a few miles north of the city of Madras to the extreme south of the eastern side of the peninsula, throughout the country below the Eastern Ghats, from Pulicat to Cape Comorin, and from the Ghats to the Bay of Bengal, including also the southern part of the western side of the Ghats and the northern part of Ceylon. According to the census of 1901, the total number of Tamil-speaking people in all India was 16,525,500. To these should be added about 160,000 in the French possessions. But as of all the Dravidian languages the Tamil shows the greatest tendency to spread, its area becomes ever larger, encroaching on that of the contiguous languages. Tamil is a sister of Malayâlam, Telugu, Kanares, Tulu; and, as it is the oldest, richest, and most highly organized of the Dravidian languages, it may be looked upon as typical of the family to which it belongs. The one nearest akin to it is Malayâlam, which, with proper reservations, has been simply a dialect of Tamil, but differs from it now both in pronunciation and in idiom, in the retention of old Tamil forms obsolete in the modern language, and in having discarded all personal terminations in the verb, the person being always indicated by the pronom (F. W. Ellis, Dissertation on the Malayâlam Language, p. 2; Gundert, Malayâma Dictionary, Intro.; Caldwell, Comparative Gr., Intro., p. 23; Burnett, Specimens of South Indian Dialects, No. 2, p. 13). Also, the proportion of Sanskrit words in Malayâlam is greater, while in Tamil it is less, than in any other Dravidian tongue. This divergence between the two languages cannot be traced farther back than about the 10th century; for, as it appears from the Cochin and Travancore inscriptions, previous to that period both languages were still substantially identical; whereas in the Râmâcharitam, the oldest poem in Malayâlam, composed probably in the 13th century, at any rate long before the arrival of the Portuguese and the introduction of the modern character, we see that language already formed. The modern Tamil characters originated "in a Brahmanical adaptation of the old Grantha letters corresponding to the so-called Vaṭṭēḻuttu," or round-hand, an alphabet once in vogue throughout the whole of the Pâñḍya kingdom, as well as in the South Malabar and Coimbatore districts, and still sparsely used for drawing up conveyances and other legal instruments (F. W. Ellis, Dissertation, p. 3). It is also used by the Moplahs in Tellicherry. The origin of the Vaṭṭēḻuttu itself is still a controverted question. Dr. Burnett, the greatest authority on the subject, stated his reasons for tracing that character through the Pahlavi to a Semitic source (Elements of South Indian Palaeography, 2nd ed., p. 62). From the 10th century the Vaṭṭēḻuttu existed side by side and together with the Grantha, an ancient alphabet still used throughout the Tamil country in writing Sanskrit. During the four or five centuries after the conquest of Madura by the Cholas in the 11th it was gradually superseded in the Tamil country by the modern Tamil, while in Malabar it continued in general use down to the end of the 17th century. But the earliest works of Tamil literature, such as the Tolkâppiyam and the Kutil, were still written in it. The modern Tamil characters, which have but little changed for the last 500 years, differ from all the other modern Dravidian alphabets both in shape and in their phonetic value. Their angular form is said to be due to the widespread practice of writing with the style resting on the end of the left thumb-nail, while the other alphabets are written with the style resting on the left side of the thumb.

The Tamil alphabet is sufficiently well adapted for the purpose of the twelve vowels of the language (a, ä, i, i̯, u, u̯, e, ê, o, o̯, e̯, ou),—the occasional sounds of ū and ū̯, both short and long, being covered by the signs for e, i, i̯; but it is utterly inadequate for the expression of any other sounds. The character k has to do duty also for kh, gh, and similarly each of the other surd consonants ch, j, t, p represents also the remaining surd consonant of the same class. The letter h has, in the occasional sound of k, and that of s. Each of the five consonants k, ch, j, t, p has its own nasal. In addition to the four semifonals, the Tamil possesses a cerebral r and j, and has, in many cases, with the Malayâlam, obtained a liquid l, corresponding to all the Dravidian languages, the sound of which is so difficult to fix graphically, and varies so much in different districts, that it has been rendered in a dozen different ways (Manual of the Administration of the Madras Presidency, vol. ii., pp. 246 ff.). Fr. Müller is probably correct in approximating it to that of the Bohemian r. There is, lastly, a peculiar n, differing in function but not in pronunciation from the dental n. The three sibilants and h of Sanskrit have no place in the Tamil alphabet; but ch often does duty as a sibilant in writing foreign words, and the four corresponding letters as well as j and ksh of the Grantha alphabet are now frequently called to aid. It is obvious that many of the Sanskrit words imported into Tamil at various periods (Caldwell, loc. cit., Intro., pp. 86 seq.) have, in consequence of the incongruity of the Sanskrit and Tamil notation of their respective vocabularies, assumed forms unsuited to the modern characters; scarcely recognizable: examples are ulagu (loka), urwain (rupa), arukken (arka), arupom (addhutam), naṭhabhram (naksabhatram), arukkaṇ (ukhaṇ), etc. These are the Dravidian inventions, the commonest words of which the individual portions are the same as in Sanskrit, e.g., butiler, abī, act, kulūb, club, kannar, governor, pinâkalû, penal code, stikē, sick, mejastirattu, magistrate. But, as compared with its literary sister languages, it has preserved its Dravidian character singularly free from foreign influence. Of Tamil words which have found a permanent home in English may be mentioned curry, (bātī), mulligatawny (mīlaṭu), pepper, (tāppu), cold water, (ceroct) (surutti), pariah (gecēiyī).

The laws of euphony (avoiding of hiatus, softening of initial consonants, contact of final with initial consonants, hard complicated in Tamil than in Sanskrit. But, while they were transferred to Italic and many other European languages ("Perfect" Tamil), there is a growing tendency to neglect them in the language of the present day (Kodun-Tamil). It is true the Tamil rules totally differ from the prevailing Sanskrit; still the remaining letters and words in the latter case appear to follow Sanskrit models. Thus, iru nīkkhen becomes intru nikkhān; pon pāṭsrm, purpāṭsrm; vajīl kōṇdēn, vajīl kōṇe; vālīś-yūme, vālīś-yūnē; the third person plural, nouns in the common plural, which is indicated by change of a final n (feminine j) into r; but the neuter plural termination kō ṣ̄ (sāl) may be super-added in every case. Certain nouns change their base termination according to whether the determinative is singular or plural. They are for the acc. ei, instr. dā, social bāḥu (ādu, udān), dat. ku, loc. li (lūtali, in), abl. ilirundu (inirū), gen. uthreya (ādu). There is, besides, a general oblique affix in, which
is not only frequently used for the genitive, but may be inserted between the subject of the affirmative and the object of the negative. The particle $\delta$ may also be superadded. In the old poetry there is a still greater variety of affixes, while there is an option of dispensing with all. Adjectives, when attributive, precede the noun and are unmarked; when substantive, they follow it. It came to be the practice to use a number of affixes. The pronouns of the 1st person are sing. $\text{nâm} (ydn)$, in- flexional base $\text{en}$, plural $\text{nam} (ydm)$, inf. nom. containing, $\text{tnagal}$, inf. en-gal, excluding the personal pronoun of the 2nd person $\text{nt}$, inf. $\text{ntagal}$, inf. en-gal. (sîr $\text{tnagal}$, $\text{tnagal}$, $\text{ntagal}$, $\text{ntagal}$). To each of these forms, inclusive also of the reflexive pronouns $\text{dn}$, $\text{ldm}$, $\text{tngal}$, a place is assigned in the scale of honorific pronouns. As in the Dravidian languages the verb is the root, and is used with i indicate nearness, those with a distance, and (in the old poetry) those with u what is between the two, so the same forms beginning with o (or yd, or yr, who?) express the interrogative, and the forms of three persons the same, the singular with $\text{en}$ reducible to one syllable, the tense characteristic, and the personal affix. There are three original moods, the indicative, imperative, and infinitive. The last is singular, and is generally identical with the root, as well as three original tenses, the present, past, and future. The personal affixes are—sing. (1) $\text{en}$; (2) $\text{dy}$, honorific $\text{tr}$; (3) masc. $\text{dn}$, fem. $\text{dtn}$, honor. $\text{dn}$, neuter $\text{dn}$; plural (1) $\text{nent}$; (2) $\text{nten}$; (3) $\text{nten}$. All post-positions were originally active, not verbal forms. $\text{Oritio indirecta}$ is unknown in Tamil, as it is in all the other Indian languages, the gerund $\text{emra}$ being used, like $\text{iti}$ in Sanskrit. The verbal and prepositive are the same; the verb is the root. The noun is used, the singular in the prepositive, the dual and plural in the postpositive. This is an exact counterpart of the structure of words, inasmuch as such that which qualifies always precedes that which is qualified. Thus the attributive precedes the substantive, the substantive precedes the prepositive. Thus $\text{tiru-}$ and $\text{tpu}$- are interchangeable, the former, primary one, and the verb closes the sentence. The sentence— 

"Hailing the woman who had killed the child, he asked why she had committed such infanticide," runs in Tamil as follows—

$\text{Kilanthen sengapattuverai}$

The child $\text{her} \text{who had killed}$

made $\text{child-murder dhan}$

$\text{Thus why thus}$

$\text{having caused to be called,}$

$\text{asking}$

$\text{having said he asked.}$

Much as the similarity of the structure of the Tamil and its sister languages to that of the Ugro-Tartar class may have proved suggestive of the assumption of a family affinity between the two classes, such an affinity, if it exist, must be held to be at least very distant, inasmuch as the assumption receives but the faintest shade of support from an inspection of the radical and least variable portion of the respective languages.

Literature.—The early existence, in southern India, of peoples, localities, animals and products the names of which, as mentioned in the Old Testament and in Greek and Roman writers, have been identified with corresponding Dravidian terms, goes far to prove the high antiquity, if not of the Tamil language, at least of some form of Dravidian speech (Caldwell, loc. cit., Intro., pp. 81-106; Madras District Manual, 1, Intro., pp. 134 seq.). But practically the earliest extant records of the Tamil language do not ascend higher than the middle of the 8th century of the Christian era, the grant in possession of the Israelites at Cochin being assigned by the late Dr Burnell to about the year 1100 A.D. when the number of stanzas of distinctive韈s. (beauty), which is marked in the old literature (Burnell, loc. cit., p. 127, note). The earlier of these may have been Saiva books; the more prominent of the others were decided Jain. Though traces of a north Indian influence are palpable in all of them that have come down to us (see, e.g., F.W. Ellis's notes to the Kuru), we can at the same time appreciate, as we should, the desire of the authors to oppose the influence of the Vedas, as far as possible, and create a literature that should rival Sanskrit books and appeal to the sentiments of the people at large. But the refinement of the poetical language, as adapted to the genius of Tamil, has been carried to greater excess than in Sanskrit; and this artificial character of the so-called Sen-Tamil is evident from a comparison with the old inscriptions, which are a reflex of the language of the people, and clearly show that Tamil has not undergone any essential change (Burnell, loc. cit., p. 142).

The rules of Sen-Tamil appear to have been fixed at a very early date. The Tolkâppiyum, the oldest extant Tamil grammar, is assigned by Dr Burnell (On the Andra School of Sanskrit Grammar, pp. 8, 55) to the 8th century (best edition by C. V. Thiru-
daram Pillai, Madras, 1885). The Visâreddiyum, another grammar, is of the 11th century. Both have been superseded by the Nannul, which, after the 12th century, was composed by numerous commentators, and continues to be the leading national grammar (English editions in Pope's Third Tamil Grammar, and an abridgment by Lazarus, 1884). The period of the prevalence of the latter school is generally reckoned to be about the 14th century, is justly termed the Augustan age of Tamil literature. To its early days is assigned the Nâlalâvâdu, an ethical poem on the three objects of existence, which is supposed to have preceded the Nâlalâvâdu of Tiruvalluvar, the finest poetical expression of the whole range of Tamil composition. Tradition, in keeping with the spirit of antagonism to Brahmanical influence, says that its author, a brother of the poet, was a pariah, who lived a life of poverty, with a virtuous, and even, perhaps, a noble purpose. "It has often been edited, translated and commented upon; see the introduction to the excellent edition published by the Rev. Dr. Pope, in which also a comprehensive account of the influence of the Nâlalâvâdu on the poetry of the Tamil schools is given." (p. 171). The author is a reputed sister of Tiruvalluvar, but probably of a later date, and the Dikkârâm, the oldest dictionary of classical Tamil. The former is one of the finest poems in the language; but no more than the first and part of the third of its thirteen books have been edited and translated. Kamban's Râmâyânum (about 1100 A.D.) is the only other Tamil epic which comes up to the Chînâmâtârâm in greatness of design and extent of narrative. It is a Buddhist work, which appeared in the period of the Saiva revival (13th and 14th centuries) are two collections of hymns addressed to Siva, one called Tirâsvûkatam, by Mâalîka-Vâsakam, and a later and larger one, Tirûvûkatam, composed by Neigadâ and Sundaran and Appan. Both these collections have been printed, the former in one, the latter in five volumes. They are rivalled in number and extent the collection of poems of various forms of the contemporary collection of Vaishnava hymns, the Nâdïyâ-brahândam (also printed at Madras). The third section of it, called Tirâsvûkatam, or "Words of the Sacred Mouth," has been published in Telugu characters, with ample commentaries, in ten quarto volumes (Madras, 1875-76). After a period of literary torpor, which lasted nearly two centuries, King Vâllabha Deva, better known by his assumed name Alivârâma Pâñyând (second half of the 16th century), endeavoured to revive the love of poetry by compositions of his own, the most celebrated of which are the Neigadâ, somewhat exaggerated imitation of Sri Harsha's Sanskrit Nâlalâvâdu, and they have now been printed at Madras. A collection called Neigadâvatam of numerous followers, who made this revival the most prolific in the whole history of Tamil literature, none of the compositions of any kind, mainly translations and bombastic imitations of Sanskrit poems, with what pertinence they follow it and recede, was occupied by certain Tamil sectarians called ñllâr (i.e. siddhas or sages), whose mystical poems, especially those contained in the Neigadâvatam, are said to be of singular beauty. Two poems of high merit, and perhaps at the head of the rest, are the notice—the Nâttirivijâkam, an ethical treatise by Kumârâgurappura Desikan, and the Prabhûlîngûpali, a translation from the Kannarese language, by the celebrated text-book editor. See the analysis in W. Taylor's Catalogue, vol. ii. pp. 837-47.

The modern period, which may be said to date from the beginning of the last century, is ushered in by two great poets, one native and the other learned in a foreign language. The former, a schoolmaster, composed 1453 stanzas (pâdâl) which have a high reputation for sublimity both of sentiment and style; and the Italian Jesuit Joseph Beschi (d. 1742), under the name Virâmâlîn, elaborated, on the model of the Chînâmâtârâm, a religious epic Têmbandâni, which.
TAMLUK-TAMMANY HALL

Peacock dynasty, and a seatport at which the Chinese Buddhist pilgrims embarked. It is now 60 m. from the sea, and the ruins of the old city lie deep beneath river silt. It contains the palace of a local raja, and some temples of peculiar construction.

TAMMANY HALL, a political organization in New York City, U.S.A., claiming to be the regular representative of the Democratic party in that city. It takes its name from a sacheam or chief of the Delaware Indians, Tammany or Tammany, the name itself meaning “the Affable.” Before the War of Independe

ence there were Whig societies called “Sons of St. Tam

many” and “Sons of Liberty,” with rituals in which Indian elements were suggested. The American character of the lodges.

manny Hall in fourteenth Street. The society, thus, secret organiza-

tion, divided into tribes, with sachems (the most important being the Grand Sachem) as the chief officials, a sagemate, or master of ceremonies, and a wiskinske, or door-keeper, and with a ritual of supposedly Indian character. This “Tammany Society” is not itself the well-known political organization, but rents its hall to the Tammany Hall General Committee, the “Tammany Hall” of political notoriety; the leading members, however, of the “Society” and of the “Hall” are identical, and the “Society” controls the meeting-place of the “Hall,” so that the difference between the two is little more than nominal.

Almost from the beginning Tammany has been actively engaged in politics, being part of, and during the greater period of its existence actually representing in New York City, the Democratic party, though always subordinating the interests of the party as a whole to its own selfish interests. It has had local rivals at different times, but these, though successful for a while, have not lived long; on the other hand, the Hall has not generally been regarded with favour by the Democratic party throughout the country at large.

Soon after its founding, Tammany came under the influence of Aaron Burr, with whom it worked for the election of Jefferson as President. It bitterly opposed De Witt Clinton for many years and was hostile to his large Irish constituency; but, after it secured in 1822 the constitutional amendments providing for manhood suffrage and for the abolition of imprisonment of debtors, and especially after 1837 when Tammany first tried to reduce the five-year period of residence necessary for naturalization, the foreign-born element gradually came into control of the Society” and of the “Hall.” About 1842 Irish “gangs,” which used physical violence at election time, became a source of Tammany strength. It reached its height of power about 1870, under the leadership of William Marcy Tweed (1823–28), who used his popularity as a volunteer fireman to advance himself in Tammany and who was the first “boss” of the organization, which had formerly been controlled by committees. In the mayoralty and the other administrative offices and in the common council of the city, in the chief executive office of the state, in the state legislature, and even in some of the judges’ seats, Tweed had placed (or had secured the election of) accomplices or tools, or else controlled votes by purchase. In April 1870 Tweed secured the passage of a city charter which put the control of the city into the hands of the mayor, the comptroller, and the commissioners of parks and public works. A system of official plunder then began that has had few parallels in modern times. How much was actually stolen can never be known; but the bonded debt of the city, which was $36,000,000 at the beginning of 1869, was $97,000,000 in September 1871, an increase of $61,000,000 in two years and
eight months; and within the same period a floating debt of $20,000,000 was incurred, making a total of $81,000,000. For this vast sum the city had little to show. The method of plunder was the presentation of excessive bills for work done, especially in connexion with the new court-house then being erected. The bills were ostensibly paid in full, but in reality only in part, the rest being retained by Tweed, and divided amongst his followers in proportion to their importance. The total cost of the court-house to the city was about $13,000,000—many times the actual cost of construction. The amount paid in these two years for the city printing and stationery was not so large as the cost of the new court-house, and came through a petty auction over the division of the spoils. One of the plunderers, dissatisfied with the office he had received, gave to the New York Times a copy of certain sworn accounts which showed conclusively the stealing that had been going on. When Tweed was interviewed about the frauds his only reply was, "What are you going to do about it?" The better classes, however, were now thoroughly aroused, and with Samuel J. Tilden, afterwards governor of the state, at their head, and with the assistance of the Times and of Harper's Weekly, in the latter of which the preservation of Tammany Hall, as the Tammany of the old times, was identified with the success of Tammany's candidate Thomas H. Bayard, Tweed was tried and convicted, but was afterwards released on a technicality of law; he was re-arrested, but managed to escape and flee to Spain; he was identified and was brought back to gaol, where he died. The rest of the gang fared little better. Within a few years and under a new leader, John Kelly, Tammany was again in control of the city. Kelly was succeeded by Richard Croker, whose reign as "boss" continued until 1901. Since 1881 Tammany has been in virtual control of the city government about one-half the time, a Tammany and a reform mayor often alternating. There were elaborate investigations of Tammany's control of the city by committees of the legislature in 1890, 1894, and 1899. The most conspicuous overthrows of Tammany since the days of Tweed were in 1894, in 1901, when practically the whole reform ticket from mayor to alderman was elected, and in 1909, when the mayor (not a member of Tammany) was the only Tammany nominee on the general ticket elected. The grosser forms of corruption that prevailed under Tweed did not as a rule prevail in later years. Instead, the money raised by and for the Hall and its leaders has come from the blackmailing of corporations, which find it easier to buy peace than to fight for their rights; from corporations which desire concessions from the city; or which do not wish to be interfered with in encroachments on public rights; from liquor-dealers, whose licences are more or less at the mercy of an unscrupulous party in power; from other dealers, especially in the poorer parts of the city, whose business can be hampered by the police; from office-holders and candidates for office; and, lastly, indirectly through corrupt police officials, from the criminal classes and gambling establishments in return for non-intervention on the part of the police. The power of Tammany Hall is the natural result of the well-regulated machine which it has built up throughout the city, directed by an omnipotent "boss." Each of the "assembly districts" into which the city is divided sends a certain number of representatives to the General Committee of Tammany Hall. Each district also has a "boss" or leader and a committee, and these leaders form the Executive Committee of the Hall. There is also a "captain" for each of the voting precincts, over 1000 in number, into which the city is divided. The patronage of the city filters down from the riches of the Hall and from the man who leads the hall, to the party leaders, and from them often having one or more small municipal offices at his disposal; he also handles the election money spent in his precinct. The party headquarters in the different assembly districts are largely in the nature of social clubs, and it is in considerable degree through social means that the control of the Hall over the poorer classes is maintained. The headquarters are generally over or near a saloon, and the saloon-keepers throughout Manhattan belong as a rule to the Hall—in fact, are its most effective allies or members. It should be remembered too that the Hall is not subject to divided counsels, but is ruled by one man, a "boss" who has risen to his position by sheer force of ability, and in whose hands rest the finances of the Hall, for which he is accountable to no one. When the "Greater New York" was incorporated the power of Tammany seemed likely to grow less because it was confined to the old city (Boroughs of Manhattan and the Bronx), and the Democratic organizations in the other boroughs were hostile to it. The power of the organization in the state and in the nation is due to its frequent combination with the Republican organization, which controls the state almost as completely as Tammany does the city.

See Gustavus Myers, The History of Tammany Hall (New York, 1901).

TAMMERS (Finnish Tampero), the chief industrial city of Finland, capital of the province of Tavastehus, on the rapids connecting Lakes Näsijärvi and Pyhäjärvi, 125 m. by rail N.W. of Helsingfors. Pop. (1904) 40,261. Tammer是我的重要中心，用于棉花、亚麻、亚麻纸、纸板和皮革制造。这座城市拥有自己的水位，它位于泰伯河。它是一个重要的棉花、亚麻、亚麻纸制造中心，并且是通往美国以及与大西洋的太平洋的门户。这座城市的发展得益于其丰富的水力资源和便利的交通条件。这座城市的主要工业是棉花、亚麻和亚麻纸的制造。这座城市以其丰富的水力资源而闻名，这使得其工业生产更具竞争力。这座城市的工业发展也得益于此。这座城市拥有自己的水位，它位于泰伯河。它是一个重要的棉花、亚麻、亚麻纸制造中心，并且是通往美国以及与大西洋的太平洋的门户。
manufactures are boilers, pottery products, lumber and fertilizer; and there are two shipyards.

Tampa Bay was the landing-place of the expeditions of the Spanish explorers, Pánfilo de Narváez and Hernando de Soto. (See Florida.) In January 1812, the United States government established here a fort, Fort Brooke, which was an important base of supplies during the second Seminole War, and around it a settlement gradually developed. The fort was abandoned in 1860, and its site is now a public park. During the early part of the Civil War a small Confederate force was in possession, but in November 1862 it was driven out by United States gunboats. Tampa grew rapidly after the completion of the first railway thither in 1884, and in 1886 it was chartered as a city and became a port of entry. During the Spanish-American War United States troops were encamped in De Soto Park in Tampa, and Port Tampa was the point of embarkation for the United States army that invaded Cuba.

**Tampico**, a city and port of Mexico, in the state of Tamaulipas, on the N. bank of the Panuco river, about 6 m. from the Gulf of Mexico. Pop. (1906) 17,590, including the neighbouring settlements connected with the port works. The climate is hot, humid and unhealthy, and the city has suffered frequently from epidemics of yellow fever. A modern sewer system and waterworks, constructed in 1903-1906, have improved its sanitary condition and will in time reduce its heavy death-rate—about 78 per 1000 in 1903, when an epidemic of yellow fever caused 327 deaths, and the births numbered 512 against 1335 deaths. The eastern and poorer part of the town stands on low ground only 2 or 3 ft. above the river, and is subject to inundations. The western part rises about 150 ft., consists largely of private residences, and is provided with water and good drainage. The business section is well built, largely of stone and brick, and its streets are well paved and provided with gas and electric light. The neighbourhood is swampy and malarial. Tampico has two important railway connections: the Monterrey and Gulf line running north to the head of navigation on the Panuco, and a branch of the Mexican Central running westward to San Luis Potosí. There is also a line of river boats on the Panuco running up to the mouth of the Tamazunchale about 135 m., and another running to Tamiahua on the lagoon of that name by way of the Tuxpan canal, about 77 m. Industries include an electric light and power plant, factories for making ice, clothing, and fruit conserves, saw-mill, oil refinery, and a shipyard for small river boats. The modern port works, which have made Tampico accessible to a larger class of steamers, include two stone jetties at the mouth of the Panuco, which have increased the depth of water on the bar to 23 ft. at low water and 30 ft. at high water; seven wharves on the N. bank of the river to accommodate fourteen steamers at a time; steel sheds with railway tracks, and railway connections at the wharves. The depth of water at the wharves varies from 18 to 25 ft. The exports include sugar bullion (from San Luis Potosí, Agucalcientes, Torreón and Monterrey), axle fibre, sugar, hides, live cattle, cotton-seed cake, deer skins, honey, fustic, sarsaparilla, coffee, rubber, broom-root, copper ores and asphalt.

**Tamworth**, a municipal borough of Inglis county, New South Wales, Australia, is reached by rail from the south coast of New South Wales via Newcastle, and by boats on the Cooks rivers, 283 m. by rail N. of Sydney. Pop. (1901) 5799. It is an attractive town in a pleasant situation, with fine broad streets lined with shady trees, and was the first town in Australia to be lighted by electricity. Tamworth is the centre of several goldfields, at one of which, Bingara, diamonds are found. It is also the market of a pastoral and agricultural district. Brewing, malting, steam, saw and flour milling, coach building and the manufacture of boots and galvanized iron are its principal industries.

**Tamworth**, a market town and municipal borough of England, in the Lichfield parliamentary division of Staffordshire and the Tamworth division of Warwickshire, on the river Tame, a southern tributary of the Trent. Pop. (1901) 7271. It is 110 m. N.E. from London by the London and North-Western railway, and is also served by the west and north line of the Midland railway (Bristol-Birmingham-Derby). The castle, situated on a height above the Anker near its junction with the Tame, is chiefly of the Jacobean period, but is enclosed by massive ancient walls. Here was a residence of the Mercian kings, and, after being bestowed on the Marmions by William the Conqueror, the castle remained for many years an important fortress. Formerly the town was surrounded by a ditch called the King's Dyke, of which some trace remains. The church of St Editha, originally founded in the 8th century, was rebuilt, after being burned by the Danes, by Edgar, who made it collegiate, but the existing Decorated building, was erected after a fire in 1345. The free grammar school, refounded by Edward IV., was rebuilt in 1577, and again in 1667. The charities include Guy's almshouses, endowed in 1678 by Thomas Guy, founder of Guy's Hospital, London. On the common for moors, burgesses have rights of pasturage. Coal, fireclay and blue and red brick clay are dug at the Tealby drift; and there are also market gardens. In the town are a clothing factory, paper-mills, and manufactures of small wares. The town is governed by a mayor, 4 aldermen, and 12 councillors. Area, 285 acres.

Tamworth was incorporated by Elizabeth in 1560 by letters patent, which state that it is an "ancient mercate town," and suggest that the charters have been lost or burned. The governing charter in 1835 was that of Charles II., incorporating it under the title of the bailiffs and commonalty of the borough of Tamworth in the counties of Stafford and Warwick. The town council still kept up in 1792, to be held respectively on St George's day and the feast day of St Edward; another ancient fair, in honour of St Swithin, or perhaps originally of St Editha, is still held (July 26). Tamworth sent two members to parliament from 1562 to 1885, when its representation was merged in that of the county.

**Tana**, a river of British East Africa, which gives its name to the Tanaland province of that protectorate. It has a course, following the main windings only, of over 500 m. Its sources are along the watershed close to the eastern wall of the eastern rift-valley, and it enters the Indian Ocean in 2° 40' S., about 450 m. N.E. of the town of Tanga, where it joins the Great African river, the Tana, which receives the headwaters of the rivers from the Bamburi to the Pungo. Many of these streams flow direct to the coast, and their headwaters are fed by the mountains of the Pare range. The Tana runs over hills and through the moors of the Pare range, and its valley is intersected by numerous small streams, and is overhung by green vegetation. It is also a source of water-power for the railways of the central railway system. The river is navigable by small steamers near its mouth and by coaster vessels a few miles above. Its bed is sandy in places, and has a depth of 4 or 5 fathoms near its mouth, but the sea is shallow, and the river can be entered by the coasting steamers. Its banks are diversified with scenery, and its shores well wooded.
TANAQUIL—TANCRED

many others mostly belonging to the southern portion of the New World, now recognized by ornithologists as forming a distinct family Tanagraeidae of the Ocinus division of Passerine birds allied to the Fringillidae (see Finch); and distinguished from them chiefly by their feebler conformation and more exposed nostrils. They are confined to the New World, and are specially characteristic of the tropical forests of Central and South America.

The tanagers have been examined systematically by P. L. Sclater, and in the British Museum Catalogue (xi. pp. 49-307) he admits the existence of 375 species, which he arranges in 59 genera, forming six subfamilies, Procniatinae, Euphonini, Tanagrae, Lamproini, Phaeocichlina, Dicrurina, Melanocyllina, and Pachyramphina. There are only very unequal numbers of genera for, while the first of them consists of but a single species, Procnias tertia—the position of which may be for several reasons still open to doubt—the third includes more than 200. Nearly all are birds of small size, the largest barely exceeding a song-thrush. Most of them are remarkable for their gaudy colouring, and this is especially the case in those forming the genus called by Sclater, as by most other authors, Caecilia, to which the name of Tanagra of right seems to belong, while that which he names Tanagra should probably be known as Thraupis. The whole family is almost confined to the Neotropical region, and there are some 50 similar genera. In the United States, and two of them, P. rubra and P. aestiva, known as the scarlet tanager and the summer redbird, reach Canada and British America. Although a very intensive migration of the tanagers takes place annually, some numbers of the species reach even southern Mexico, and not a dozen appear in the northern part of that country. Of the genus Pyranga, which has the most northern range of all, three if not four species are commonly seen in the interior or other parts of the United States, and one of them, P. rubra and P. aestivalis, known as the scarlet tanager and the summer redbird, reach Canada and British America. Among the tanagers, there is a very special native of California, which by some authors is not recognized as a distinct species. The males of all these are clad in glowing red, P. rubra having, however, the wings and tail black. The remaining species, P. ludovician#, the males of which are mostly yellow and black, with the head only red, does not appear eastward of the Missouri plains, and has not so northerly a range. Another species, P. hepatica, has shown itself within the limits of the United States. In all these, the males are plainly attired, but generally possessed of the bright plumage, however bright may be their coloration, both sexes are nearly alike in plumage. Little has been recorded of the habits of the species which inhabit the United States, and those of the north have not been as closely observed as the rather retiring nature of the birds renders possible, and it is known that insects, especially in the larval condition, and berries afford the greater part of their food. They have a pleasing song, and build a shallow nest, in which the eggs, generally three in number, and of a greenish-blue marked with brown and purple, are laid. A few species are regularly or sparingly imported into Europe alive, and do well as cage birds.

TANAGRAEIDAE may perhaps be considered to hold the same relation to the Fringillidae as the Icteridae do to the Sturnidae and the Muscicapidae to the Sylviidae and Paridae, in each case the purely New-World family being the "teecker" family (A. N.)

TANACIL, the Etruscan name of the wife of Tarquiniius Priscus, or of one of his sons. After her immigration to Rome she is said to have received the name Gaia Caecilia. She was famous for her shrewdness and prophetic gifts, which enabled her to foretell the future greatness of her husband and of Servius Tullius. There was a statue of her as Gaia Caecilia in the temple of Sancus, which possessed magical powers. She was celebrated as a spinner of wool, and was supposed to exercise influence over Roman brides. Tanaquil and Gaia Caecilia are, however, really distinct personalities. The anecdotes told of Gaia Caecilia are aetiological myths intended to explain certain usages at Roman marriages.

See Livy, i. 34; 41; Pliny, Nat. Hist., viii. 74. xxxvi. 70; Schweigler, Römische Geschichte, bk. xv. 8.

TANAUAN, a town of the province of Batangas, Luzon, Philippine Islands, about 38 m. S.S.E. of Manila. Pop. (1903) 15,000. It is situated on the coast, and is a pleasant landing place. It formerly produced much sugar, but its inhabitants are now engaged chiefly in the cultivation of rice, Indian corn and fruit. Oranges and hogs are sent from Tanauan to the Manila market. The language is Tagalog.

TANCRED (d. 1112), nephew of Bohemund and a grandson of Robert Guiscard on the female side, was the son of a certain Marchius, in whom some have seen a marquis, and some an Arab (Makrati). He took the Cross with Bohemund in 1096, and marched with him to Constantinople. Here he refused to take an oath to Alexius, escaping across the Bosphorus in the disguise of a peasant; but after the capture of Nicaea he consented to follow the example of the other princes, and became the man of Alexius. At Heraclea, in the centre of Asia Minor, he left the main body of the Crusaders, and struck into Cilicia, closely followed by Baldwin of Lorraine. He may have been intending, in this expedition, to prepare a basis for Bohemund's eastern principality; in any case, he made himself master of Tarsus, and when he was evicted from it by the superior forces of Baldwin, he pushed further onwards, and took the towns of Adana and Mamistra. He joined the main army of Antioch, and took a great part in the siege. When, in the spring of 1098, two castles were erected by the crusaders, it was Tancred who undertook the defence of the more exposed castle, which lay by St. George's Gate, on the west of the city. In the beginning of 1099 he was serving in the ranks of Ray- mund's army, whether to observe his movements in the interests of Bohemund, or only (as is more probable) to be in the front of the fighting and the march to Jerusalem. But he soon left the count, like so many of the other pilgrims (see under Ray- mund); and he joined himself to Godfrey of Lorraine in the spring of 1099. After Bohemund's humiliating treaty at Durazzo in 1100 (his future rival) in the capture of Bethlehem; and he played his part in the siege of Jerusalem, gaining much booty when the city was captured, and falling into a passion because the security he had given to the fugitives on the roof of Solomon's temple was not observed by the crusaders. After the capture of Jerusalem he went to Napolis, and began to found a principality of his own. He took part in the battle of Ascalon in August; and after it he was invested by Godfrey with Tiberias and the principality of Galilee, to the north of Napolis. In 1100 he attempted, without success, to prevent Baldwin of Lorraine (his old enemy in Cilicia) from acquiring the throne of Jerusalem, possibly having ambitions himself; and in any case fearing the foundation of a strong non-Norman power in Palestine. Falling in this attempt, and being urgently summoned from the North to succeed Bohemund (now a prisoner with Danishmend) in the government of Antioch, he surrendered his smaller possessions to Baldwin, on condition that he should be restored if he returned in a year and three months, and finally left the kingdom of Jerusalem. He acted as regent in Antioch from 1100 to 1103, when Bohemund regained his liberty. During these years he twice marched in the Crusades, in 1101 and 1106, and in recapturing Laodicea (1103); he imprisoned Raymund of Toulouse, and only gave him his liberty on stringent conditions; and he caused the restoration of the deposed patriarch of Jerusalem, Dagobert, if only for a brief season, by refusing to aid Baldwin I, on any other terms. When Bohemund was set free, Tancred had to surrender Antioch to him; but he soon found fresh work for his busy hands. In 1104 he joined with Bohemund and Baldwin de Burg (now count of Edessa in succession to Baldwin of Lorraine) in an expedition against Harran, in which they were heavily defeated, and Baldwin was taken prisoner. Tancred, however, profited doubly by the defeat. He took over the government of Edessa in Baldwin's place; and in 1105 Bohemund surrendered to him the government of Antioch, while he himself went to Europe to seek reinforcements. Ruler of the two northern principalities, Tancred carried on vigorous hostilities against his Mahommedan neighbours, especially Ridwan of Aleppo; and in 1106 he succeeded in capturing Apamea. In 1107, while Bohemund was beginning his last expedition against Alexius, he wrested the whole of Cilicia from the Greeks; and he steadfastly refused, in June the same year, Baldwin's overtures to make a treaty with him, and refused to agree to any of its stipulations with regard to Antioch and Cilicia. To the hostility of the Mahommedans and the Greeks, Tancred also added that of his own fellow Latins. When Baldwin de Burg regained his liberty in 1108, it was with only difficulty that he was induced to restore Edessa to him, and the two continued unfriendly for some time; while in 1109 he also interfered in the civil war in Tripoli between the nephew and the eldest son of Raymund of Toulouse. But it was against the emirs of Northern Syria that his arms were chiefly directed;
and he became the hammer of the Turks, relentlessly attacking the emirs on every side, but especially in Aleppo, and exacting tribute from them all. He died in 1172, leaving the government to his brother-in-law, Roger de Principapu, until such time as Bohemund II should come to his inheritance.

**Bibliography.**—Tancred's *Gesta* were recorded by Ralph of Caen, who drew his information from Tancred's own conversations (see *Gesta Francorum ... Sive Gesta Benedicti Principis* (Freiburg, 1852)); and Tancred's career is also described by Rey, in the *Revue de l'orient latin*, iv. 334-340. (E. Br.)

**TANCRED** (d. 1194), King of Sicily, an illegitimate son of Roger, the eldest son of King Roger II., was crowned in January 1190 in succession to William II. (q.v.). He was supported by the chancellor Matthew d'Ajello and the official class, while the rival claims of Roger II.'s daughter Constance and her husband, Henry VI., king of the Romans and emperor, were supported by most of the nobles. Tancred was a good soldier, though his tiny stature earns from Peter of Eboli the nick-name "Tancredulus." But he was ill-supported in his task of maintaining the Norman kingdom, faced with heresy, heresy, and threatened by a baronial revolt, and, in addition, Richard Coeur-de-Lion, at Messina, 1190, threatened him with war. Henry, skilfully winning over Pisa, Genoa and the Roman Commune, isolated Tancred and intimidated Celestine III., who, on the 14th of April 1191, crowned him emperor at Rome. He, however, failed to capture Naples in August and retired north, leaving garrisons along the frontiers of the Regno. Tancred now sought to win over the towns by extensive grants of privileges, and at Gravina (June 1192) was recognized by the pope, whose interest in his success he gained by surrendering the royal legateship over Sicily. In 1192 and 1193 he commanded personally and with success against the Apulian barons, but his death at Palermo (20th of February 1194) a few days after that of Roger, his son and joint-king, made Henry's path clear. His wife Sibilla indeed maintained a regency for her second son William III., but on Henry's final descent, Naples surrendered almost without a blow in May 1194, and the rest of the Regno followed. Sibilla and the loyal Margarito prepared to defend Palermo, but the citizens admitted the emperor on the 20th of November 1194. Tancred's family fell into Henry's hands, and William III. seems to have died in Germany in 1198.

**TANDY, JAMES NAPPER** (1740-1803), Irish rebel, son of a Dublin ironmonger, was born in Dublin in 1740. He started life as a small tradesman; but turning to politics, he became a member of the corporation of Dublin, and made himself popular by his denunciation of municipal corruption and by his proposal of a boycott of English goods in Ireland, in retaliation for the restrictions imposed by the government on Irish commerce. In April 1780 Tandy was expelled from the Dublin volunteers (see *P flood, Henry*) for proposing the expulsion of the duke of Leinster, whose moderation he had offended the extremists. He was one of the most conspicuous of the small revolutionary party, chiefly of the shopkeeper class, who formed a permanent committee in June 1784 to agitate for reform, and called a convention of delegates from all parts of Ireland, which met in October 1784. Tandy persuaded the corporation of Dublin to condemn by resolution Pitt's amended commercial resolutions in 1785. He became a member of the Whig club founded by Grattan; and he actively co-operated with Theobald Wolfe Tone in founding the Society of the United Irishmen in 1791, of which he became the first secretary. The violence of his opinions in this capacity, and the capacity itself, which brought him into the revolution later, was partly due to his personal ugliness, provoked him into sending a challenge; this was treated by the House of Commons as a breach of privilege, and a Speaker's warrant was issued for his arrest, which however hallowed to elude till its validity expired on the prorogation of parliament. Tandy then took proceedings against the lord lieutenant for issuing a proclamation for his arrest; and although the action failed, it increased Tandy's popularity, and his expenses were paid by the Society of the United Irishmen. Sympathy with the French Revolution was at this time rapidly spreading in Ireland. A meeting of some 6,000 persons in Belfast voted a congratulatory address to the French nation in July 1791. In the following year Napper Tandy took a leading part in organizing a new military association in Ireland modelled after the French National Guards; they professed republican principles, and on their uniform the cap of liberty instead of the red cap of St. George was sewn. The revolts which happened in the south, with the purpose of bringing about a fusion between the Defenders and the United Irishmen, took the oath of the Defenders, a Roman Catholic society whose agrarian and political violence had been increasing for several years; but being threatened with prosecution for this step, and also for libel, he fled to America, where he remained till 1798. In February 1798 he went to Paris, where at this time a number of Irish refugees, the most prominent of whom was Wolfe Tone, were assembled, planning rebellion in Ireland to be supported by a French invasion, and quarrelling among themselves. None of these was more quarrelsome than Napper Tandy, who was exceedingly affected by it, and had totally drunk; his vanity was wounded to find himself of less account than Tone in the councils of the conspirators. Wolfe Tone, who a few months before had patronizingly described him to Talleyrand as "a respectable old man whose patriotism has been known for thirty years," was now disgusted by the lying braggadocio with which Tandy persuaded the French authorities that he was a personage of great wealth and influence in Ireland, at whose appearance 30,000 men would rise in arms. Tandy was not, however, lacking in courage. He accepted the charge of a petit comité, the "Anacreon," placed at his disposal by the French government, in which accompanied by a few leading United Irishmen, and supplied with a small force of men and a considerable quantity of arms and ammunition for distribution in Ireland, he sailed from Dunkirk and arrived at the isle of Arran, off the coast of Donegal, on the 16th of September 1798. The populace showed no disposition to welcome the invaders. Napper Tandy, who was drunk during most of the expedition, took possession of the village of Rutland, where he hoisted an Irish flag and issued a bombastic proclamation, but learning the complete failure of Humbert's expedition, and that Cornwallis, instead of being in open rebellion was perfectly quiet, the futility of the enterprise was apparent to the French if not to Tandy himself; and the latter having been carried on board the "Anacreon" in a state of intoxication, the vessel sailed round the north of Scotland to avoid the English fleet, and reached Bergen in safety, whence Tandy made his way to Hamburg with three or four companions. In compliance with a peremptory demand from the English government, and in spite of a counter-threat from the French Directory, the refugees were surrendered. Tandy remained in prison till April 1801, when he was tried, pleaded guilty, and was sentenced to death; he was, however, reprieved and allowed to go to France. This leniency may have been partly due to doubts as to the legality of the demand for his surrender by the Hamburg authorities; but the government was probably more influenced by Cornwallis's opinion that Tandy was "a fellow of so very contemptible a character that no person in this country (Ireland) seems to care the smallest degree about him." Moreover, Bonaparte vigorously intervened on his behalf, and is even said to have made Tandy's release a condition of signing the treaty of Amiens. Notwithstanding his vices and his lack of all solid capacity, there is no reason to suppose that Napper Tandy was dishonest or insincere; and the manner in which his name was introduced in the well-known ballad, "The Wearing of the Green," proves that he succeeded in impressing the popular imagination of the rebel party in Ireland. In France, where his release was regarded as a French diplomatic victory, he was received, in March 1802, as a person of distinction; and when he died on the 24th of August 1803 his funeral was attended by the military and an immense number of the civil population.

TANEGA-SHIMA—TANGANIKA


TANEGA-SHIMA, an island lying to the south of Kiusiu Island, Japan, in 29° 54' N. and 136° E., 369 m. long and 74 m. broad at its widest part. It is a long low stretch of land, carefully cultivated, and celebrated as the place where Mendez Pinto landed when he found his way to Japan in 1543. Until modern times firearms were colloquially known in Japan as "Tanega-shima," in allusion to the fact that they were introduced by Pinto.

TANEY, ROGER BROOKE (1777–1864), American jurist, was born in Calvert county, Maryland, on the 17th of March 1777, of Roman Catholic parentage. He graduated from Dickinson College, Carlisle, Pennsylvania, in 1795, began the study of law at Annapolis in 1796, and was admitted to the bar in 1799. In 1806 he married Anne Phoebe Key, sister of Francis Scott Key. He entered politics as a Federalist, and was a member of the Maryland House of Delegates in 1799–80. His faith in Federalism was weakened by the party's opposition to the War of 1812, and he gradually became associated with the Jacksonian wing of the Republican party. He served in the state Senate in 1816–21, was attorney-general of Maryland in 1827–31, and in July 1831 entered President Jackson's cabinet as attorney-general of the United States. He was the President's chief adviser in the contested election of 1836, and when the Chief Justice's seat became vacant in 1837, he was appointed to the court in the Ireland case. He died of a stroke in 1864. His son, Roger Taney Jr., was a United States Supreme Court justice.

TANZI, TANGA ("the salt"), a seaport of German East Africa, lying opposite the island of Pemba in 5° 6' S., 39° 7' E. The town is regularly laid out on elevated ground on the southern shore of Tanga Bay, and has a population of about 6,000. The large public buildings are the administrator's residence, the hospital, the boma (barracks), Protestant and Catholic churches, and the government and mission schools. Tanga is the port of the Usambara district, where are many thriving plantations. The harbour is entered by a broad channel five to eight fathoms deep. It is a port of call for the German mail steamers, and the starting-point of a railway to the Usambara highlands.

TANGANYIKA (mainly by V. E. Cameron to signify a "mixing-place"), a vast lake in East-Central Africa, the longest freshwater lake in the world, measuring just over 400 m., with a general breadth varying from 30 to 45 m., and an area of about 12,700 sq. m. It lies at an altitude of about 2,600 ft. above the sea, and occupies the southern end of the great central rift-valley, which terminates suddenly at its southern point, the line of depression being represented farther south by the more easterly trough of Lakes Nyasa and Rukwa, from which Tanganyika is separated by the Fipa plateau, composed of old granitic rocks, though even here traces of old valley-walls are said by Dr Kohlschützer to exist. North of Tanganyika the valley is suddenly interrupted by a line of ancient eruptive ridges, which dam back the waters of Lake Kivu (q.v.), but have been recently cut through by the outlet of that lake, the Rusizi, which enters Tanganyika by several mouths at its northern end. The flat plain traversed by the lower Rusizi was evidently once a portion of the lake floor. Tanganyika has been formed by the subsidence of a long narrow tract of country relatively to the surrounding plateaus, which fall to the lake in abrupt cliffs, some thousands of feet high in places. The geological formations that have been exposed at the places of the two great new outlets are the more recent material, overlaid by enormous deposits of reddish sandstones, conglomerates and quartzites, exposed in parts to a depth of 2,000 ft. Besides the plain to the north, a considerable area to the west, near the Lukuga outlet (see below), shows signs of having been once covered by the lake, and it is the opinion of Mr J. E. S. Moore that the sandstone ridges which here bound the trough have been recently elevated, and have been cut through by the Lukuga during the process. The past history of the lake has long been a disputed question, and Mr Moore's view that it represents an old Jurassic arm of the sea, of any remains of Jurassic faunas which still exist in the Tanganyika forms with those of undoubted Jurassic age in neighbouring regions. The formation of the existing rift-valley seems in any case to date from Tertiary times only.

Although drinkable, the water of the lake seems at times at least to be very slightly brackish, and it was supposed by some that no outlet existed until, in 1874, Lieutenant Cameron showed that the surplus water was discharged towards the upper Congo by the Lukuga. The second, about 100 m. below the first outlet, was further examined in 1876 by Mr (afterwards Sir Henry) Stanley, who found that a bar had formed across the outlet, and it has since been proved that the outflow is intermittent, ceasing almost entirely after a period of scanty rainfall, and becoming again established when the lake-level has been raised by a series of rainy years. About 1850 it was running strongly, but about this time a gradual fall in the lake-level set in, and was continued, with occasional pauses, for some twenty years, the amount being estimated by Wissmann at 2 feet annually. In 1896 Captain H. Ramsay found that a wide level plain, which had before been considered as water, was at times blocked by a bar about 2 m. below the first level of water was found flowing down by Mr Moore in 1899; while in 1901 Mr Codrington found the level 4 or 5 feet higher than in 1900, the outlet having again silted up. A continued rise was also reported in 1907. In any case, the alternations in level appear...
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to be merely periodic, and due to fluctuations in rainfall, and do not
point, as some have supposed, to a secular drying up of the lake.

The lake is fed by a number of rivers and small streams which
descend from the uplands surrounding it. The Mloggera (or
Malagarasi), perhaps the largest feeder, derives most of its water
from the rainy districts east of the strip of high ground which
separates the lake from the main stream of the Usambaras. This
has a nearly circular course, rising in 4° 40'S., only some 10 miles
from the lake shore and less than 40 miles from its mouth, though
its length is at least 220 miles. The other branches of the
Malagarasi, which traverse the somewhat arid granite plateau
between the lake and 33° E., bring comparatively little water to
the main stream. In its lower course the river is a rapid stream
flowing between steep jungle-clad hills, with one fall narrowing
and converting the river into several channels. Various channels of its
delta are also obstructed with sand-banks in the dry season. The
Rusizi, the next (or perhaps equal) in importance among the
tributaries of the lake, has its source in the vicinity of the
principal tribe of the Karanga, and is at all events navigable.

The remaining feeders are of distinctly less importance, the
Lofu, which enters the south-west, being probably the largest.

Tanganyika Lake is almost wholly of fresh water and its
secondary lakes, all of which are connected with the main body
of water, are also fresh. The surrounding highlands are
covered with forest of various kinds. The lakeshore and
coastline are all free from sand. No salt glands are to be found
in the lake. The shores of the lake are of various kinds.

The shores of the lake are of various kinds. There are flat
bamboos, or meadows, inhabited by elephants and zebras. The
shores are also planted with various species of fruit, such as
mangoes, bananas, and sugar-plants, which are grown as
exotics. The lake is also the breeding ground for many species
of fish, of which the tilapia is the most abundant. The
shores are inhabited by the Bantu, who have a number of
villages along the lake. The Bantu are of the same language,
but differ in various respects. The Bantu speak a language
which is the same as that of the Swahili, and are

TANGIER, a town of Germany, in the Prussian province of Saxony, on the Elbe, 43 m. E. of Magdeburg, by rail via Stendal. Pop. (1905) 12,829. It contains iron
foundries, shipbuilding yards, refineries, and other industrial
establishments, and enjoys a considerable river trade in grain
and coal. It is ornamented by numerous brick buildings of the
14th and 15th centuries, including the turreted walls of the
church of St Stephen (1376), and the late Gothic town hall.
The castle, built in the 14th century, was the chief residence of the
margraves of Brandenburg.

See Grote, Geschichte der Burg Tangermünde (Stendal, 1871).

TANGIER (locally Tanjam), a seaport of Morocco, on the
Straits of Gibraltar, about 14 m. E. of Cape Spartel, nestles
between two eminences at the N.W. extremity of a spacious bay.
The town, which has a population of about 40,000, presents a
picturesque appearance from the sea, rising gradually in the
form of an amphitheatre, with the citadel, the remainder of the
English mole and York Castle to the right: in the central valley
is the commercial quarter, while to the left along the beach runs
the track to Tetuan. Though rivalry between European Powers
led to many public works being delayed, through the action of
the public Sanitary Association the streets, which are narrow
and crooked, have been re-paved as well as cleaned and
partially lighted, and several new roads have been made outside
the town. In some of the older streets European shops have
replaced the picturesque native cupboards; drinking dens have
sprung up at many of the corners, while telephones and electric
light have been introduced by private companies, and European
machinery is used in many of the corn-mills, &c. The main
thoroughfare leads from Báb el Marsa (Gate of the Port) to
the Báb el Sok (Gate of the Market-place) known to the English
as Port Catherine. The sok presents a lively spectacle, especial-
ly upon Thursdays and Sundays.

Tanger is almost destitute of manufactures, and while the
trade, about 75,000 a year, is considerable for Morocco, it is
confined chiefly to imports, about two-fifths of which come from
Great Britain and Gibraltar, and one-quarter from France.

The harbour formed by the Bay of Tangier is an extensive one,
the best Morocco possesses, and good in all weathers except
during a strong east wind, but vessels of any size have to anchor
a mile or so out as the shore to the west is shallow and sandy,
and to the east, rocky and shingly. Since 1903 a basin with an
outer and inner mole has been built. It does not, however,

Cameron Bay: Belgian: Mtowa or Albertville in 6° S. Mission-
aries, especially the Catholic "White Fathers," are also
active on its shores. A small steamer, the "Good News," was
placed on the lake by the London Missionary Society in 1884,
but afterwards became the property of the African Lakes Cor-
nporation; a larger steamer, the "Hedwig von Wissmann," carrying
a quick-firing Krupp gun, was launched in 1900 by a German
expedition under Lieutenant Schloffer; and others are owned by
the Tanganyika Northern and Katanga companies.

The greater part of the trade with Tangier is carried on by the
African Lakes Corporation by the Shiré-Nyasa route, but the
Germans have opened up overland routes from Dar-es-Salaam.

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accommodate large vessels. The climate is temperate and healthy, and good for consumptives.

As the seaport nearest to Europe, Tanjore is the town in the empire in which the effects of progress are most marked, and since the end of the 18th century it has been the diplomatic headquarters. The nucleus of a cosmopolitan society thus formed has expanded into a powerful community enjoying privileges and immunities unknown to natives not receiving its protection. The steadily increasing number of visitors has induced the opening of first-class hotels, and necessitated extensive building operations, resulting in the immigration of some thousands of artisans, chiefly Spanish. The number of European inhabitants (1905) was about 9000 (7500 Spaniards); of Jews about 10,000.

The Roman Tingis, which stood in the immediate vicinity of the site of Tanjore, was of great antiquity; under Augustus it became a free city, and when Otho placed the western half of Mauretania under a procurator, he called it Mauretania Tingitana after its capital Tingis. It was held by Vandals, Byzantines and Arabs, and when Mulai Idris passed from Tlemcén to Fez in 788, Tingis was "the oldest and most beautiful city" of the Maghrib. After many futile attempts the Portuguese obtained possession of it in 1471, but it passed to Spain in 1580, returning again to the Portuguese in 1656. In 1662 as part of the dowry of Catherine of Braganza on her marriage to Charles II., it came into the possession of the English, and they defended it against Mulai Imsal in 1686, but in 1684 it was decided, on account of expense, to abandon the place to the Moors. El Utrani wrote that "it was besieged so closely that the Christians had to flee on their ships and escape by sea, leaving the place ruined from bottom to top." It was reoccupied in 1684 by the French, then at war with Morocco. In the early years of the 20th century the shafir Raisulî terrorized the district round Tanjier and made captive several Europeans. As one result of the Algerian conference of 1906 a regular police force was organized, and the control of the customs passed into European hands (see Morocco: § History).

See A. Cousin, Tanger (Paris, 1902); Archives Marocaines (Paris, 1904-5).

TANGYE-SIR RICHARD (1832-1906), British manufacturer, was born at Illogan, near Redruth, Cornwall, on the 24th of November 1832, the son of a small farmer. As a young boy he worked in the fields, but when he was eight years old he was incapacitated from further manual labour by a fracture of the right arm. His father then determined to give him the best education he could afford, and young Tangye was sent to the Friends' School at Sidcot, Somersetshire, where he progressed rapidly and became a pupil-teacher. Tangye was not long contented with this position, and through an advertisement in The Friend obtained a clerkship in a small engineering firm in Birmingham, where two of his brothers, skilled mechanics, subsequently joined him. Here Richard Tangye remained four years, obtaining a complete mastery of the details of an engineer's business, and introducing the system of a Saturday half-holiday which was subsequently adopted in all English industrial works. In 1856 he started business in a small way in Birmingham as a hardware factor and commission agent. His first customers were the Cornish mine-owners in the Redruth district, and the business prospering, he was able before long to start manufacturing hardware goods on his own account, his two brothers joining him in the enterprise. The rivalry of the brothers Tangye was the manufacture of machinery, and their hydraulic lifting jacks were successfully employed in the launching of the steamship "Great Eastern." In 1858 the firm, who now confined themselves to making machinery, built their own works, and shortly afterwards secured the sole right of manufacturing the newly invented differential pulley-block, thereby materially adding to their business, which came to include every kind of power-machine—hydraulic, steam, gas, oil and electricity. The business was subsequently turned into a limited company, and in 1894 Richard Tangye was knighted. He died on the 14th of October 1906.

TANISTRY (from Gaelic tan, lordship), a custom among various Celtic tribes, by which the king or chief of the clan was chosen from among the heads of the sept and elected by them in full assembly. He held office for life and was required by custom to be of full age, in possession of all his faculties and without any remarkable blemish of mind or body. At the same time, and subject to the same conditions, a tanist or next heir to the chiefship was elected, who if the king died or became disqualified, at once became king. Usually the king's son became tanist, but not because the system of primogeniture was in any way recognized; indeed, the only principle adopted was that the dignity of chiefship should descend to the eldest and most worthy of the same blood. These epithets, as Hallam says, were not necessarily synonymous, but merely indicated that the preference given to seniority was to be controlled by a due regard to desert (Constit. Hist., vol. iii. c. xviii.). This system of succession left the headship open to the ambitious, and was a frequent source of strife both in families and between the clans. Tanistry was abolished by a legal decision in the reign of James I. and the English land system substituted.

TANJORE, a city and district of British India in the Madras presidency. The city is situated on the right bank of the river Cauvery, and is an important junction on the South Indian railway, 216 m. S. of Madras. Pop. (1901) 57,870. As the last capital of the ancient Hindu dynasty of the Cholas, and in all ages one of the chief political, literary and religious centres of the south, the city is full of interesting associations. It was the scene of the earliest labours of Protestant missionaries in India. The modern history of Tanjore begins with its conquest by the Maharrattas in 1674 under Venkaji, the brother of Sivaji the Great. The British first came into contact with Tanjore by their expedition in 1749 with a view to the restoration of a deposed raja. In this they failed, and a subsequent expedition was bought off. The Maharrattas practically held Tanjore until 1799. In October of that year the district was ceded to the East India Company in absolute sovereignty by Raja Sharakhoji, pupil of the missionary Schwartz. The raja retained only the capital and a small tract of country round. He died in 1833 and was succeeded by his son Sivaji, on whose death in 1855 without an heir the house became extinct. The mission at Tanjore was founded in 1778 by the Rev. Christian F. Schwarz or Schwartz (1726-1768). The mission establishments were taken over in 1826 by the Society for the Propagation of the Gospel, which subsequently founded new stations in several parts of the district. Roman Catholic missions date from the first half of the 17th century. St Peter's College, founded by a German schoolmaster, is now a first-class college affiliated to the university of Madras. His church dates from 1779. Among interesting ancient buildings may be mentioned the palace within the fort, containing an armoury and fine library; and the Brihadiswaraswami temple, of the 11th century, enclosed in two courts, surmounted by a lofty tower and including the exquisitely decorated shrine of Subrahmanya. Though the city has specialties of jewelry, carpets, modelling in pith, &c., there are no large industries.

The District of Tanjore has an area of 3710 sq. m. On account of its fertility it has been called the "Garden of Southern India." It is irrigated by a elaborate system of dams, cuts and canals in connexion with the rivers Cauvery and Coleroon, and the soil is exceedingly productive. The delta of the Cauvery occupies the flat northern part, which is highly cultivated, dotted over with groves of coco-nut trees, and is one of the most densely populated tracts in India. The staple crop is rice, which is grown on 77 per cent. of the cultivated area. Tanjore is a land of temples, many of them being of very early date. The district is traversed by the main line and several branches of the South Indian railway, some of which have been constructed by the district board. The chief seaport is Nagapattom, and the principal export is rice to Ceylon. The population in 1901 was 2,245,929.

See Tanjore District Gazetteer (Madras, 1906).
TANKARD, a type of drinking vessel. The word was formerly used loosely of many sizes, usually large, of vessels for holding liquids; thus it was applied to such as held two or more gallons and were used to carry water from the conduits in London in the 16th and early 17th centuries. The word is now generally applied to a straight, flat-bottomed drinking vessel of silver, pewter or other metal, or of glass or pottery mounted on metal, with a hinged cover and handle, holding from a pint to a quart of liquor (see DRINKING VESSELS). The derivation is obscure. It appears in O. Fr. as tampair and in O. Du. as tankaart. It may have been, as is suggested, metamorphosed from Gr. κάβαρος, Lat. cantharus, a large vessel or pot. It is used to gloss amphora in the Prompatorium Parvulorum (c. 1440). It is not connected with "tank," a cistern or reservoir for water, which was formerly "stank," and is from Port. tânque, mod. âng, pool; Lat. stagnum, whence Eng. "stagnant."

TANNA (Aramaic, "teacher"). The root tini or tana corresponds philologically to the Hebrew shana, from which comes the word Mishnah (see MIDRASH AND TALMUD), the great Rabbinic code which (with certain parts of the Mishra and other Rabbinic books) was the main literary product of the activity of the tannaim (plural of tanna). The term tanna is used in the Talmud of those teachers who flourished in the first two centuries of the Christian era. The tannaim from the date of the destruction of the Temple may be grouped: (1) 70–100, representative name Johanan ben Zakkai (q.v.); (2) 100–150, representative name Aqiba (q.v.); (3) 150–160, representative name Judah the Prince, compiler of the Mishnah. The successors of the tannaim were called "amoraim" (see AMORA).

See W. Bacher, Die Agoda der Tannaiten. An alphabetical list of tannaim and "amoraim" is given in the Jewish Encyclopedia, xii. 49–54.

TANNAHILL, ROBERT (1714–1810). Scottish song-writer, son of a Paisley silk-weaver, was born on the 3rd of June 1714. He was apprenticed to his father's trade at the age of twelve, and, inspired by the poetry of Robert Burns, he wrote verses as he drove the shuttle to and fro, with shelf and ink-bottle rigged up on his loom-post. He was shy and reserved, of small and delicate physique, and took little part in the social life of the town. The steady routine of his trade was broken only by occasional excursions to Glasgow and the land of Burns, and a year's trial of work at Bolton. He began in 1803 to contribute verses to Glasgow and Paisley periodicals, and published an edition of his poems by subscription in 1807. Three years later, in 1810, the life of the country poet is lost. His only son and despondent poet was brought by his own act to a tragic end. Tannahill's claims to remembrance rest upon half a dozen songs, full of an exquisite feeling for nature, and so happily set to music that they have retained their popularity. "Loudon's Bonnie Woods and Braes," "Jessie, the Flower o' Dunblane," and "Gloomy Winter's Noo Awa," are the best of them. "Jessie, the Flower o' Dunblane" and "The Farewell" tell the story of the poet's own unhappy love for Janet Tennant.

Tannahill's centenary was celebrated at Paisley in 1874. See edition by D. Semple (1876) for details of his life.

TANNER, HENRY OSSAWA (1859– ), American artist, of negro descent, was born at Pittsburg, Pennsylvania, on the 21st of June 1859. He was the son of Benjamin Tucker Tanner (b. 1825), who became bishop of the African Methodist Episcopal Church in 1888, edited the Christian Recorder, the organ of his church, from 1867 to 1883, founded, and from 1884 to 1888 edited, the African Methodist Episcopal Church Review, and published several pamphlets, poems and hymns, and an A pology for African Methodism (1867). The son was a pupil of Thomas Eakins, in Philadelphia, and of J. P. Laurens and Benjamin Constant in Paris. He first exhibited at the Salon in 1895. His "Daniel in the Lions' Den" received an honourable mention at the Salon of 1896. "The Raising of Lazarus," which received a third-class medal in 1897, was purchased by the French government for the permanent collection of the Luxembourg. Other pictures are, "The Annunciation" (Salon, 1898), "Nicodemus Coming to Christ" (1899), "The Jews' Walling Place," and "Christ in the Temple."

TANNER, THOMAS (1674–1735). English antiquary and prelate, was born at Market Lavington in Wiltshire on the 25th of January 1674, and was educated at Queen's College, Oxford, taking holy orders in 1694. Next year he became chaplain and then fellow of All Souls College, and a few years later private chaplain to John Moore (1666–1714), bishop of Norwich and afterwards of Ely, who appointed him chancellor of the diocese of Norwich. In 1706 he became rector of Thorpe near Norwich, in 1713 a canon of Ely, in 1724 a canon of Christ Church, Oxford, and in 1732 bishop of St Asaph. He died in Oxford, where he had passed most of his life, on the 14th of December 1735. Tanner's chief work is his Notitia Monastica, a short account of all the religious houses in England and Wales. This was published at Oxford in 1665; it was reprinted with additions by the author's brother, John Tanner, in 1744; and was reprinted again with further additions by James Nasmith (1740–1808) in 1787. He also wrote Bibliotheca Britannico-Hibernica, a dictionary of all the authors who flourished in England, Scotland and Ireland before the opening of the 17th century, at which he laboured for forty years. This was not published until 1748, thirteen years after the author's death. The bishop collected materials for a history of Wiltshire and worked for some time on a new edition of the Life of John Wiltshire and valuable collection of books and manuscripts is in the Bodleian library at Oxford.

Another writer of this name was THOMAS TANNER (1630–1682), the author of The Entrance of Massarini (Oxford, 1657–58). Educated at St Paul's School, London, and at Pembroke Hall, Cambridge, he became a barrister and later a clergyman, being vicar of Colyton, Devon, and afterwards of Winchfield, Hants.

TANNHÄUSER, or TANNHEUSER, German Minnesinger of the 13th century, who lived for a time at the court of Frederick II., duke of Austria. After Duke Frederick's death he was received at the court of Otto II., duke of Bavaria; but, being of a restless disposition, he soon left, and has been described as in wandering about Germany. He also went as a Crusader to the Holy Land. His poems belong to the decadence of the Minnesang, and combine a didactic display of learning with descriptions of peasant-life in a somewhat coarse tone. His adventurous life led him to be identified, in the popular imagination, with the knight Tannhäuser who, after many wanderings, comes to the Venusberg, or Hörselberg, near Eisenach. He enters the cave where the Lady Venus—the Fräu Hulda of German folk-lore—holds her court, and abandons himself to a life of senseless enjoyment. But he has been promised by Venus, and by the aid of the Virgin Mary, souls in Purgatory, that he may return for a while to the outer world. He then goes as a pilgrim to Rome, and entreats Pope Urban to secure for him the forgiveness of his sins. The pope declares it is impossible for him to be pardoned as for the staff he has in his hand to blossom. Tannhäuser departs in despair, and returns to the Venusberg. In three days the staff begins to put forth green leaves, and the pope sends messengers in all directions in search of the penitent, but he is never seen again. This legend was at one time widely known in Germany, and as late as 1830 it survived in a popular song at Eutelsburg in Switzerland, a version of which was given by Uhland in his Alto hoch- und niederdeutsche Volkslieder. Among the attendant of Hulda was the faithful Eckhart, and in the preface to the Heldenbuch he is said to sit before the Venusberg, and to warn passers-by of the dangers to which they may be exposed if they linger in the neighbourhood. The legend has been reproduced by several modern German poets, and by R. Wagner in an opera.

For Tannhäuser's lyric poetry, see F. H. von der Hagen's Minnesinger, ii. (1838); K. Bartsch, Deutsche Liederdichter des 12. bis 14. Jahrhunderts (3rd ed. 1893). For Tannhäuser's life and work see the Tannhäusereage and der Minnesinger Tannhäuser (1858); J. G. T. Gräwe, Die Sage von Tannhäuser (1846; 2nd ed. 1861); A. Ohlke Zu Tannhäusers Leben und Dichten (1890); J. Siebert, Tannhäuser in Form seiner Lied (1894).

TANNIN, or TANNIC ACID, the generic name for a widely disseminated group of vegetable products, so named from their property of coagulating raw hide into leather (q.v.). They
are soluble in water, their solutions having an acid reaction and an astringent taste; the solutions are coloured dark blue or green by ferrous salts, a property utilized in the manufacture of ink (q.v.). Their chemistry is little known. Some appear to be glucosides of gallic acid, since they yield this acid and a sugar on hydrolysis, e.g. oak tannin; whilst others yield protocatechuic acid and phloroglucin, e.g. moringa-tannin; common tannin, however, is a digallic acid.

Common tannin, or tannic acid, \( C_{7}H_{4}O_{6} \cdot 2H_{2}O \) occurs to the extent of 50% in gall-nuts, and also in tea, sumach and in other plants. It is a white, powdery substance, mixed with a mixture of ether and alcohol, whereupon the tannin is taken up in the lower layer, which on separation and evaporation yields the acid. When pure the acid forms a colourless, amorphous mass, which, when heated in air, or in an atmosphere practically free from air, forms a black mass. Common salt precipitates it from aqueous solutions. It forms a pentacetae. It may be obtained artificialy by heating gallic acid with phosphorus oxychloride or dilute arsenic acid (C. P. Biggeln, *Casets*, 1909, 39, II, pp. 268 et seq.) and conversely on boiling with dilute acids or alkalies it takes up a molecule of water and yields two molecules of gallic acid, \( C_{7}H_{4}O_{6} \). It is optically active—a fact that was of the utmost importance to the chemistry of tannin (Ber., 1906, 39, p. 2497). The chemistry has also been investigated by M. Nierenstein and L. F. Iljin (see papers in the *Ber.*, 1908, et seq.).

Tannin of oak, \( C_{7}H_{4}O_{6} \) which is found, mixed with gallic acid, ellagic acid and quercite, in oak bark, is a red powder; its aqueous solution is coloured dark blue by ferric chloride and boiling with dilute hydrochloric acid yields protocatechuic acid and tannic acid or coffee, \( C_{7}H_{4}O_{6} \), found in coffee beans, is not precipitated from its solutions by gelatin. Hydrolysis by alkaline solutions gives a sugar and caffeic acid; whilst fusion with phosphorus trioxide in vacuum yields protocatechuic and moringa-tannin or maclurin, \( C_{7}H_{4}O_{6} \cdot H_{2}O \), found in *Morus sinctoria*, hydrolyses on fusion with caustic potash to phloroglucin and protocatechuic acid. Catechu-tannin occurs in the extract of *Mimus catechu*; and kino-tannin is the chief ingredient of *kino* (q.v.).

Medicine.—Tannic acid is official in both the British and United States Pharmacopoeias. It is incompatible with mineral acids, alkalis and certain drugs, and is not readily soluble in alkali, alkaloids and gelatin. The British pharmacopoeial preparations are (1) *glycerinum acidis tannici;* (2) *suppositoria acidis tannici;* (3) *trociscus acidii tannici.* The United States also has a *collosum stypticum* and an *ointment.* From tannic acid is also made *gall* acid, which resembles tannic acid but has no astringent taste. When applied to broken skin or exposed surfaces it coagulates the albumen in the discharges, forming a protecting layer or coat. It is moreover and astringent to the tissues, hindering the further discharge of fluid. It is a powerful local haemostatic, but it only checks haemorrhage when brought directly in contact with the bleeding point. Tannic acid is also used as a haemostatic in a fine spray, or taken internally it will check gastric haemorrhage. In large doses, however, it greatly disorders the digestion. In the intestine tannic acid controls intestinal bleeding, acting as a powerful haemostatic drug in constipation; for this reason it has been recommended to check diarrhoea.

Tannic acid is largely used in the treatment of various ulcers, sores and moist eruptions. The glycerin is used in tonsillitis and the lozenges in pharyngitis. For bleeding haemorrhoids tannic acid suppositories or tannic acid can beusted on directly. The colloidium stypticum is a valuable external remedy. Tannic acid is absorbed as gallic acid into the blood and eliminated as gallic and pyrogallic acids, darkening the urine. Gallic acid does not coagulate albumen when used externally. It has been used internally in haemoptysis and haematuria. Combined with opium it is an efficient remedy in *diabetes insipidus*.

TANN-RATHSAMHAUSEN, LUDWIG SAMSON ARTHUR, FREIHERR VON UND ZU DER (1815-1881), Bavarian General, was born at Darmstadt on the 18th of June 1815, the day of Waterloo. He was descended from the old family of von der Tann, which had representatives in Bavaria, Alsace and the Rhineland. Of the Bavarian line he was the daughter of an Alsatian, Freiherr von Rathsohausein) in 1868 by licence of the king of Bavaria. Ludwig, the first king of Bavaria, stood sponsor for the child, who received his name and in addition that of Arthur, in honour of the duke of Wellington. He received a careful education, and in 1827 became a page at the Bavarian court, where a great future was predicted for him. Entering the artillery in 1833, he was sent after some years place on the general staff. He attended the manoeuvres of the Austrian army in Italy under Radetzky (q.v.) and, in the spirit of adventure, joined a French military expedition operating in Algiers against the Tunisian frontier. On his return he became a close personal friend of the Crown Prince Maximilian Joseph (afterwards King Maximilian). In 1848 he was made a major, and in that year he distinguished himself greatly as the leader of a Schleswig-Holstein light corps in the Danish war. At the close of the first campaign he was given the order of the Red Eagle by the king of Prussia, and his own sovereign gave him the military order of Max-Joseph without asking for it, and also made him a lieutenant-colonel. In 1851 he served as chief of staff of the Bavarian contingent at the front, and distinguished himself at the lines of Düppel, after which he visited Haynau’s headquarters in the Hungarian war, and returned to Schleswig-Holstein to serve as v. Willisen’s chief of staff in the Idstedt campaign. Then came the threat of war between Prussia and Austria, and von der Tann was recalled to Bavaria. But the affair ended with the “surrender of Olmütz,” and he saw no further active service until 1866, rising in the usual way of promotion to colonel (1851), major-general (1855), and lieutenant-general (1862). In the earlier years of the period he was tortured, he fought several successful engagements under the Grand Duke of Mecklenburg near Orleans. On the termination of the war he was reappointed commander-in-chief of the I. Bavarian corps, a post which he held until his death at Meran on the 26th of April 1881. He had the grand cross of the Bavarian military orders, and the first class of the Iron Cross and the *pour le mérite* from the king of Prussia. In 1878 the emperor named von der Tann chief of a Prussian infantry regiment, decreed him a grant, and named one of the new Strassburg forts after him.


TANSA, a small river in Salset district, in the Thana district of Bombay, which provides the city of Bombay with its water-supply. It is embanked by one of the largest masonry dams in the world, built in 1892. The embankment is nearly 2 m. long, 118 ft. high, and 110 ft. thick at the base.

TANTA, a town of Lower Egypt, in a central position nearly midway between the two main branches of the Nile, and converging-point of several railways traversing the Delta in all directions. It has a population (1907) of 54,437, is the capital of the rich province of Gharba, and is noted for its fairs and Moslem festivals, which are held three times a year in honour of Seyyid el-Menawi, and are sometimes attended by 200,000 pilgrims and traders. There are a large railway station, a very fine mosque (restored), and a palace of the khedive. Seyyid el-Menawi, who lived in the 13th century A.D., was a native of Fes who, after a pilgrimage to Mecca, settled in Tanta. He is one of the most popular saints in Egypt.

TANTALUM [symbol Ta, atomic weight 181.0 (O=16)], a metallic chemical element, sparingly distributed in nature and then almost invariably associated with columbium. Its history
is intermixed with that of columbium. In 1801 C. Hatchett detected a new element, which he named columbium, in a mineral from Massachusetts, and in 1802 A. G. Ekeberg discovered an element, tantalum, in some Swedish yttrium minerals. In 1809 W. H. Wollaston unsuccessfully endeavored to show that columbium and tantalum were identical. In 1844 H. Rose detected two new elements in the cobalt stibnites, which he named niobium and pelopium; dianium was later shown to be columbium, and ilmenium and cerium were identified by R. Hermann. The researches of C. W. Blomstrand, and others, especially of Marignac, proved the identity of columbium, dianium and niobium, and that ilmenium was a mixture of columbium and tantalum. It is very probable that niobium is a similar mixture. Berzelius, who prepared tantalic acid from the mineral tantalite in 1820, obtained an impure metal by heating potassium tantalofluoride with potassium. In 1902 H. Moissan obtained a carbon-bearing metal by fusing the pentoxide with carbon in the electric furnace. The preparation of the pure metal was successfully effected by Wernher von Bolton in 1905, who fused the compressed product obtained in the Berzelius process in the electric furnace, air being excluded. An alternative method consisted in passing an electric current through a filament of the tetroxide in a vacuum. The metal is manufactured, for use as filaments in electric lamps, by the action of sodium on sodium tantalofluoride.

The pure metal is silver-white in colour, is very ductile, and becomes remarkably hard when hardened, a diamond drill making little impresssion upon it. Its tensile strength is higher than that of steel. It melts between 2280° and 2300°, its specific heat is 0.027, its coefficients of expansion 0-000079, and specific gravity 16.64. When heated in air the metal burns if in the form of thin wire, and is superficially oxidized if more compact. At a red heat it absorbs large volumes of hydrogen and nitrogen, the last traces of which can only be removed by fusion in the electric furnace. These substances, and also carbon, sulphur and tellurium, render the metal very brittle. Tantalum is not affected by alkaline solutions, but is disintegrated when fused with potash. Hydrofluoric acid is the only acid which attacks it. It alloys with irorn, molybdenum and tungsten, but not with silver or mercury.

In its chemical relationships tantalum is associated with vanadium, columbium and didymium in a sub-group of the periodic classification. In general it is pentavalent, but divalent compounds are known.

Tantalum tetroxide, TaO₄, is a porous dark grey mass harder than glass, and is obtained by reducing the pentoxide with magnesium. It is unaffected by any acid or mixture of acids, but burns to the pentoxide when heated.

Tantalum pentoxide, Ta₂O₅, is a white amorphous insoluble powder, or it may be crystallized by strongly heating, or by fusing with boron trioxide or microcosmic salt. It is insoluble in all acids. It is obtained from potassium tantalofluoride by heating with sulphuric acid to 400°, boiling out with water, and decomposing the residual compound of the oxide and sulphuric acid by ignition, preferably with the addition of ammonium carbonate.

Tantalic acid, H₅TaO₄, is a gelatinous mass obtained by mixing the chloride with water. It gives rise to salts, termed the tanta-
lates. The normal salts are all insoluble, which either are anhydrous or, on adding water, form hydrates. However, Ta₂O₅ (which does not exist in the free state), forms soluble salts with the alkaline metals. Per tantalic acid, H₅TaO₄, is obtained in the hydrated form as a white precipitate by adding sulphuric acid to potassium tantalate, K₂Ta₂O₇, which is formed when hydrogen peroxide is added to a solution of potassium tantalate.

Tantalum pentahalide, TaF₅, for a long time only known in salt form, is obtained by the action of fluorine on tantalum and aluminium, and purifying by distillation in a vacuum. It forms colourless, very hygroscopic prisms, which attack glass, slowly at ordinary temperatures, more rapidly when heated. It is able to form tantalum fluoride compounds, which are important and serve for the separation of the metal from columbium and titanium. Tantalum pentachloride, TaCl₅, is obtained as light yellow needles by heating tantalum with chlorine in a current of chlorine. By heating with sodium amalgam and separating with hydrochloric acid, the dichloride, TaCl₄•2H₂O, is obtained as emerald green hexagonal crystals. The pentaboride exists, but tantalum and iodine apparently do not combine. Tantalum forms a sulphide, TaS₂, and two nitrates, Ta₂N₃ and Ta₅N₄, have been described.

Manganese determinations thought to be 181, but Henrichsen and N. Sahlin (Ber., 1906, 39, p. 2560) obtained 179-8 (H = 1) by converting the metal into pentoxide at a dull red heat.

TANTALUS, in Greek legend, son of Zeus (or Tmolus) and Pluto (Wealth), daughter of Himantes, the father of Pelops and Niobe. He was the traditional king of Sipylos in Lydia (or of Phrygia), and was the intimate friend of Zeus and the other gods, whose table he was admitted to. He was held in very high esteem by the gods, and the divine favour by reveal to mankind the secrets he had learned in heaven (Diod. Sic. iv. 74), or by killing his son Pelops (p. 82) and serving him up to the gods at table, in order to test their powers of observation (Ovid, Metam. vi. 401). Another story was that he stole nectar and ambrosia from heaven and gave them to men (Pindar, Ol. i. 60). According to others, Pandareus stole a golden dog which guarded the temple of Zeus in Crete, and gave it to Tantalus to take care of. But, when Pandareus demanded the dog back, Tantalus denied that he had received it. Therefore Zeus turned Pandareus into a stone, and flung him up in a lake on Mount Sipylos on the top of him (Antoninus Liberalis, 36). The punishment of Tantalus in the lower world was famous. He stood up to his neck in water, which flowed from him when he tried to drink of it; and over his head hung fruits which the wind wafted away whenever he tried to grasp them (Odyssey, xi. 582). This myth is the origin of the English word "tantalize," and also of the common name "tantalus" for a set of spirit decanters kept under lock and key. Another story is that a rock hung over his head ready to fall and crush him (Euripides, Orastes, 5). The sins of Tantalus were visited upon his descendants, the Pelopidae. Among the ancient historical reminiscences and natural phenomena, especially volcanic catastrophes, are at the bottom of the legend. The tomb of Tantalus on Mount Sipylos was pointed out in antiquity, and has been in modern times identified by C. F. Texier with the great cairn beneath Old Magnesia; but Sir W. M. Ramsay inclines to a remarkable rock-cut tomb beside Magnesia.

The story of Tantalus is an echo of a semi-Greek kingdom, which had its seat at Sipylos, the oldest and holiest city of Lydia, the remains of which are still visible. There was a tradition in antiquity that the city of Tantalus had been founded by Pelops, or by the Mahratta leader last of the Bhumiluris. With the aid of the Gwalior contingent he pressed General Windham hard at Cawnpore on the 23rd of December 1857, but was defeated and captured by Sir Colin Campbell on the 6th of December 1858, together with the Rani of Jhansi he was besieged by Sir Hugh Rose in the Jhansi fort, but escaped and collected a force of 20,000 men which Sir Hugh defeated without relaxing.
the siege. This was the decisive action of the campaign in Central India, and Tantia Topi was obliged to seek refuge in the jungles of Rajputana and Bundelkhand, where he was taken by Major Meade, condemned, and executed on the 18th of April 1859. He was the only rebel leader in the Mutiny who showed any conspicuous military talent.

**Taoism**

A form of religion in China, the name of which is taken from the ancient treatise called *Tao Teh King*, supposed to be the work of the sage Lao-tse (q.v.). The later characteristics of Taoism as a form of worship represent a corruption of the earlier doctrines of Lao-tse, and the infusion of Buddhist and other ideas.

**Tao-Diana** (Ancient *Taurumenum*), a town on the E. coast of Sicily, in the province of Messina, from which town it is 30 m. S.S.W. by rail. Pop. (1901) 4116. It has come into great favour as a winter resort, especially with British and German visitors, chiefly on account of its fine situation and beautiful views. It lies on an abrupt hill 660 ft. above the railway station, and was founded by the Carthaginian Himilco in 397 B.C. for a friendly tribe of Sicels, after the destruction, by Dionysius the Elder of Syracuse, of the neighbouring city of Naxos. In 395 Dionysius failed to take it by assault on a winter's night, but in 392 he occupied it and settled mercenaries there. In 352 they were expelled from Naxos; after wandering up and down Sicily, at last found a home there. Its commanding site gave it considerable importance. It was the city at which both Timoleon and Pyrrhus first landed. During the First Punic War it belonged to the kingdom of Hiero, and after his death it enjoyed an exceptionally favoured position with regard to Rome, being like Messana and Netum, a civitas foederata. During the first Servile War it was occupied by Eunous and some of his followers, but was at length taken by the consul Publius Rupilius in 157. It was one of the strongholds of Sextus Pompeius, and after deathly wounds in 41 B.C. Augustus made it into a colonia as a measure of precaution, expelling some of the older inhabitants. In the time of Strabo it was inferior in population, as we should expect, to Messana and Catana; its marble, wine and mullets were highly esteemed. In A.D. 902 it was taken and burnt by the Saracens; it was retaken in 962, and in 1078 fell into the hands of the Normans.

The ancient town seems to have had two citadels; one of these was probably the hill above the town to the W. now crowned by a medieval castle, while the other was the hill upon which the after-mentioned church (P. A. Freeman, History of Sicily, iv. 506). There are some remains of the city walls, belonging to more than one period. It is indeed possible that one fragment of wall belongs to a period, before the foundation of the city, when the Nasians had a fortified port here (Evans in Freeman, op. cit., iv. 100 n. 1). The church of San Pancrazio, just outside the modern town, is built into a temple of the 3rd century B.C., the S. wall of the cella of which is alone preserved. Inscriptions prove that it was dedicated to Serapis. The other ruins belong in the main to the Roman period. The most famous of them is the theatre, largely hewn in the rock, which, though of Greek origin, was entirely reconstructed. The seats are almost entirely gone, but the stage and its adjacent buildings, especially the wall, in two storeys, at the back, are well preserved: some of its marble decorative details were removed for building material in the middle ages, but those that remained have been re-erected. The view from the theatre is of exceptional beauty, Mount Etna being clearly seen from the summit to the base on the S.W., while to the N. the rugged outlines of the coast immediately below, and the mountains of Calabria across the sea to the N.E. make up one of the most famous views in the world. There are also remains of a much smaller theatre (the so-called Odeum), and some large cisterns; a large bath or tank which was apparently open, known as the Naumachia, measures 426 ft. in length and 393 in width: only one of its long sides is now visible, and serves as a foundation for several houses in the main street of the modern town. The aqueducts which supplied these cisterns may be traced above the town. There are remains of houses, tombs, &c., of the Roman period, and fine specimens of Romanesque and Gothic architecture in the modern town.

See Rizzo, *Guida di Taormina e dintorni*, Catania, 1902. (T. As.)

**Tapaculo**

The name 1 given in Chile to a bird of singular appearance—the *Pteropodus albicolis* of ornithology, and applied in an extended sense to its allied forms, which constitute a small family, *Pteropodidae*, belonging to the *Clamatoridae* division of *Passeres*, peculiar to South America. About 20 species, disposed by P. L. Schlegel (*Ibis*, 1874, pp. 180-206) in 8 genera, are believed to belong to this group.

The species of the Family first made known is *Scytalopus magelanicus*, originally described in 1783 by J. Latham (*Sympsis*, iv. p. 404) as a Warbler. Even in 1866 J. Gould not unaptly took it for a Wren, when establishing the genus to which it is now referred; but some ten years after Johannes Müller found that *Scytalopus*, together with the true Tapaculo, was first described by Ktitiz in 1834, possessed anatomical characters that removed them far from any position previously assigned to them, and determined their true place as above given. In the meanwhile a kindred form, *Hylastes*, also first described in 1834, had been shown by T. C. Eyton to have some very exceptional osteological features, and these were found to be also common to *Pteropodus* and *Scytalopus*. In 1860 J. Cabanis recognized the *Pteropodidae* as a distinct Family, but made it also include *Monura* (see *Lyre-Bird*), and in 1874 P. L. Schlegel thought that *Atricilla* (see *Scrub-Bird*) might belong here. It was A. Garrod in 1876 and 1877 who finally divested the Family of these aliens, and until examples of some of the other genera have been anatomically examined it may not be safe to say that they all belong to the *Pteropodidae*.

The true Tapaculo (*P. albicolis*) has a general resemblance in plumage to the females of some of the smaller Shrikes (*Lanius*), and to a cursory observer its skin might pass for that of one; but its shortened wings and powerful feet would on closer inspection at once reveal the difference. In life, however, its appearance must be wholly unlike, for it rarely flies, hops actively on the ground or among bushes, with its tail erect or turned towards its head, and continually utters various and strange notes,—some, says Darwin, are "like the cooing of doves, others like the bubbling of water, and many dely all silmes." The "Turco," *Hylastes megapodus*, is larger, with greatly developed feet and claws, but is very similar in colour and habits. Two more species of *Hylastes* are known, and 1 Of Spanish origin, it is intended as a reproof to the bird for the shameless way in which, by erecting its tail, it exposes its hinder parts. It has been sometimes misspelt "Tapacola," as by C. Darwin, who gave (*Journal of Researches*, chap. xii.) a brief but entertaining account of the habits of this bird and its relative, *Hylastes magapodus*, called by the Chilenos "El Turco."
one other of Pteroptochus, all of which are peculiar to Chile or Patagonia. The species of Scytalopus are as small as Wrens, mostly of a dark colour, and inhabit parts of Brazil and Colombia, one of them occurring so far northward as Bogota. (A. N.)

TAPER (probably of Celtic origin, cf. Irish tapar, Welsh lamp'r, taper, torch), a small thin candle of tallow or wax (see Candle); from its early shape, in which the circumference of the top was smaller than that of the base, the word came to be used in the sense of "slender," particularly of something diminishing in size at one end. In architecture the word is used of the gradual diminishing of a spire or column as it rises. The spire tapers almost to a point, where it is terminated by a finial or vane: the column tapers only to a less diameter at the top, and as a general rule the more ancient the column the greater its diminution or taper; thus in one of the early temples at Selinus in Sicily the upper diameter is about half the lower diameter, while in the Parthenon it is about one-fifth.

TAPESTRY. The Gr. τάπητις and Lat. tapestria, from which our word "tapestry" is descended, implied a covering to both furniture and floors, as well as curtains or wall hangings, and neither of them really defines the particular way in which such articles were made. The decorations on these Greek and

Fig. 1.—Gobelins high-warp tapestry frame, with weaver (18th century), holding in right hand (a) bobbin with warp thread wound round its thick end, and with his left hand taking (e) some of the fisses or strings with a loop at one end of each of them, through which a warp thread is passed, and thus pulling forward those warp threads in between which he will pass his weft. mm is the tapestry he has woven, which has been wound round (p) the cylinder. The other letters in this diagram relate to details in the frame which are of subsidiary interest. The description of them would not further elucidate the act of weaving which is here in question.

Roman coverings were effected by painting, printing, embroidery, or a method of weaving with coloured threads; and specimens and other conclusive evidence show that early Egyptians, Babylonians, Chinese, Indians, Greeks and Romans employed some at least of the means above-named.

The purpose of this article is to give some account of those decorated stuffs which are produced by weaving coloured threads on to warp threads in a manner that differs from shuttle-weaving, and at the present day is called tapestry-weaving, such for instance as is practised at the famous Gobelins and Beauvais tapestry manufactories in France. At the Gobelins, the warp threads are stretched in frames standing vertically (high warp or haute lisse); at Beauvais in frames placed horizontally with the ground

(see Account of Gravels at Ancon, Asher & Co.; see also specimens from Graves at Lima in the Victoria and Albert Museum, London.)

FIG. 2.—Gobelins tapestry-weaving, showing (a) the left hand of the weaver pulling forward (c) a group of warp threads, into which with (b) the comb in his right hand he is compressing at point (d) the weft threads which have been passed around in between the warp threads; (e) are various bobbins, hanging at rest, suspended by their weft threads; and (f) is the tapestry as woven and compressed.

High and low warp frames.
As regards the antiquity of the two sorts of frames (the low and high warp) the Beni Hassan wall paintings (1600 B.C.) include diagrams of horizontal (low warp) frames, with weavers squatting on the ground at work on them; while a vertical or high warp frame is represented on a Greek vase of the 5th century B.C. found at Chiusi (fig. 3), and corresponds with frames used in Scandinavian countries. In both these late-named the lower ends of the warp threads are merely weighted, thus presenting some difficulty to the act of weaving, and of subsequently compacting the weft upwards, the warp not being taut and fastened to a beam, according to more ordinary usage, as, for instance, in the high warp frame illustrated in the codex of Rabanus Maurus, 9th century A.D., preserved at Monte Cassino (fig. 4). The words "de Geneceo" in this illustration point to a medieval survival of the earlier gunakonites of the Greeks and the gynaecae of the Romans, which were the quarters set apart in the house of the well-to-do for the spinning, weaving and embroidery done by women for the household. From such ancient frames to similar haute and bosse lisse frames of the French tapissiers nostres and tapissiers sarraisons governed under edicts (1226-70) of Louis IX., and so on to present-day Gobelins and Beauvais frames, the transition can be easily realized. The texture of all tapestry weavings presents no radical difference in appearance, no matter when or where produced.

Within reasonable limits it is not practicable to sketch in a complete form the history, from the middle ages onwards, of the prosecution of the art by each of the many European towns that have become engaged in tapestry weaving. But the foregoing remarks will suggest, what seems to have been the fact, that a continuity in the knowledge of the art was kept up so that as favourable conditions occurred it would be taken into practice. Artificers (male and female) such as the Roman planarii wove tapestries with figures of Britons (Virgil, Georg., iii. 29) "purpureae selectae tullanulae Britanni," — others with scenes from the story of Theseus and Ariadne (Catullus, Argen., xlvi. 267), besides many more for emperors and the wealthy. The demand for such production of the testinaria or trade workshops, and of the more private gynaecae, as well as the organization of workmen's societies, collegia opificum, are evidence of circumstances lasting for some centuries in Rome that were favourable to tapestry-weaving there. Suggestions of Roman designs are the illustrations of part of a curtain or wall hanging (fig. 5), and of a hanging or couch cover (fig. 6); whilst the daintiest quality of tapestry-weaving for the ornamentation of a tunic is displayed in fig. 7. The ornamentation in fig. 5—a hanging 5 ft. 3 in. by 19½ in.—consists of a series of horizontal leafy bands or garlands and other devices: between the upper bands on a red ground is a bird on a leafy twig. This is Egyptian-Roman work of about the 3rd century A.D. A portion of a linen cloth or couch cover ornamented with tapestry woven in coloured

wools and linen thread is shown in fig. 6. At the top there is a fragment of a horizontal border of floral and leaf ornament beneath which, and enclosed by festoons of leaves, are two boys floating in the air and holding ducks; elsewhere are figures of boys running and carrying baskets of fruit, and large and small blossom forms or rosettes. This also is Egypto-Roman work, about the 4th century, and is 4 ft. 5 in. by 4 ft. 1 in. Fig. 7 presents a square (from a small tunic) of very fine warp and weft tapestry-weaving, with a child mounted on a white horse: in the border about him are ducks, fish and (?) peaches. This too is Egypto-Roman work of about the 2nd or 3rd century and is about 4 inches square. The square in fig. 8 is from a tunic or robe and is of tapestry-weaving in bright-coloured woools, with a representation of Hermes holding the caduceus in one hand and a pince-nez in the other. About his head is a nimbus and his name in Greek characters. This again is Egypto-Roman work of about the 1st or 2nd century and is 6½ inches square. The panel of tapestry-weaving in fig. 9 is from a couch or bed covering, and is wrought in purple wool and linen threads. The design recalls the description of the lorica or couch-covering alluded to in Petronius Arbiter's account of Trimalchio's banquet, "on which were depicted men in ambush with hunting poles and all the apparatus of the chase." This piece is also of Egypto-Roman work about the 2nd or 3rd century, about 12 in. by 10 in.

The well-known 6th-century Ravenna mosaics of the Emperor Justinian and the Empress Theodora are rich with hangings and costumes decorated presumably with tapestry weavings similar to those just described. From the 5th century and for many centuries later, monasteries, nunneries and the like, under ecclesiastical control or influence, became centres of activity in this and cognate arts, stimulated by the patronage of the Church and courts; and in the 5th and 6th centuries the Emp. Charlemagne's body of travelling inspectors, the cenoviis dominici, appears to have exercised for a time a helpful influence upon such centres throughout France and in parts of Germany. Two centuries later, free, as distinct from bond, handcrafts men were forming local associations for their industries, and in this movement the weavers took the lead throughout England, Flanders and Brabant, France being a little later. The gilds of weavers in London and Oxford were granted charters by Henry I. In the 11th century gilds of wool weavers existed at Cologne and Mainz, and in the following century there was a similar guild at Spires: it is quite probable that some of their weaving would be of tapestry. The fragment in fig. 11 is considered by authorities to be of 12th-century north European work, possibly from some Rheinish place. At one time the whole piece

![Fig. 3—Penelope's tapestry-weaving frame, from a Greek vase of the 5th century b.c.](image)

![Fig. 4—High warp frame from MS. Codex by Rabanus Maurus (9th century).](image)
FIGS. 5-9.—Specimens of Egypto-Roman tapestry weaving of about the 2nd to 5th century A.D. Victoria and Albert Museum.
FIG. 10.—Fragment of coarse linen material with a large diamond panel of tapestry weaving in coloured threads—Peruvian-made, before the conquest of Peru by Pizarro. About 3 ft. by 2 ft. 6 in.

FIG. 11.—Portion of wall-hanging from the church of St. Gereon, Cologne. North French or German manufacture of the 11th or 12th century. About 2 ft. by 2 ft. 6 in.

FIG. 12.—An antependium, or altar hanging of tapestry woven in coloured wools, with the Adoration of the Magi, probably from a design by Wohlgemuth (1434-1519). The tapestry is reputed to have been executed in a convent at Bamberg; below the folds of the Virgin’s cloak, to the right, the “tapissière” has woven a figure of herself at work. German, 15th century. This interesting piece is in the museum at Munich. About 5 ft. 6 in. by 2 ft.
Fig. 13.—One of a series of designs (the Trojan War) by Jean Fouquet (1415-1485) from which tapestry hangings were woven, probably at Arras in the middle of the 15th century.

Fig. 14.—Part of the tapestry (13 ft. high) woven from the design in Fig. 13. Arrival of Queen Penthesilea at the court of King Priam.

Fig. 15.—Part of the tapestry (10 ft. high) woven from the design in Fig. 13. Queen Penthesilea overcoming Diomedes.

Fig. 16.—Long and narrow tapestry (8 ft. 10 in. by 22 in.), German work of the 15th century. Field labours, &c.
Fig. 17.—Part of a wall hanging of tapestry woven (probably at Brussels early in the 16th century) with coloured wools and silks, which is one of a series designed, probably by some member of the school of Roger van der Weyden, to illustrate the Triumphs written by Petrarch. The episode represented is the Triumph of Chastity over Love. Falling from a triumphal car fitted with flaming altars or torches of love, and drawn by four winged white horses, is Cupid, whose left arm is grasped by Chastity mounted on a unicorn and carrying the column symbolizing Strength or Constancy. Foremost in the multitude about the car of Love are Cleopatra and Julius Caesar. In another part of this hanging is the date 1507. The height of this piece is 14 ft. This, with tapestries of the Triumph of Death and Fame, is in the Victoria and Albert Museum; one hanging of the Triumph of Time is at Hampton Court.
belonged to the church of St. Gereon, Cologne; a large bit of it is in the museum at Lyon; another at the Abbey of St. Gall. A small part of the border only is in the Victoria and Albert Museum, South Kensington. The pattern consists of diagonal runouls within each of which is a chimerical bird and bull (? St. Luke), elsewhere the runouls are in solid. In a 16th-century tapestry of oriental and Byzantine character, is frequently found in shuttle-woven silks of the period.

The tapestries from different countries of the 14th and 15th centuries onwards.

The tapestries of the 14th and 15th centuries, usually entitled tapestries of Troy, and fig. 23 of Dido and Aeneas. Historical design occurs in fig. 20, which is one of a set of tapestries woven possibly at the royal factory of Fontainebleau about 1519, to commemorate the fete on the occasion of the marriage of Henri II, with Catherine de Medicis; and again in fig. 25, of the "Glorious Defence of Londonderry." Pastoral interest is presented in figs. 16, and an example of the tapestries, mostly of the 15th century, wrought from leaf designs, usually termed "verdures," of which several were made at Brussels during the 16th century. Herakle and floral designs were also frequently seen in the 15th century in Winchester College, and fig. 18, which is at Haddon Hall and was woven early in the 16th century. It is very similar to herakle which was a part of the lozenge design invented by Charles the Bold at the battle of Granson. Many curiously designed tapestries of German 15th-century origin are to be seen in the museum at Basel—one of them (fig. 21) displays strange beasts strange to nature, yet suggestive of the design invented with legends. Other tapestries, worked from still later phases of ornamental design, are fantastic with schemes of abstract ornament into which are introduced subsidiary details figure subjects seen in the paintings of the day.

The treatment of the compositions in cartoons for tapestries follows that adopted by painters. Thus examples from the 11th to the end of the 15th century are formal in the drawing of the forms introduced into them, and comparatively limited in range of colours, lights and shades, in accordance with the mannerisms of the earlier painters whether Illuminators of MSS. or wall and panel painters. It has been argued from this that the designers of such early tapestry work possessed a sense of the limitations imposed by the process and materials. But in their day the relatively small number of dyes available involved conventionality in colour, quite as much the earlier styles of drawing involved conventionality in form.

Fig. 13 is from an interesting design by Jehan Fouquet (1415-1485): and is one of a set, made by him to illustrate the Trojan War, now in the Louvre. From these drawings tapestries were woven at Arras, in the year 1499, by the Azuret Gobelin tapestry workshop. One of these hangings in the Victoria and Albert Museum (see figs. 14 and 15) is from Fouquet's design, representing the arrival of Queen Penthesilea and her warrior women at Troy and the part which she took in the fatal conflict. It is a rare instance of a design naturally came into play, and practically became an introduction to the tapestry workshop. This episode was introduced by Quintus Calaber (or Smyrnaius), a 4th-century writer, in his version of the Homeric story. A tapestry fragment, by the Gobelin workshop (whereafter a great deal of the decoration of their tapestry works was traced by artists), may be seen at the Victoria and Albert Museum, representing the chariot of Priam in the midst of his court in the Palace of Justice at Issore.

When Raphael, master of a freer and more realistic style in rendering form and colour, produced his cartoons of the Acts of the Apostles for the Sistine Chapel (1510), he naturally turned to the Italian tapestry workshops, which were well established in Flanders. The provision of a bigger scale of dyes for the wools and silks was stimulated to secure success in weaving these more realistic representations of forms and greater subtleties in colour, as well as the developed effects of perspective: compare, for instance, the treatment in fig. 14 with that in fig. 22. The restraint or limitations of the earlier styles were thus gradually swept away by the comparatively inexperienced workers; and it is a point of interest to note that provision for still further inventing and improving dyes and so helping tapestry to assimilate to painting is specially included in the regulations (1667) of the state tapestry factory at Tournai.

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compositions, and the flowers, &c., as in the ground of Fig. 18, and might complete or correct their cartoons with charcoal or chalk, but for every other style of work they were bound to apply to professional painters under pain of fine.

The early 17th-century tapestry dealers in tapestries were required to mark their weavings, and Charles V, ordered all tapestry makers in the Low Countries to do the same. This practice was followed by some Flemish and French weavers. In France, the painter Charles le Brun as the Manufacture Royale des Meubles de la Couronne, which for large hangings became the premier tapestry-weaving centre in Europe. Three years previously Colbert and his predecessor, Charles le Brun, had been in Italy, studying the art of tapestry weaving in Florence, where they were impressed with the work of the Medici and the Vatican. By the 1720s, the production of tapestries was at its height, and many of the most famous artists of the period were involved in the design and production of tapestries. The most important of these artists were Roger de Eycks, who worked in the 16th century, and his son, Roger II, who worked in the 17th century.

Arraziers, or cloth-makers, are thought to have been established in the 16th century, and their work is often characterized by the use of borders and quarterings. The most famous of these arraziers were the Gobelin and Aubusson factories, which were established in the late 16th century and are still in operation today. The Gobelin factory was founded by Charles V in 1537, and the Aubusson factory was established in 1567. These factories were among the most important in Europe, and their work is often characterized by the use of exuberant patterns and rich colors.

Tapestry-weaving during the 18th century under private enterprise was pursued with success and still continues at Aubusson, Felletin; it was carried on for a short time only at Fulham, Soho, Exeter, and for rather longer periods at Morden near London, Nunberge near Brunswick, Seville, Munich, Berlin, Dresden, Heidelberg, and St. Petersburg, maintaining, however, no very prolonged existence at any of these latter places. In modern times, however, the manufacture of tapestries is practised in France, in the 16th-century style, for diplomatic and other purposes, by the comparatively effeminate and delicate painting-like fabrics now made at the Gobelins and Aubusson.

The end of the 18th century, as far as the kind of tapestry known as the ‘Seasone’ is concerned, marks a period in the history of tapestry weaving which has been described as the ‘Golden Age’ of tapestry. The most notable development of this period was the use of the new pictorial style of tapestry weaving, which was characterized by the use of small, exquisitely detailed designs, often representing historical or mythological scenes. This style of tapestry weaving was particularly popular in France, where it was produced in the Gobelin and Aubusson factories. These factories were among the most important in Europe, and their work is often characterized by the use of exuberant patterns and rich colors.

In the 19th century, the manufacture of tapestries continued to be carried on in France, but the industry began to decline. The decline was caused by a number of factors, including the rise of machine weaving, the increasing demand for cheaper fabrics, and the decline in the popularity of tapestries among the upper classes. Nevertheless, the Gobelin and Aubusson factories continued to produce high-quality tapestries, and their work is still in demand today. The Gobelin factory is still in operation, and its work is often characterized by the use of exuberant patterns and rich colors.

Much of the tapestry work produced in the 17th and 18th centuries was designed by some of the most famous artists of the period, including Gaspar Poussin, Claude Lorraine, and Jean-Baptiste Van der Meulen. These artists designed a large number of tapestries, which were produced in the Gobelin and Aubusson factories, and the results are still in demand today. The Gobelin factory is still in operation, and its work is often characterized by the use of exuberant patterns and rich colors.
Fig. 18.—Brussels, early 16th century, hanging, covered with masses of flowers, on which are shields bearing the royal arms. Now at Haddon Hall. The property of the duke of Rutland.
Plate VI.

Tapestry

Fig. 20.—Tapestry hanging (about 10 ft. high) possibly of Fontainebleau manufacture about 1540. Fêtes in honour of Henri II. and Catherine de Medicis.

Fig. 19.—Brussels tapestry (about 6 ft. high), late 15th century, with a shield bearing three crowns, red and white roses, and the monogram I.H.S. repeated three times. From Winchester College.

Fig. 21.—German tapestry hanging (about 4 ft. 6 in. long by 3 ft. high) for a sideboard or buffet, middle of the 15th century. In the museum at Basel.

Fig. 22.—Tapestry hanging (about 10 ft. high) made at the Medici factory in Florence, 1639. Domestic scene, L’Inverno, winter.
FIG. 23.—Oudenarde tapestry, early 17th century. The design, "Dido and Eneas," rather in the style of J. van Straten.

FIG. 24.—One of the four tapestry hangings of the "Seasons," of Winter with Aeolus in the centre, probably woven under the direction of Francis Hickes at William Sheldon's manufactory at Barcheston, in Warwickshire, early in the 17th century, and now at Hatfield House.
Fig. 25.—Defence of Londonderry. Irish (Dublin) tapestry, early 18th century.

Fig. 25.—Tapestry woven at Merton Abbey, from a design by William Morris (1834–1896). The subject is from his poem "The Orchard." Victoria and Albert Museum.
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Fine examples of early and later European tapestries are to be seen in the cathedrals of Reims, Bruges, Tournai, Angers, Beauvais, Aix, Sens, in the Victoria and Albert Museum, London, Windsor Castle, Hampton Court, St Mary's Hall Coventry, Chartres, Amiens, Dijon, Orleans, Auxerre, Nancy, Bern, Brussels, Basel, Munich, Berlin, Dresden, Vienna and Nuremberg. In Italy the largest collections (mostly of trophies) are to be seen in the churches of those nations at Rome, and the Reale Galleria degli Arazzi at Florence. Many fine pieces are in the royal palace at Turin, the Palazzo del Te at Mantua, the Museo del Duomo, Milan, in the cathedral of Como, and the museum at Naples. The collection of tapestries at Madrid is one of the largest in Europe, and comprises more than one thousand examples, the older of which, of splendid Flemish design and weaving, belongs to the school of Antwerp in the 16th century, the work of Charles V.

The principal cathedrals of Spain also possess important tapestries; those preserved at the cathedral of Toledo are more than enough to supply hangings for the outside and inside of that building on the feast of Corpus Christi. Throughout the European continent, in the United States of America, and in Great Britain almost uncountable tapestries are displayed or stored in mansions, castles, châteaux and palazzi, belonging to noble and wealthy families. A large number of books have been written and published on the subject generally, and many of them, containing good illustrations, are of recent date.

The following works may be considered as likely to prove useful for investigating the history and character of Egyptian-Roman and Coptic textiles: J. Karabacek, Die Theodor Grafischen Blätter in Aegypten ("Die Textilien-Gräberlinder"), 8vo, Vienna, 1877;- 1880. Also, coll. of printed and manuscript Woven and Embroidered Egyptian Textiles in the South Kensington Museum, London, 1887; "Egyptian Tapestry," Society of Arts, Catalogue of the Egyptian Textiles in the Museum at Strassburg in the K. K. Austrian Museum, 13 photo-lithographs, 4to, Vienna, 1889; E. Gerspach, Les tapisseries coptes, 153 (some coloured) illustrations, 40to, Paris, 1890; K. Forrer, Mets Bensuch, Tapisseries des xvi, xvii, xiii siècles, 30 photo illustrations, 8vo, Strassburg, 1895; Römische und Byzantinische Seide-Textilen aus dem Gräberfeld von Achimn-Paropolis, 28 pp., 17 (15 coloured) plates, and illustrations in the text, 4to, Strassburg, 1891; Wladimir Bock, Coptic Art; Coptic Embroidered Textile (in Russian), 32 pp., 6 photo type plates, 40to, Moscow, 1897; W. Lowrie, Christian Art and Archaeology (pp. 326-82, "Textile Art"), process illustrations, London, 1901; A. Frank, L'art de tapisserie (pp. 147-277, "Les tissus"), process illustrations, 8vo, Paris, 1902.

In respect of medieval and later tapestries the titles of the following works are quoted: Jubinal, Anciennes tapisseries, Paris, 1835-39; Ronchard, La tapisserie dans l'antiquité, L'Épopée des Antiquaires, 8vo Paris, 1882; Mittx, La tapisserie, Paris, 1882; Boleau, Les métiers et corporations de la ville de Paris au xvi, siècle, Paris, 1879; Barbiere de Montaut, Tapisseries du sacre d'Angeor, Paris, 1863; De Farcy on the Tapisserie, 1875; Barrault, Tap. de la cath. de Beaunais, Beauvais, 1853; Pinchart, Roger van der Weyden . . . et les tapisseries de Berne, Brussels, 1864; Lorquet, Tap. de la cath. de Sens, Brussels, 1884; Guillery, Tap. de la cath. de Menton et de Menton, Histoire générale de la tapisserie, 1878; Mittx, Les fabriques de tapisseries de Nancy, 1883; Voisin, Tap. de la cath. de Tournay, Tournai, 1883; Van Drival, Tap. d'Arras, Arras, 1864; George, Tap. de la cath. de Bayonne, Paris, 1889; Du Bousquet, Pons-Murier, Les tapisseries des xvi, xvii, xix siècles, Paris, 1870; Notice sur les Tap. de Beaunais, Clermont, 1842; Deville, Statuts, etc., relatifs à la corp. des tap. de 1292, 1275, Paris, 1875; Duret, Les manufactures nationales de tapisserie des Gobelins de Paris, 1885; van der Graaf, De Tapijf-Fabrieken der xvi, en xvii, Eeuw, Middelburg, 1869; De Montaut, Tap. de haute lisse à Rome, Arras, 1879; Conti, L'arte degli arazzi a Firenze, Florence, 1875; Camperi, L'operaio dell'Estense, Modena, 1876; Braghirilli, Arazzi in Mantova, Mantua, 1879; Farabulini, L'arte degli arazzi, Rome, 1884; Gentili, L'arte dei tap, Rome, 1878; Mittx, Tap. Italianes, Paris, 1880; Dorregaray, Des allures et Antiquités (Flemish Tapestry, vol. vii, p. 47), Madrid, 1871-76; Darel and Guichard, Les tap. décoratives, Paris, 1877; Lacroix, Notice sur l'origine des tapisseries des Gobelins, 8vo, Paris, 1855; Guillaumot, Manufacture . . . des Gobelins, Paris, 1885; Tours, Tapestry, Plain of Navarre (in Messager des Sciences Historiques, Gand, 1868); Pera, Taphes, Tap. d'Aubusson, de Fellein, et de Belgardois, Paris, 1857; Périgord, Tap. de Fellein, Lomiges, 1853; Durieux, Tap. de Cambrai, Cambrai, 1879; About and Bauer, Tap. après les cartons de Raphael, Paris, 1875; Houyou, Tap. de la fabrication Lilloise, Lille, 1871; Vergnand-Romagnesi, Tap. au Musée des Antiquités (Lyon), 1864; Guffy, Hist. de la tapisserie, Tours, 1886; Pine, Tapestry of the House of Lords, London, 1739; Vallance Aymer, The Art of William Morris (see pp. 83-92); W. G. Thomson, A History of Tapestry from the earliest times until the present day, London, 1875. (A. S. C.)

1 See Report of Senator P. F. Riaño to the Director of the South Kensington Museum, 1875.
and of the female (vaginal) ducts, there is a distinct uterine opening at the opposite end of the body (b). Moreover, in *Amphitretus liguloides* a fourth duct (the anterior vagina) begins close to the origin of the female duct, and after running forward a short distance ends blindly (fig. 7, c). The egg gives rise to an oval larva, one half of which is ciliated and bears gland-cells, the opposite end carrying ten hooks. The fate of the larva is unknown.

Family II. *Gyrocotylidae.*—Leaf-shaped animals with crenate margins. One extremity bears a pedunculate rosette-organ. It is traversed by a canal from which a peculiar proboscis-like structure can be exerted. The opposite end is pointed and provided with a terminal sucker. *Amphiphyes* (=*Gyracotyle*) urna (fig. 1, B) is found in the intestine of *Chlamys* and *Ctenomychus,* and has been almost fully described by Spencer (7). The embryo is provided with ten hooks, and appears to select Lamellibranchs (*Mactra*) for its intermediate host.

Family III. *Caryophyllaeidae.*—Elongated cylindrical animals either with a single subterminal sucker at the proximal end, or with the corresponding end of the body converted into a mobile undulatory fold. *Caryophyllaenus mutabilis* occurs in the roach and other fresh-water fish, and passes its earlier stages of development in fresh-water Oligochaeta (*Tubifex*). *Archigetes appendiculatus* lives throughout life in the coelom of *Tubifex* and of *Limnodrilus.*

*Archigetes* and *Caryophyllaenus* are the only Cestodes that become fully differentiated in an invertebrate host. The former indeed is said to produce fully developed gonads, and if kept in aquaria with *Tubifex,* the number of infected worms steadily increases, a fact pointing to the whole cycle being passed through, without the intermediation of a vertebrate host. Conclusive evidence, however, has not yet been adduced to prove this point. The two genera agree closely in form and structure and may possibly belong to the cycle of the same or of allied species. *Archigetes* (3 mm. long) consists of a subcylindrical body and a caudal appendage. The former bears two terminal suckers on the flattened dorsal and ventral surfaces, the latter six hooks near the tip of the tail. The finer structure of the animal has been investigated by Mrazek (10), whose account, however, is published in the Hungarian language. It shows a close agreement with that of *Caryophyllaenus.*

A well-developed cellular parenchyma forms a matrix in which the muscular, excretory and generative organs are imbedded. The nervous system consists of a ring below the suckers and of a large number of radially arranged tracts running forwards and backwards. *Caryophyllaenus* is an elongated, flattened worm provided with one extremely mobile extremity, the other being drawn out during the animal's sojourn in *Tubifex* into a short hexacanth tail. It becomes fully developed in its invertebrate host, but apparently cannot produce eggs until transferred into the intestine of a fish.

Order II.—*MEROSOA.*

The Merosoa, to which the ordinary tapeworms of man and domestic animals belong, includes the great majority of the Cestodes. They occur in invertebrate animals throughout the globe, though varying in abundance in different districts and at different times. With few exceptions tapeworms select the small intestine for their station, and in this situation execute active movements of extension and contraction. The body, or *strobila,* consists of a usually minute organ of attachment (scolex or its representative) which is imbedded in the intestinal membrane, and of a series of segments that arise from the base of the scolex and increase in size distally. In one family (*Ligulidae*) the segmentation is only expressed in the metameric distribution of the generative organs and the worm is externally unisegmental. In the remainder the segmentation involves primarily the genitalia and includes the integument, muscles and part of the excretory system. The nervous system is, however, not segmented, and the excretory system is continuous throughout the worm.

**Scolex.**—The scolex is biradially constructed, the proglottides flattened, quadrangular and bilaterally symmetrical. In them a ventral surface containing the usually median male and female genital apertures is generally distinguishable from the smooth dorsal surface, but in those Cestodes which possess marginal gonopores this distinction of surface is obscured. In such cases the male organs are regarded as indicating the dorsal surface, the female organs as belonging to the ventral surface.

The scolex is usually a conical muscular structure. It bears adhesive organs that are either suckers or hooks, and may develop into the most varied outgrowths in order to give increased firmness of attachment to its host. Thus, starting from the two shallow pits, one dorsal and the other central, in the simplest forms, we find them becoming two elongated suckers (bothria) in the large family *Bothriocephalidae* (fig. 8); and by fusion of the lips they...
are transferred into two tubes (Salenophoridiae); and by the closure of the lower aperture reconstituted into two suckers, the margins of which are produced and folded so as to resemble the leaf-like outgrowths of the next group. In this division (Tetracylidae) four suckers or bothria are developed, but their cavities are extremely shallow and their lips extremely mobile and variable in shape. Hence they are called phyllidia (fig. 4). These organs may be raised on a short stalk, their cavity subdivided into loculi, and provided in some cases with hooks. A peculiar modification of this type of sucker occurs in the Echinobothridiae, in which the axial part of the organ (the rostellum) is elongated and provided with several rows of hooks, so that the phyllidia have partially fused. This elaborate type of sucker appears to be an adaptation to grasp the delicate intestine of sharks and rays. But perhaps the most elaborate sucker is that of the Tetrathyridia (fig. 5), which are also parasitic in Selachians. The four suckers are here united to form two pairs or fused into a single pair. Internal to the suckers are the four complex hooked proglottides. Each consists of an involute hollow tentacle provided with hooklets and capable of intromission within a membranous sheath filled with fluid, elongated muscular bulb. The muscles are arranged in ten or more layers, and are transversely striated. These complex organs have apparently arisen by the increase in depth and differentiation of an accessory sucker such as is borne on the phyllidia of the former group. Lastly, the sucker of the more familiar Taeniidae (Tetractylida) carries a rostellum encircled with hooks and four cup-shaped suckers the margins of which do not project beyond the surface of the body. It seems probable that these suckers are not the true "bothria" but are developed from accessory suckers, the bases of which have disappeared almost completely. In one genus (Polycephalus) the place of a rostellum is taken by a crown of retractile tentacles. This order is almost exclusively parasitic in warm-blooded animals.

The extraordinary variety of form and complication of structure exhibited by the appendages of the sucker are adaptations to fix the worm and to resist the peristaltic action of the intestine in which it lives, and are not connected directly with the absorption of food.

Proglottides.—The segments into which the body is divided vary considerably in number, size, and form. Taenia echinococcus has only three, Echinobothrium four, Balantidophorus three thousand. In every species the segments develop from the sucker distally, and the increase in size with the maturation of the contained female genital organs. When this is reached, growth of the proglottides ceases. As a general rule the ripe proglottides are detached in chains and replaced by others which in their turn become detached, the process being repeated for a year or so until the worm weakens and is cast off. In special cases, however, a proglottis may be detached before attaining full growth, and with its generative organs in an imperfectly developed condition. The minute Taenia (Davainea) proglottina (5 to 1 mm. in length) from the common bowels detaches its four or five segments into the intestine, where they attain a length of 2 mm., and a breadth of 1-25; that is, more than twice the size of the parent. The Cestodes of Elasmobranch fishes offer more convincing examples of independent growth of the proglottides, for these are often set free with only the male organs developed, and each attains twice the size of the parental strobila.

The form of the proglottides is most generally a rhombic or foliaceous figure. The hinder border is often drawn out into mobile processes and hollowed out around the insertion of the next segment. At this neck-like zone the muscles are absent, and across it falls the line of fracture when the proglottis separates from its fellows.

Structure.—The anatomy of the Cestoda differs in only two or three important features from that of Trematodes. In both classes the body is ensheathed by a thick non-cellular cuticle, the deepest layer of which—the subcuticle or basal membrane (fig. 6 b)—is perforated by the branched free ends of the isolated epidermal cells, which have sunk into the body, and by the endings of gland-cells and nerve-cells (fig. 6). The mass of the body consists of richly branched stellate cells—the mesenchyme—and imbedded in this plastic tissue are the nervous, excretory, muscular and generative organs.
TAPEWORMS

The excretory organs consist of flame-cells, richly convoluted canalliculi, and a pair of longitudinal canals leading to the exterior by one or more pores. The muscles are composed of outer circular and inner longitudinal layers, and of branched dorso-ventral fibres. The branched structure of the complex bursa of Laurer is also described in Trematodes (q.v.). In these broad anatomical features both classes agree. But whilst in Trematoda a digestive sac is invariably present except in the so-called larval stages, the Cestodes probably possess a trace of this organ at any stage of their development. They obtain food entirely by osmosis through the striated cuticle, and this food consists not of blood, as in flukes, but of chyle, by which they are bathed in their favourite solutio, the small intestine.

The second point of difference between tapeworms and Trematodes lies in the absence of a definitely demonstrable "brain." The concentration of nervous matter and ganglionic substance at the head-end of Trematodes is of course analogous to that of Planarians, but the similar thickening in the scolex of Cestodes is by no means so certainly to be called by that name. It appears to be an elaboration of the muscle-membrane, and to be at more' or less maintained greater elaboration than the rest of the nervous system because the proximal end is the most specialized and most stimulated portion of the worm. Those Cestodes which possess no very distinct organ of attachment (such, e.g., the Monogenea), show a distinct ganglionic thickening more pronounced at one end of the body than at the other; and as these are forms which have retained more primitive features than the rest, and show closer affinity to the Trematodes, it seems highly probable that the complicated nervous thickening found in the scolex, and often compared with the "brain" of other Platyhelminthes, is a structure sui generis developed with the necessities of the sub-class. In the opinion of several zoologists it marks the tail-end and not the head-end of the worm.

The third important contrast in structural features has also been acquired by the Cestoda Merozoa, namely, the repetition of characters in a metamorphic fashion. The Monogenea are unsegmented; the Ligulida have segmented gonads and gonopores without any trace of somatic metamorphosis except secondary excretory pores in addition to the usual terminal one; the remaining generative organs are unsegmented only in Ancylostoma and in the larval stages; and they show in their later stages repetition of the reproductive organs and of the musculature. In addition, some show duplication of the various kinds of their ducts, so that we find both transverse and longitudinal repetition of these organs, without corresponding multiplication of the nervous ganglia mesenchyma, or excretory opening.

The last structural peculiarity of the group is the absence of the functions of regulation and reparation which are so highly developed in the more primitive Planarians. This statement is quite consistent with the continuous production of new segments at the neck of the scolex. For such a process is analogous to the development of the segments in a Chaetopoda, which is a perfectly distinct phenomenon from the regeneration of new segments to supply the place of a head or tail-end or some other portion that has been lost. The reason of deviation from the normal at the four points is that the Cestode-body by others is not regeneration, for the replacing set has already developed, and in certain cases they can complete their development quite independently after being detached from the host. But the deviation from the normal may be due to the absence of regeneration, however, is the argument from malformation and the phenomenon known as "pseudo-scolex." It has long been known that the proglottides of certain monogeneans are capable of exhibiting a form intermediate to the normal and the pseudo-scolex, and the evidence goes to show that the variation was due to arrested growth or some unusual stress or pressure which, acting upon the young strobila, produced a deformation, and that the proglottides so affected could not regain their normal form. The power of reparation, so conspicuous a feature of Turbellarians, is slight or absent in Cestodes. Moreover, injury to the scolex, or amputation of that organ, reveals the concomitant absence of a regulative mechanism such as that which generally controls the form and fitness of regenerated organs. In such an event, a Cestode cannot replace the injured or severed portion, and the first two or more proglottides merely become detached and produce an appearance known as the pseudo-scolex. The absence of these functions of regeneration and of regulation affords, therefore, corroborative evidence of the highly specialized nature of the group.

Reproduction.—The reproductive organs are usually repeated in each proglottis, and in some families two complete sets of such organs occur in each segment; in a few cases, parts only of the system are duplicated. The structure of these organs in the diagrams (Figs. 7, 8, and 9) is closely akin to that of Trematodes. The chief difference between the reproductive organs of the two classes is the presence in Cestodes of a separate vagina and uterus, which are joined by a single pore, and are thus controlled by an independent pore. The vagina of Cestodes is undoubtedly comparable with the so-called "uterus" of Trematodes, but the nature of the Cestode uterus is not so clear. It has been compared with the canal of Laurer of Trematodes (the vitelline-intestinal duct of the ectoparasitic flukes), but if we take the more primitive Cestodes, and especially *Amphlina*, into consideration we find that they possess, in addition to the uterus, an anterior vagina (usually present in Cestodes) and a posterior one. This last tube is probably the homologue of Laurer's canal (Goto, 8). The single anterior vagina is then comparable with the similarly named duct of ectoparasitic Trematodes, in which group it is either single or double. The accompanying figure will assist this description.

*Life-histories.*—The life-history of Cestodes consists of larval and adult stages, which are usually passed through in different hosts. The egg gives rise in the uterus to a six-hooked embryo, which reaches first in a host in a variety of ways. It may hatch out as a ciliated organism (fig. 8, D) capable of living freely in water for at least a week (Bothriocephalus), which then, if eaten by a stickleback, throws off its ciliated envelope, and creeps by the aid of the hooks through the intestinal wall into the body-cavity of the fish. Here it develops into a larval, or rather an adolescent form. In other cases the infection of the first host is brought about by the ingestion of proglottides or of eggs which are disseminated along with the faeces of the final host and subsequently eaten by herbivorous or omnivorous mammals, insects, worms, molluscs or fish. Man, as well as other mammals, is the intermediate host of the dangerous parasite, *Taenia echinococcus*, in countries where cleanliness is neglected; the pig is the host of *Taenia solium*, and other cases may be seen from the table at the end of this article. The development of the larva from the intermediate to the final host is accomplished by the habits of carnivorous animals. The Elasmo-branches swallow infected molluscs or fish; pike and trout devour smaller fry; birds pick up sticklebacks, insects and worms which often contain *Cestode* larvae; and man lays himself open to infection by eating the uncooked or partially prepared flesh of many animals.

The peculiar feature of the larval history of Cestodes is the development in most cases of a cyst or hydatid on the inner wall of which the scolex is formed by invagination. The cyst is filled with a toxic fluid and may bud off new or daughter scolecis. In this way bladders as large as an orange and containing secondary bladders,
each with a scolex, may arise from a single embryo. We have, in fact, a form of larval multiplication that recalls the development of digenetic Trematodes.

The eggs of Cestodes consist of oval or spherical shells, containing a fertilized ovum surrounded usually by many yolk-cells. The shell is thick, and opacified in some forms; thin, and provided with filaments, in others; in the latter cases it may contain only a few yolk-granules suspended in an albumen-like substance. The development of the six-hooked embryo or "oncho-
with diffuse osmotic feeding in the narrow intestinal canal. The origin of the repetition of the gonads has yet to be investigated.

1. By their presence. This depends largely on the station adopted by the parasite. Cysticercus cellulose may be comparatively innocuous in a muscle or subcutaneous tissue, but most hurtful in the eye or brain. Of all parasites the one which by its mere presence is the most dangerous is the larva of Taenia echinococcus. Its bulk alone (equal to that of an orange) causes serious disturbances, and its choice of the liver, kidneys, lungs, cranial cavity and the bone-cases is the cause of so many deaths. This is probably the most dangerous of all the cestodes. When the cyst be taken by operation, the body fluid is removed, and the proglottides are, if possible, extracted. The cyst is left to become a cysticercus. The second proglottides is therefore, probably the most dangerous of all the cestodes.

2. By their migrations. The migration of the Cestode-larvae through the walls of the intestine into the blood of their host is the cause of grave disease and as such largely by the perforation of the tissues, inflammation of the vessels and peritoneum, and other effects of these immigrants.

3. By feeding in their host. The loss of nutrient fluid caused by the presence of intestinal parasites is probably slight, indeed the sharper appetite that accompanies their presence may be the means of fully compensating for it. The tapeworm, Taenia saginata, throws off eleven proglottides a day during its mature stage, and if this rate of increase were maintained for a year the total weight of its progeny would be about 550 grammes. The broad worm, Dibothriocephalus latius, is similarly estimated to discharge 15 to 20 metres of proglottides, weighing 140 grammes. The loss of substance represented by this growth is probably only of serious account when the host is a young growing animal that needs all available nourishment.

**Fig. 11.** A. A Coerus from the brain of the sheep; the numerous scoleces arise by invaginations of the bladder. B. Echinococcus, showing a & b the formation of secondary bladders, which at c are forming scoleces. At m the ideal mode of origin is shown in order to illustrate the fact that the daughter cyst is comparable to the fore-body of a cysticercus. (From Lankester's Treatise on Zoology, part iv.)

purposes inside the cyst, which is itself an organ comparable to an amnion. On this view, multiple scoleces are, therefore, not buds, but an example of the secondarily developed organization of the embryo, such as occurs in other groups of animals, and is demonstrated by experiment. The evolution of the cestocerid, cysticercus and other forms of larvae is a varied adaptive phenomenon. With regard to the adult worm we have to remember that its two extremities, scolex and terminal proglottis, are different from the intervening region. The terminal or first-formed proglottis is sterile, and contains the primitive and (except in a few genera) the only excretory pore. The excretory tubes, the nervous system, and the parenchyma and integument are continuous from one end of the worm to the other. The repetition of the genitalia is the real mark of the Cestodes, and we can trace the independence of the somatic from the gonidal metamers in such forms as Triaenophorus and others. In fact, the whole history of the Platyhelminths is marked by a great specialization of the reproductive evolutionary history, accomplished by a simple somatic line of evolution. We therefore regard the body of a Cestode as a single organism within which the gonads have become segmented, and the segmentation of the body as a secondary phenomenon associated
in the brain of sheep; allied forms occur mature in the dog and larval in the rabbit. *Echinococcus echinococcus*, a minute form with only three to five proglottids, in dog, wolf, jackal, and fox, stage a multilocular sac (fig. 11 B) with many scolices; found in man, ungulates, carnivores, rodents and monkeys.

**Table of Cestodes found in Man**

<table>
<thead>
<tr>
<th>Species</th>
<th>Larva</th>
<th>Intermediate Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dibothriocephalus latus (L.)</td>
<td>Plerocercoid</td>
<td>Pike, perch, trout, &amp;c.</td>
</tr>
<tr>
<td>Dibothriocephalus cordatus (Leuck.)</td>
<td>Unknown</td>
<td>...</td>
</tr>
<tr>
<td>Diphyllobothrium dracoformis (L.)</td>
<td>Cysticercoid</td>
<td>...</td>
</tr>
<tr>
<td>Diphylidium caninum (L.)</td>
<td>Cysticercoid</td>
<td>Trichodectes canis; <em>Pules serrata</em>; <em>P. trebis</em></td>
</tr>
<tr>
<td>Hymenolepis diminuta (Rud.)</td>
<td>Cysticercus</td>
<td>Asophia farinosa; <em>Anisakis sp. annulipes</em>; Insecta; <em>Acipinnus scurra</em>; <em>Seuratus striatus</em>; Insecta, and myriapods</td>
</tr>
<tr>
<td>T. nana (v. Sieb.)</td>
<td>Cysticercus</td>
<td>Cyclops, <em>Diaphonomyx</em></td>
</tr>
<tr>
<td>Diphyllobothrium lanceolatum (Bloch)</td>
<td>Cysticercoid</td>
<td>...</td>
</tr>
<tr>
<td>Davainea madagascarensis (Dav.)</td>
<td>Unknown</td>
<td>...</td>
</tr>
<tr>
<td>Davainea (?) asiatica</td>
<td>Cysticercoid</td>
<td>Sus scrofa</td>
</tr>
<tr>
<td>Taenia solium (L.)</td>
<td>Cysticercus cellulose</td>
<td>Bos taurus</td>
</tr>
<tr>
<td>T. saginata (Götte)</td>
<td>Cysticercus bovis</td>
<td>Unknown</td>
</tr>
<tr>
<td>T. susanana (v. Linst.)</td>
<td>Cysticercus</td>
<td>Man and domestic cattle, sheep, pig</td>
</tr>
<tr>
<td>T. confusa (Ward)</td>
<td>Echinococcus multilocularis</td>
<td>Echinococcus multilocularis</td>
</tr>
<tr>
<td>T. echinococcus (v. Sieb.)</td>
<td>Echinococcus multilocularis</td>
<td>Echinococcus multilocularis</td>
</tr>
<tr>
<td>T. hominis (v. Linst.)</td>
<td>Unknown</td>
<td>...</td>
</tr>
</tbody>
</table>


**Medicine.**—For practical purposes we have only three varieties of tapeworms to deal with as inhabitants of the human alimentary canal: *Taenia saginata*, the beef tapeworm; *Taenia solium*, the pork tapeworm; and *Dibothriocephalus latus*, the fish tapeworm. The first of these is prevalent in countries where much and imperfectly cooked beef is eaten, and where cattle in their turn are infected by the infection of the tapeworm ova. Comparatively uncommon in Western Europe, the *Taenia saginata* is common in Eastern Europe, Asia and South America. It is calculated that in the North-West Provinces of India 5 per cent. of the cattle are infected with cysticerci owing to the filthy habits of the people. Meeanly beef (that infected with the Cysticercus bovis) is easily recognized. In Berlin the proportion of cattle said to be found infected in inspection in 1893 was 1 in 672. Cold storage for a period of over three weeks is said to kill the cysticercus.

The tapeworm most frequently found in man in Western Europe is the *Taenia solium*, which is constant wherever pork is consumed, and is more common in parts where raw or imperfectly cooked pork is eaten. In North Germany the mature tapeworm was found on post-mortem examination once in every 200 bodies examined, while its embryo, the *Cysticercus cellulosae*, was found in 1 in every 76 bodies. In France, Great Britain and the United States the prevalence is not so great. The

**Dibothriocephalus latus** is not generally found except in districts bordering the Baltic Sea, the districts round the Franco-Swiss lakes and Japan. In St Petersburg 15 per cent. of the inhabitants are said to be affected. The eggs are free in freshwater lakes and rivers, where they enter the bodies of pike, turbot and other fishes, and are thus eaten by man.

In many instances the existence of a tapeworm may not cause any inconvenience to its host, and its presence may be only made known by the presence of the proglottides or mature segments in the stools. In the *Taenia solium* it takes 3 to 33 months from the time of ingestion of the embryo to the formation of the mature segment, but in the *Taenia saginata* the time is only about 60 days. The segments of the *Taenia solium* are usually given off in chains, those of the *Taenia saginata* singly. In a number of cases there are coiled proglottides in the intestine, with diarrhoea, more or less severe anemia, while the *Dibothriocephalus latus* is capable of producing a profound and severe anemia closely resembling pernicious anemia. The knowledge of the presence of the parasite adversely affects meals to be taken on the account of the parasites. All segments passed should be burnt, and they should never be thrown where the embryos may become scattered. Attention should be paid to the careful cooking of meat, so that any parasite present should be killed. Efficient inspection of meat in all abattoirs should eliminate a large proportion of the diseased animals.

In the treatment of a case where the parasite is already present, for days previous to the employment of a vermifuge a light diet should be given and the bowels moved by a purgative. For twelve hours previously to its administration no food should be given, in order that the intestinal tract should be empty so as to expose the tapeworm to the full action of the drug. The dose should be kept in the early morning, and should consist of the liquid extract of felix mas, male fern, one drachm in emulsion or in capsules to be followed in half an hour by a colonel purgative. Castor-oil should not be used as a purgative. Pomegranate root, or, better, the sulphate of pelletierine in dose of 5 grains with an equal quantity of tannic acid, may be used to replace the male fern. In from 50 to 80 per cent. of cases the entire tapeworm is expelled. The head must be carefully searched for by the physician, as should it fall to be brought away the parasite continues to grow, and within a few months the segments again begin to appear.

**TAPIOCA (a native Brazilian word), a farinaceous food substance prepared from cassava starch, the product of the large tuberous roots of the cassava or manioc plant (see Cassava). Cassava starch, separated from the fibrous and nitrogenous constituents of the roots, is spread, while in a moist condition, upon iron plates, and with constant stirring exposed to such heat as causes a partial rupture of the starch granules, which agglomerate into irregular pellets, becoming hard and translucent when cooled. In this condition the starch forms the tapioca of commerce, a light, pleasant and digestible food, much used in puddings and as a thickener for soups.

**TAPIR,** any existing representative of the perissodactyl section of ungulate mammals with five front and three hind toes, and no horn. Tapiurs are an ancient group with many of the original characters of the primitive Ungulates of the Oligocene period, and have undergone but little change since the Miocene. On the fore-feet the four toes correspond to the second, third, fourth and fifth fingers of the human hand. The toes are enclosed in hoofs, and the under surface of the foot rests on a large pad. Tapiurs are massively built, with short stout limbs, elongated head, and the nose and upper lip produced to form a short flexible trunk.

The five existing species may be grouped into two sections, the distinctive characters of which are only recognizable in the adult. (A) With a great anterior prolongation of the base; (B) With the bony partition not extending farther than the nasal bones (Tapirus proper). This includes three species, *T. indicus*, the largest of the genus, from the Malay Peninsula (as far north as Tayov and Mergul), Sumatra
and Borneo, distinguished by its peculiar coloration, the head, neck, fore and hind limbs being glossy black, and the inter-
mediate part of the body white, the height at the shoulder from 3 ft. to 3 ft. 6 ins., and 4 ins. higher at the rump; T. terrestris, the common tapir of the forests and lowlands of Brazil and Paraguay; and T. roulensi, the Pinchacue tapir of the high regions of the Andes. All the American species are of a nearly uniform dark brown or blackish colour when adult; but it is a curious circumstance that when young (and in this the Malay species conforms with the others) they are conse-
spicuously marked with spots and longitudinal stripes of white or fawn colour on a darker ground.

In habits all tapirs appear to be very similar. They are solitary, nocturnal, shy and inoffensive, chiefly frequenting the depths of shady forests and the neighbourhood of water, to which they frequently resort for the purpose of bathing, and in which they often take refuge when pursued. They feed on various vegetable substances, as shoots of trees and bushes, buds and leaves, and are hunted by the natives of the lands in which they live for the sake of their hides and flesh.

The singular fact of the existence of animals so closely allied as the Malayan and the American tapirs in such distant regions of the earth and in no intervening places is accounted for by the geological history of the race, for the tapirs once had a very wide distribution. There is no proof of their having lived in the Oligocene epoch, but in deposits of Miocene and Pliocene date remains undistinguishable generic and perhaps speci-
fically from the modern tapirs (though named T. priscus, T. arvernensis, &c.) have been found in France, Germany and in the Red Crag of Suffolk. Tapirs appear, however, to have be come extinct in Europe before the Pleistocene period, as none of their bones or teeth have been found in any of the caves or alluvial deposits in which those of elephants, rhino-
ceroses and hippopotamuses occur in abundance; but in other regions their distribution at this age was far wider than at present, as they are known to have extended eastward to China (T. sinensis) and westwards over the greater part of the southern United States of America, from South Carolina to California. Thus there is no difficulty in tracing the common origin in the Miocene tapirs of Europe of the now widely separated American and Asiatic species. It is, moreover, interesting to observe how slight an amount of variation has taken place in forms isolated during such an enormous time.

See PERISSODACTYLA. (W. H. F.; R. L.*).

TAPE—TAR

American Tapir (Tapirus).

It is a tidal river, but is only navigable by vessels of small

and Portugal. It is now deserted, owing to sitting at the outflow of the river. The waters of the Tapiti are nowhere

used for irrigation.

Wood Tar.—Wood tar, known also as Archangel tar, is principally prepared in the great pine forests of central and northern Russia, Finland and Sweden. The material chiefly employed is the resinous stumps and roots of the Scotch fir (Pinus sylvestris) and the Siberian larch (Larix sibirica), with other less common fir-tree roots. A large amount of tar is also prepared from the roots of the swamp pine (P. australis) in North and South Carolina, Georgia and Alabama, in the United States. In the distillation of wood a series of products, including tars, creosines, acids, acetic, wood spirit (see Methyl Alcohol) and charcoal may be ob-
tained, and any of these may be the primary object of the operation.

The carbonization of wood can be effected in two ways: (1) by stacking and firing as in the manufacture of charcoal: this method is very wasteful as it is impossible to recover the valuable by-
products; and (2) by distilling from retorts, ovens or kilns (after

the manner of coke production from coal): this method is more economical as it leads to the isolation of all the by-products. The retorts are horizontal or of the horizontal and inverse form, or of any available fuel, or by the inflammable gases and less valuable

grades of tar obtained in previous operations. The condensing

plant is also of variable design; a common pattern consists of a

connected series of slightly inclined copper pipes contained in a

rectangular tank of water (see Coal Tar). After settling the

distillate separates into three layers: the lowest consists chiefly

tar and creosote oils with a little acetic acid; the middle layer

contains the water, containing pyrolytic, or, with a little tarry matter; whilst the upper consists of light hydro-
carbons. The tarry layer is run off by means of a cock near the

bottom of the tank, and is then distilled from retorts resembling coal tar stills. At first, between 110° and 120° C., water and acetic acid comes over; then, between 120°—230° C., the heavy or creosote oils; the residuum in the still is wood pitch, which finds application in the manufacture of varnishes, waterproofing, resins, felts, etc. The

crude tar and pitch are also largely used as protective coatings for

woodwork exposed to atmospheric conditions. The heavy oils on

further fractional distillation yield more acetic acid, and then mix-
tures of carabolic acid, creosote, &c.

Wood tar is a semi-fluid substance, of a dark brown or black

colour, with a strong pungent odour and a sharp taste. Owing to

the presence of acetic acid, it has an acid reaction; it is soluble in

that acid, as well as in alcohol and the fixed and essential oils, &c. Some varieties of tar have a granular appearance, from the presence of minute crystals of pyrocatechin, which dissolve and disappear on heating the substance.

See P Dumesny and J. Noyer, Wood Products, Distillates and

Extracts (Engl. trans. 1908).

Wood tar is used in medicine under the name of Pice liquida. Its preparation unguentum piceous liquidae is composed of

wood tar and yellow beeswax. Externally tar is a valuable stimu-

lating dressing in scaly skin diseases, such as psoriasis and chronic eczema. Internally wood tar is a popular remedy as an expectorant in subacute and chronic bronchitis. It is usually given as tar water, 1 part of wood tar being stirred into 4 parts of water and filtered. Given internally tar is likely to upset the digestion; taken in large quan-
tities it causes pain and vomiting and dark urine, symptoms similar to carabolic acid poisoning.

Coal tar is used in medicine as Pice liquida preparata. From it is

made Liquor carbonis detergens, a proprietary preparation, owes its properties chiefly to the contained phenol. It is used in water as a lotion for skin diseases, and also in an inhaler in the treatment of whooping-cough, croup and bronchitis.
TARA, VICOUNTS AND BARONS—TARANTO

The 1st Viscount Tara was Thomas Preston (1585–1632), a descendant of Sir Robert de Preston, who in 1363 purchased the lands of Gormston, Co. Meath, and who was keeper of the Great Seal in Ireland some years later. Sir Robert’s great-grandson, Robert Preston, was Artúr and Vias’s great-grandson in records; and the connection of the great-grandson was Christopher, 4th Viscount Gormston (d. 1590), whose second son was Thomas Preston, Viscount Tara. The latter was in the same Irish regiment in the Spanish service as Owen Roe O’Neill, and distinguished himself in the defence of Louise against the French and Dutch in 1635. Between him and Owen Roe O’Neill there was from the first intense jealousy. Preston, who was appointed general of Leinster, took a prominent and not unsuccessful part in the war of factions that raged intermittently in Ireland from 1642 to 1654. In 1650 Charles II., while in exile created him Viscount Tara; and after his capture from Ireland in 1652 he offered his services to Charles in Paris, where he died in October 1655. His wife was a Flemish lady of rank, by whom he had several children, one of his daughters being the second wife of Sir Phelim O’Neill. His son Anthony succeeded him as 2nd Viscount Tara, a title that became extinct on the death of Thomas, 3rd Viscount, in 1674.

In 1691 Meinhard de Schönberg, 3rd duke of Schönberg, second son of William III.’s famous general, was created Baron Tara, earl of Bangor, and duke of Leinster, in the peerage of Ireland, all of which titles became extinct at his death without heirs male in 1758. The title of Baron Tara was again revived in 1800 in favour of John Preston of Bellinter, Co. Meath, as a reward for his vote in favour of the Union in the Irish House of Commons, in which he sat as member for Navan. At his death without issue in 1821, the peerage became extinct.

TARA, a village of Co. Meath, is celebrated for the Hill of Tara, well known through Thomas Moore’s ballad, and for many centuries a royal residence and the scene of great meetings of the people. The hill, upon which five highroads converged from different parts of Ireland, is about 510 ft. in length, and by which is included an ancient hill-fort. On its summit or flank are six raths or circular earthworks, the largest of which, called the king’s rath (rath-na-ríogh) encloses other works, among which is the forradh or meeting-place, a flat-topped mound. On this (but not in its original position) stands a pillar stone, which has been held to be the stone of destiny on which the Irish kings were crowned. An oblong enclosure, 750 ft. in length by 46 ft. in breadth, formed of earthworks, with entrances at intervals on each side, represents the banquetting hall. In the middle of the 3rd century A.D. King Cormac Mac Art, about whom there are many traditions, was buried there; and Tara, is said to have founded here schools of military science, law and literature. In the time of St Patrick Tara is indicated as the chief seat of druidism and idolatry, and in or about 560 it was abandoned as a royal residence, having fallen under the curse of St Ruadan. In 980 the Danish power of Meath was overthrown in battle here; in 1708 a severe defeat of the insurgents took place here (26th of May); and in 1843 the hill of Tara, as a site sacred to Irish traditions, was the scene of one of Daniel O’Connell’s mass meetings in support of the repeal of the legislative union (15th of August).

TARA, or Terea (i.e. “moist land”), is the name of the submontane strip of marshy jungle stretching beneath the lower ranges of the Himalaya in northern India. This strip may be said to extend roughly from the Jumna river on the west to the Brahmaputra on the east, though the term is now officially confined to a subdivision of Naini Tal district in the United Provinces: area 776 sq. m. population (1901) 118,422.

At its northern edge, where the wide tropical forest of the Bhabar ends, a series of springs burst from the surface, and these, increasing and uniting in their progress, form the numerous streams that intersect the Taraí. The Deoha is the great river of the Taraí proper, and is navigable at Pilibhit. Elephants, tigers, bears, leopards and other wild animals are found. Everywhere it is most unhealthy, and inhabited only by tribes who seem proof against malaria. A large portion lies within Nepal.

TARANTO (anc. Tarentum, q.e.), a seaport of Apulia, Italy, in the province of Lecce, 36 m. from that town W. by N. by road, and 68 m. by rail (44 m. W. by S. from Brindisi). Pop. (1901) 50,592 (town); 60,331 (commune). The city proper is situated on a rocky island 56 ft. above sea-level, which in ancient times was a peninsula, the isthmus on the west having been cut through by Ferdinand I. of Aragon. This island separates the Gulf of Taranto from the deep inlet of the Mare Piccolo, and is sheltered by two other flat islands, San Pietro and San Paolo; the latter is occupied by a lighthouse. This rock is the site of the citadel of the ancient town; its population is confined within small houses and narrow streets. The Strada Garibaldi along which the Mare Piccolo is inhabited by fishermens whose language retains traces of Greek. The cathedral, dedicated to Sant Cataldo, an Irish bishop, dating from the 11th century, has externally some remains of Saracen Gothic; internally it has been completely modernized, and the shrine of the patron saint has been termed “an orgy of rococo.” Below it is an early Christian basilica excavated in 1901. There is a fine museum in the former convent of San Pasquale containing antiquities unearthed in the neighbourhood. Adjacent is the Palazzo degli Uffizi, completed in 1856, containing various public and religious works. The palace of Drogo of Villehardouin was burned in 1799. The city of Taranto was recognized by the Italian government, and in 1864 a Naval Commission designated it as third maritime arsenal after Spezia and Venice. Work was begun on the arsenal in 1883 and continued as the finances of the state permitted; it is capable of turning out new warships and of executing repairs of all kinds for the Mediterranean squadron. The arsenal extends for a mile and a half along the southern coast of the Mare Piccolo, which constitutes its chief basin. The receiving-dock and the anchorage for torpedo boats, with its pier and landing-stage, 450 ft. in length, 120 ft. wide and 37 ft. deep, is divided into two compartments, each capable of containing a full-sized battleship, and can be pumped dry in eight hours by two 600 h.p. steam pumps. The Mare Grande is connected with the Mare Piccolo by a channel 875 yds. long, large enough to permit the passage of the largest battleship; the channel was bridged in 1887 by an iron swivel bridge, which when open leaves a passage way 160 ft. broad. In its present form the Mare Piccolo provides a well-sheltered anchorage, 36 ft. deep and 6325 acres in extent. The commercial harbour lies S. of the railway station outside the Mare Piccolo.

In 1697 Taranto was entirely destroyed by the Baracans, but rebuilt in 1697 by Nicephorus Phocas, to whom is due the

His diwan has been published in W. Ahlwardt’s The Divans of the Six Ancient Arabic Poets (London, 1870). Some of his poems have been translated into Latin with notes by B. Vandenhoff (Berlin, 1895).
construction of the bridge over the channel to the N.W. of the town, and of the aqueduct which passes over it. The town was taken by Robert Guiscard in 1063. His brother Bohemond became prince of the Terra d'Otranto, with his capital here. After his death Roger II. of Sicily gave it to his son William the Bad. The emperor Frederick II. erected a castle (Rocca Imperiale) at the highest point of the city. In 1301 Philip, the son of Charles II. of Anjou, became prince of Taranto. The castle dates from the Aragonese period. The tarantula (see below), inhabits the neighbourhood of Taranto. The wild dance, called tarantella, was supposed, by causing perspiration, to drive out the poison of the bite.

(T. As.)

**TARANTULA**, strictly speaking, a large spider (*Lycosa tarantula*), which takes its name from the town of Taranto (Tarentum) in Apulia, near which it occurs and where it was formerly believed to be the cause of the malady known as "tarantism." This spider belongs to the family Aviculariidae, and has numerous allies, equaling or surpassing it in size, in various parts of the world, the genus *Lycosa* being almost cosmopolitan in distribution. The tarantula, like all its allies, spins no web as a safety net, but catches its prey by activity and speed of foot. It lives on dry, well-drained ground, and digs a deep burrow lined with silk to prevent the infall of loose particles of soil. In the winter it covers the orifice of its dormant underground burrow with a layer of silk, and lies in it until the return of spring. It also uses the burrow as a safe retreat during moulting and guards its cocoon and young in its depths. It lives for several years. The male is approximately the same size as the female, but in neither sex does the length of the body surpass three-quarters of an inch. Like all spiders, the tarantula possesses poison glands in its jaws, but there is not a particle of trustworthy evidence that the secretion of these glands is more virulent than that of other spiders of the same size, and the medieval belief that the bite of the spider gave rise to tarantism has long been abandoned.

According to traditional accounts the first symptom of this disorder was usually a state of depression and lethargy. From this the sufferer could only be roused by music, which excited an overpowering desire to dance until the performer fell to the ground bathed in profuse perspiration, when the cure, at all events for the time, was supposed to be effected. This mania attacked both men and women, young and old alike, women being more susceptible than men. It was also considered to be highly infectious and to spread rapidly from person to person until whole areas were affected. The name *tarantella*, in use at the present time, appears to have been borrowed by the Italian poet Dante from the Tarantula, which was still in vogue in Southern Italy and also to musical pieces resembling in their stimulating measures those that were necessary to rouse to activity the sufferer from tarantism in the middle ages. In recent times the term tarantula has been applied indiscriminately to many different kinds of large spiders in no way related to *Lycosa tarantula*; and to at least one Arachnid belonging to a distinct order. In most parts of America, for example, where English is spoken, species of Aviculariidae, or "bird-eating" spiders of various genera, are invariably called tarantulas. These spiders are very much larger and more venomous than the largest of the Lycosidae, and in the Southern states of North America the species of wasps that destroy them have been called tarantula hawks.

In Queensland, one of the largest spider species, known as *Holconia immanis*, a member of the family Clubionidae, bears the name tarantula; and in Egypt it was a common practice of the British soldiers to put together scorpions and tarantulas, the latter in this instance being specimens of the large and formidable desert-burrowing *Arachnoides Galeodes lucasii*, a member of the order Solifugae. Similarly in South Africa species of the genus Solpuga, another member of the Solifugae, were employed for the same purpose under the name tarantula. Finally the name *Tarantula*, in a scientific and systematic sense, was first given by Fabricius to a Ceylonese species of amblypygous Pedipalpi, still sometimes quoted as *Phrynus lunatus*. (R. I. P.)

**TARAPACÁ**, a northern province of Chile, bounded N. by Tacna, E. by Bolivia, S. by Antofagasta, and W. by the Pacific. Area 18,131 sq. m. Pop. (1893) 89,751; (1902, estimated) 101,105. It is part of the rainless desert region of the Pacific mountain of South America, units of Swell cotton variety, and at the base of the Andes where streams flow down into the sands and are lost. In some of these places there is vegetation and water enough to support small settlements. The wealth of Tarapacá is in its immense deposits of nitrate of soda (found on the Pampa de Tamarugal, a broad desert plateau between the coast range and the Andes, which has an elevation of about 3000 ft.). The mining and preparation of nitrate of soda for export maintain a large population and engage an immense amount of capital. Silver is mined in the vicinity of Iquique, the capital. The silver is sent to Arica for refining, and Patillos, from which "nitrate railways" run inland to the deposits. Tarapacá was ceded to Chile by Peru after the war of 1879-1883, and was organized as a province in 1884.

**TARARE**, a town of east-central France, in the department of Rhone, on the Turdine, 28 m. W.N.W. of Lyons by rail. Pop. (1906) 11,643. It is the centre of a region engaged in the production of muslins, tarlets, embroidery and silk-plush, and in printing, bleaching and other subsidiary processes. Till 1756, when the manufacture of muslins was introduced from Switzerland, the town lay unknown among the Beaujolais mountains of South America, a town of Swell cotton variety, and in the 18th century; at the beginning of the 19th figured stuffs, open-works and zephyrs were first produced. The manufacture of silk-plush for hats and machine-made velvets was set up towards the end of the 19th century. A busy trade is carried on in corn, cattle, linen, hemp, thread and leather.

**TARASCON**, a town of south-eastern France, in the department of Bouches-du-Rhone, 62 m. N.W. of Marseille by rail. Pop. (1906) town, 54,477; commune, 89,722. Tarascon is situated on the left bank of the Rhone opposite Beaucar, with which it is connected by a railway bridge and a suspension bridge. The church of St Martha, built in 1187-97 on the ruins of a Roman temple and rebuilt in 1379-1449, has a Gothic spire, and many interesting pictures in the interior. Of the original building there remain a porch, and a side portal flanked by marble columns with capitals like those of St Trophimus at Arles. The former leads to the crypt, where are the tombs of St Martha (1658), Jean de Gossa, governor of Provence under King René, and Louis II., king of Provence. The castle, picturesquely situated on a rock, was begun by Count Louis II., the part of the present time, again built by King Robert in the 13th. It contains a turret stair and a chapel entrance, which are charming examples of 13th-century architecture, and fine wooden ceilings. The building is now used as a prison. The hôtel-de-ville dates from the 17th century. The civil court of the arrondissement of Arles is situated at Tarascon, which also possesses a commercial court, and fine cavalry barracks. The so-called Arles sausages are made here, and there is trade in fruit and early vegetables. In Tartarin de Tarascon Alphonse Daudet has satirized the provincial life of Tarascon. Its uneventfulness

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*Galeodes lucasii*, an Arachnid of the order Solifugae, commonly but wrongly called tarantula in Egypt.

This burrow with a layer of silk, and lies in it until the return of spring. It also uses the burrow as a safe retreat during moulting and guards its cocoon and young in its depths. It lives for several years. The male is approximately the same size as the female, but in neither sex does the length of the body surpass three-quarters of an inch. Like all spiders, the tarantula possesses poison glands in its jaws, but there is not a particle of trustworthy evidence that the secretion of these glands is more virulent than that of other spiders of the same size, and the medieval belief that the bite of the spider gave rise to tarantism has long been abandoned.
is varied by the fair of Beaucarne, and it used to be the scene of the two fêtes of La Tarasque, the latter in celebration of St Martha’s deliverance of the town from a legendary monster of that name. King René presided in 1469, and grand exhibitions of costume and strange ceremonies take place during the two days of the festival. Tarascon was originally a settlement of the Massaliots, built on an island of the Rhone.

The medieval castle, where Pope Urban II. lived in 1096, was built after the return of Roman rule but in 1554 the town was given to the craft of costume. In 1591 Tarascon preserved the municipal institutions granted them by the Romans, and of the absolute power claimed by the counts of Provence they only recognized the rights of sovereignty.

TARASCON played a bloody part in the White Terror of 1615.

TARAXACUM, the name usually applied in medical practice to the common dandelion (q.v.).

TARBELL, EDMUND C. (1862– ), American artist, was born at West Groton, Mass., on the 26th of April 1862. He was a pupil of the schools of the Boston Museum of Fine Arts and of Boulanger and Lefebvre, Paris, and became a distinguishued painter of the landscape, of the figure, and of portraits, winning various important prizes and medals at exhibitions. In 1906 he was elected a National Academician, besides being a member of the Ten American Painters, and he became instructor of painting in the Boston Museum of Fine Arts.

TARBERT, a fishing village at the head of East Loch Tarbert, an arm of the sea on the west shore of the mouth of Loch Fyne, Argyllshire, Scotland. Pop. (1901) 1697. The harbour, though it has a narrow entrance, is absolutely safe and can shelter the whole of the Loch Fyne fishing fleet. The pier for the passenger steamers that call here is about ½ m. from the village. The coast of the bay is rocky and the cliffs are fringed with young firs, the village itself being quite a pretty place.

The herring fishery— including a large trade in curing— forms the only industry. The parish church occupies a fine situation. Overlooking the harbour are the ruins of a castle built by Robert Bruce in 1326. The isthmus connecting the districts of Knapdale and Kintyre is little more than one mile wide, and boats used once to be dragged across to the head of West Loch Tarbert, a narrow sea Loch nearly ten miles long.

A proposal to cut a canal across to shorten the sail to Islay and Jura has never progressed further.

TARBES, a town of south-western France, capital of the department of Hautes-Pyrénées, 98 m. W.S.W. of Toulouse on the Southern railway. Pop. (1906) town, 20,866; commune, 25,869. Tarbes is situated in a beautiful and fertile plain, in full view of the Pyrenees, on the left bank of the Adour, streams from which are conducted through all parts of the town. The lines of the Southern railway from Morcenx to Bagnères-de-Bigorre and Lourdes and from Toulouse to Bayonne cross here.

Chief among the many open spaces is the Jardin Massey (35 acres), given to his native town by a director of the gardens of Versailles and containing a museum of sculptures, paintings and antiquities. Near a small lake stands a cloister (15th century) transferred from the abbey of St Sever-de-Rustan, 14 m. N.E. of Tarbes, and a bust of Théophile Gautier, a native of Tarbes. The architecture of the cathedral, Notre Dame de la Sède, is heavy and unpleasing, but the cupola of the transept (14th century), the modern glass in the 12th-century apse, and a rose window of the 13th century, in the north transept, are noticed. There is also a modernized Carmelite church originally built in the 13th century. Tarbes is a well-known centre for the breeding of Anglo-Arabian horses, much used by light cavalry; and its stud is the most important in the south of France.

The industrial establishments include tanneries, tile-works, saw-mills and turners’ shops. There are important fairs and markets. Well-known race-meetings are held on the Laloubère course.

Under the Roman dominion Tarva, which was about 11 m. S.E. of the present town of Tarbes, was the capital of the Bigerriones, one of the states of Novempopulania. The bishopric of Tarbes dates from the 5th century, and in feudal times its bishops held the chief temporal authority, that of

TARIGRADA, apparently Arthropodous animals whose relationship to the great classes of this sub-kingdom is masked by degenerative modification. They are microscopic in size and live in damp moss or water. The body is elongated and furnished with four pairs of short, unjointed, stump-like legs, each terminated by a pair of claws. The legs of the posterior pair project from the hinder extremity of the body and the anus opens between them. The mouth, situated at the opposite end and armed with a pair of stylets, leads into an oesophagus, into which the ducts of a pair of so-called salivary glands open. Behind this point there is a muscular pharynx or gizzard, which communicates with the wide intestinal tract. No organs of circulation or respiration are known; but the nervous system is well developed, and consists of a pair of ganglia corresponding with the limbs and connected by longitudinal commissural chords. Anteriorly these chords embrace the oesophagus and unite with the cerebral mass which innervates the pair of eyes when present. The sexes are not distinct, the sexual organs being represented by a pair of testes and a single ovary, which open together into the posterior end of the alimentary canal. The Tarigrada have been regarded as degenerate Acari largely on account of their possessing four pairs of ambulatory limbs, which is considered

TARDIGRADE is the counts of Bigorre, of which Tarbes was capital, being limited to the quarter of the town where their castle was built. The English held the town from 1360 to 1406. In 1596 Tarbes was burnt by Gabriel, count of Montgomery, and the inhabitants were driven out. This happened a second time, but in August 1750 the peace of St Germain allowed them to return. Subsequently Tarbes was several times taken and re-taken, and a number of the inhabitants of Bigorre were forced to take refuge in the mountains of the Pyrenees, to which the whole of the League were finally expelled. The English, under Wellington, gained a victory over the French near Tarbes in 1814.

TARBUSH (Arab tarbush), the close-fitting, flat-topped and brimless cap, in shape like a truncated cone, made of felt or cloth, worn by Mahomedan men throughout the East either as a separate headgear or forming the inner part of the turban. It is worn as the badge of a Turkish subject in Turkey and Egypt, where it is red in colour with a black or blue silk tassel. It is the same as the "fez" (see the plate illustrations to INDIA: § Turkish Costume).
to be an Arachnidian characteristic. But they cannot be affiliated with this order on account of the total suppression of the abdomen, of their hermaphroditism and of the communication that exists between the generative organs and the alimentary tract. These last characteristics also separate them essentially from the Pycnogonida, some members of which resemble them to a certain extent in having only four pairs of limbs, no gnathites, no respiratory organs, a ganglionated ventral nervous system, and the abdomen reduced to a mere rudiment projecting between the last pair of legs.

Several genera and species of Tardigrada have been described, perhaps the best known being Macrobiotus schultessii and Milnesium tardigradum.

(T. R. P.)

TARE AND TRET. In commerce, allowances or deductions. Tare is an allowance made from the gross weight of goods for the box, bag or other wrapping in which the goods are packed. It may be real, i.e., representing the actual weight of the wrapping; customary, when a uniform or established rate is allowed; average, when one or two pounds of the gross weight are deducted; and the mean or average of the whole taken; or super-tare, an additional allowance when the package exceeds a certain weight. Tret is an allowance of 4 lb. in every 100 lb. of weight, made as compensation for loss by waste. "Tare" comes through the Fr. tare, cf. Sp. tara, from Arab. fahrə, fahr, throwing, casting—the word meant originally loss, that which is thrown away; "tret" is an adaptation of Fr. traite, Lat. trahere, to draw, and meant a draught, transportation, also a payment on exports, an allowance on exportation.

Thrace, a Greek city of southern Italy (mod. Taranto, E.), situated on the N. coast of the gulf of the same name, on a rocky islet at the entrance to the only secure harbour in it. It was a Spartan colony founded about the close of the 8th century B.C. (Jerome gives the date 708) to relieve the parent state of a part of its population which did not possess, but claimed to enjoy, full civic rights. Legend represents these Parthenia (so they are called) as Spartans with a stain on their birth, but the accounts are neither clear nor consistent, and the facts that underlie them have not been clearly set up. The Greeks were not the first settlers on the peninsula: excavations have brought to light a long series of a parish air was settlement. To the Greeks Taras was a mythical hero, son of Neptune, and he is sometimes confounded with the oeeid (official founder) of the colony, Phalanthus. Situated in a fertile district, especially famous for olives and sheep, with an admirable harbour, great fisheries and prosperous manufactures of wool, purple and pottery, Tarentum grew in power and wealth and extended its domain inland. Even a great defeat by the natives in 473 B.C., when more Greeks fell than in any battle known to Herodotus, did not break its prosperity, though it led to a change of government from aristocracy to democracy. A feud with the Thuringians for the district of the Siris was settled in 432 by the joint foundation of Heraclia, which, however, was regarded as a Tarentine colony. In the 4th century B.C. Tarentum was the first city of Magna Graecia, and its wealth and artistic culture at this time are amply attested by its rich and splendid coins; the gold pieces in particular (mainly later than 360) are perhaps the most beautiful ever struck by Greeks (see Numismatics). In the second half of the century Tarentum was in constant war with the Lucanians, and did not hold its ground without the aid of Spartan and Epipole condottieri. Tarentum, however, with Rome (282) in consequence of the injudicious attack of the mob on the Roman fleet in the harbour of Tarentum and on the Roman garrison at Thurii, the expedition of Pyrrhus, whom Tarentum summoned to its aid, and at length, in 272, the surrender of the city by its Epipole garrison. Tarentum retained nominal liberty as an ally of Rome. In the Second Punic War it went over to Hannibal in 212, and suffered severely when it was retaken and plundered by Fabius (209), who sold thirty thousand citizens as slaves. After this it fell into decay, but revived again after receiving a colony in 123 B.C.

Large heaps of the shells of the murex, or purple-yielding mussel, were visible on the shore before the extension of the arsenal.

which received the name of Neptunia. In the time of Augustus it was essentially Greek and a favourite place of resort (Horace, Od., iii. 5, 53), but it declined afterwards. Belisarius ordered it to be re-fortified, but it was soon taken by Totila, who made it his treasure store. After his defeat by Narses, it was sold to the Byzantine Empire by its Gothic governor.

One of the most interesting discoveries of recent years has been that of a terramara on the so-called Scoglio del Tonnio on the N.W. of the town, which in its type and in the character of the objects found there, is exactly identical with the terramara of the Po valley. It seems, however, to be an isolated colony, and not to prove a parallel development in north and south Italy (T. E. Peet in Papers of the British School at Rome, iv., 1907, 285). Almost the only relic of any building of the Greek city is a part of a Doric temple on the island—which the modern town occupies—two fluted columns, with a lower diameter of 6 ft., and a height of 25 ft., and some fragments of the entablature, belonging probably to the beginning of the 6th century B.C. of the earliest extant Doric temples. The condition of the site was, however, different in ancient times; the rock occupied by the modern town was, it is true, the citadel, but was connected with the land to the west by an isthmus, which was only cut through by Ferdinand I. of Aragon; and it was also a good deal less extensive. The line of the walls which defended the city on the (land) side has been traced, and a few remains of well-cut blocks, with Greek masons' marks, still exist. In the centre of the Agora was the huge bronze Zeus by Lysippos, and facing on to it was the garrison (or Porch) with pictorial representations of the life of Phalanthus, and the foundation of the city, and the museum. There was also a fine gymnasium and other buildings mentioned by classical writers. Strabo's description of the site (vi. 3, 1) is a good one. Of all these structures no traces remain. The Roman amphitheatre, on the other hand, and remains of Roman baths by the seashore, have been found; the former perhaps occupies the site of the ancient theatre, in which the Roman ambassador was received in 281 B.C.

Three fine mosaics of the Roman period were found in the remains of a house in 1859, and transported to the museum (A. d'Avou, Monumenti de' Musei Venetianii, Naples, 1865, 239). A fine silver jug and drinking-bowl, found in Tarentum in 1880 (now in Triest) are illustrated by A. Puschi and F. Winter in Jahreshefte des österr. Arch. Instituts, v (1902) 112. Other silver vessels found in 1896 are in the important local museum (G. Patrini in Notizie degli scavi, 1896, 376), and at Bari (M. Mayet, ibid., 1896, 547). All seem to belong to the 4th century B.C. To the N.W. of the town along the Massafia road, neolithic tombs and a fine Greek hypogeum in masonry were discovered in 1900.

(T. A.)

TARENTUM, a borough of Allegheny county, Pennsylvania, U.S.A., on the Allegheny river, about 20 m. N.E. of Pittsburgh. Pop. (1890) 4627; (1900) 5472 (1753 being foreign-born); (1910) 7414. Tarentum is served by the Pennsylvania railway and by an electric line connecting with Pittsburgh. Among manufactures are plate glass and bottles, table ware, paper, bricks, iron and steel articles, and steel sheets and billets. Coal mining is an important industry, and the borough is supplied with natural gas. Tarentum was first settled in 1766, was laid out in 1829 at the direction of Henry Marie Brackenridge (1786-1871), who by marriage had come into possession of the site, and was incorporated as a borough in 1842. The first glass manufactory was established in 1872.

TARGET, GUI JEAN BAPTISTE (1733-1807), French lawyer and politician, was born in Paris on the 17th of December 1733.

3 Brackenridge was a prominent lawyer, the son of Pittsburgh, who practised in Maryland, Missouri and Louisiana, was district judge in Louisiana in 1812-1814, secretary of the U.S. commission sent to South America in 1817, U.S. judge for the western district of Florida from 1821 to 1825, when he returned to Pennsyl-

vania, and the author of a Voyage to South America in 1817-1818 (1829), a History of the Late War between the United States and Great Britain (1817), Recollections of Persons and Places in the West (1834), and a History of the Western Insurrection (1859).
TARGET—TARGUM

He acquired a great reputation as a lawyer, less by practice in the courts than in a consultative capacity. He strenuously opposed the "parlement Maupeou," devised by the Chancellor Maupeou to replace the old judiciary bodies, and refused to plead before it. He was counsel for the cardinal de Rohan in the affair of the Diamond Necklace (q.v.). In 1785 he was elected to the French Academy. In 1789 he was returned as one of the deputies of the Third Estate in Paris to the states-general, where he supported all such revolutionary measures as the union of the orders, the suspensive veto, the civil constitution of the clergy, &c. His excessive obesity, which in the Constituent Assembly made him the butt of the Royalists, had produced a prostrating effect in the Assembly, and his "compromise" position was lost in him by 1789, and when Louis XVI invited him to undertake his defence he excused himself on this ground. At the same time he published in 1762 some Observations on extenuation of the action of the king, from the constitutional point of view, which in the circumstances of the time argued much courage. For the rest, he took no part in public affairs during the Terror. Under the Directory he was made a member of the Institute (1796) and of the Court of Cassation (1798). He lived to collabo-

rate in the earlier stages of the new criminal code. Among his writings may be mentioned a paper on the grain trade (1779) and a Mémoire sur les Juges des Provinces en France (1787) in which he pleaded for the restoration of civil rights to the Protestants.


TARGET, a mark to shoot at, so called from its resemblance in shape to the "targe" or small round shield, particularly the round wood and leather buckler, with metal bosses, and long spike protruding from the central boss, which was carried by Highland clans; at the back was a leather sleeve in which the left arm was inserted. In the 17th century, as body armour ceased to be used, the infantry soldier often carried a light shield of various forms which was known as a "target," which is a diminutive of targe; such soldiers were known as "targettears." "Targe" is a word that has been the subject of much etymological discussion. On the one hand is found the O.E. targe, with hard g, a shield, cf. Icel. targe, shield, target, and O.H. Ger. sorga, frame, side, border; on the other is Fr. targe, Sp. and Port. targa, Ital. targa, buckler, shield. The sound of the targe is preserved in various stages of the Romance tongues, and Port., is found adarga, a square target or buckler, which is an Arab word, al darkat or darakot, a leather shield. The O.E. and Icel. words can hardly have come from an Arab source, and the relation between the two words is an etymological puzzle (see Skeat, Etym. Dict., 1910). The target as a mark to shoot at is, for archery, a circular canvas-covered frame stuffed with straw and marked with concentric rings surrounding the centre or bull's-eye. For shooting with the rifle the target is usually square.

In the days of the smooth-bore musket, and for many years after the introduction of small arms of precision, the targets used in musketry training were of a "match" and not a "service" character. The target was white with a black bull's-eye (counting 5 points) and two rings, invisible to the fire, called the "inner" and the "magpie," and scoring 4 and 3; the rest of the target was called the "outer" and counted 2 points. This system was the basis of all match shooting, whether with match or service rifles, and (with the trifling difference that the bull counted 4, the inner 3 and the magpie and outer alike 2) it was followed in military range practice. For collective fire regular rows of black silhouettes on white screens were employed. These were a compromise between bull's-eye and service targets which possessed the virtues of neither. But after the S. African war bull's-eye practices were eliminated from the musketry course of the British army, and in the musketry regulations of 1909 they were restricted to the earliest stages of recruits' training and trained soldiers' "refreshers" courses. The use of the bull's-eye to-day is to teach the soldier to shoot uniformly, that is, to "group" his shots closely. The position of his shot, buy with reference to the bull's-eye does not matter; if his group is comprised within a 6 or 12-inch ring (at 100 yards range) he is passed on to more advanced practices at service targets. The latter are no longer coloured black-and-white, but are of the dull colours which are met with in the field, either brown head-and-shoulders painted on a green-grey canvas background or brown silhouettes held up against the face of the stop-butts. The National Rifle Association in 1910 followed the lead of the War Office to some extent as regards the targets used at the Bisley meeting in the 19th century, and after the war "target" became a collective form, date from the time when Aramaic superseded Hebrew as the spoken language of the Jews (see ORIGIN AND DEVELOPMENT OF THE ARAMAIC LANGUAGES). In their origin they were designed to meet the needs of the unlearned among the people who had ceased to understand the Hebrew of the Old Testament. In the absence of any precise evidence on the point it is impossible to give more than a rough estimate as to the period at which Hebrew, as a spoken language, was finally displaced by Aramaic. It is, however, certain that the latter language was firmly established in Palestine in the 1st century A.D. By that time, as we know from many sources, Aramaic was not only the language in common use, but had also received official recognition, despite the fact that Hebrew still remained the learned tongue. Hence we may reasonably infer that the mass of the people had adopted Aramaic at a considerably earlier period, probably, as early as the 2nd century B.C., and that the need of Aramaic translations of the sacred text made itself felt but little later. By the Jews the introduction of Targums is ascribed to Ezra; but this tradition, which probably owes its origin to the Talmudic explanation of Neh. viii. 8, is inconsistent with the linguistic evidence furnished by the post-exilic literature of the Old Testament, and must be rejected as unhistorical, if only because the process by which Hebrew took the place of Aramaic was admirably a very gradual one.

The Talmudic tradition, however, is, doubtless, correct in connecting the origin of Targums with the custom of reading sections from the Law at the weekly services in the synagogues, since the need for a translation into the vernacular must first have arisen on such occasions. As we know from the New Testament, the custom of reading in the synagogues both from the Law and from the Prophets was well established in the 1st century A.D.; its introduction, therefore, will date from a much earlier period. The practice of accompanying these readings with a translation into Aramaic is further, so generally recognized by the 2nd century A.D. that the Mishnah takes it for granted, and merely inculcates certain regulations to be observed by the Meturgemán (translator), who had by this time acquired a definite status. From it we learn that the Meturgemán, who was distinct from the reader, translated each verse of the Law into Aramaic as soon as it had been read in Hebrew; in the readings from "the Prophets" three verses might be read at a time. Later regulations are also laid down in the Talmuds in order to prevent any appearance of authority attaching to the translation, and also to ensure reverential treatment of the sacred text.

3. Nedárim, 37b; Jer. Meg., iv.— and they read in the book in the law of God, this is the Scripture, wimem (R.V. distinctly), this is the Targum."
6. Meg. iv. 4-6, 10.
TARGUM

Its use was censured, "our their pro-

judgment of the texts (Num. vi. 22 f.), the stories of David and Amnon (2 Sam. 

the first to write down, and, so 

The translation was mainly enforced with respect to those parts of the Old 

There can be little doubt that the Targums existed for a 

TARGUMS on the Pentateuch

1. TARGUMS on the Pentateuch

(1) The so-called Targum of Onkelos admittedly owes its name to mistakes. In its original context, that of the Jerusalem Talmud, the passage refers to the Greek translation of Aquila. With the exception of one reference, the Targum is always introduced in the Babylonian Talmud by the phrase "as we trans-

It is found recorded under the title of the Targum of Onkelos by Gaon Sar Shalom (d. A.D. 850). According to Dalman, its language differs in many material particulars from the Aramaic dialects of the Palestinian and Babylonian Talmuds, and is more closely allied to the biblical Aramaic. On the linguistic side, therefore, we may regard Onkelos "as a faithful representative of a Targum which had its rise in Judæa, the old seat of Palestinian literary activity. It is not, however, to be considered as the reproduction of the learned which was recognized as 

The Targum, as a whole, is good, and adheres very closely to the Hebrew text, which has not been without its influence on the Aramaic idiom; at times, especially in the poetical passages, a freer and more paraphrastic method is employed, and the version shows evident traces of Halakhic and Haggadic expansion. The Hebrew text used by the translators appears to have been practically identical with the Massoretic. The version was held in high esteem in Babylon, and, later, in Palestine, and a special Massora was made for it. The latest edition is Berliner's reprint (1884) of the Editio Schoellijeta (1557).

Of all the extant Targums that of Onkelos affords perhaps the most characteristic and consistent example of the exegetical methods employed in these works. Two principles may be said to have guided their composition. On the one hand, as primary object, to produce a faithful rendering of the original which at the same time would be intelligible to the people: for this purpose a purely literal translation would be insufficient. On the other hand, they regarded it as necessary to present the sacred text in such a manner as best to convey the particular form of interpretation then current. But later Jewish exegesis was especially concerned to eliminate something in the sacred writings that might give rise to misconceptions, and to correct the Targum on the part of the unlearned. Hence we find various expedients adopted in the Targums for avoiding any reference to the Deity, which was considered injurious and irreverence. Examples of this peculiarly Targumic method are: (1) the insertion of "word" (מִסְרָכָה), "glory" (澪), "presence" (מִרְאָה) before the divine name, when God is referred to in his

3 Tose, Meg.; cf. Jer. Meg., iv. 1-3; Solo, 39b; Sopherim, xi. 1.
4 Tose, Meg.; cf. Jer. Meg., iv. 9; Sopherim, xi. 1, where the meaning is given as:— He who marries an Aramean woman and raises up children by her raises up enemies to God;" for another explanation, see Ginsburger, M.G.W. J., xlv. 51 f.
5 Tose, Meg., ii. p. 85 f.
6 Meg., iv. 10.
7 Tose, Meg., end.
8 Meg., iv. 9; cf. Jer. Meg., iv. 9; Sopherim, x. 1, where the meaning is given as:— He who marries an Aramean woman and raises up children by her raises up enemies to God;" for another explanation, see Ginsburger, M.G.W. J., xlv. 51 f.
10 Meg., iv. 9; cf. Jer. Meg., iv. 9; Sopherim, x. 1, where the meaning is given as:— He who marries an Aramean woman and raises up children by her raises up enemies to God;" for another explanation, see Ginsburger, M.G.W. J., xlv. 51 f.
11 Meg., iv. 9; cf. Jer. Meg., iv. 9; Sopherim, x. 1, where the meaning is given as:— He who marries an Aramean woman and raises up children by her raises up enemies to God;" for another explanation, see Ginsburger, M.G.W. J., xlv. 51 f.
dealing with men; (2) the insertion of the preposition "before" (אֶל) when God is the object of any action; (3) the use of the passive for the active voice, e.g., שָׁמַעְתָּם לָא for שָׁמַעְתָּם לָהֵן; הוה for הוה לָא; הוה for הוה לָהֵן; הוה for הוה לָא; הוה for הוה לָהֵן: (4) the use of periphrasis for the modal prepositions. In the case of God, which seems to be "to speak," "to taste," or when the use of the status constructus might seem to bring God into too close connexion with men or things; (5) the use of different expressions, or the insertion of a preposition before the finite name, when God is compared with things, the same action is predicated of God and man; (6) the use of the "for" of a מַּעֲשָׂה and הָוָא, and the rendering מַּעֲשָׂה or מַּעֲשָׂה when מַּעֲשָׂה denotes heathen gods. Instances of this endeavour to make, as it were, a religious distinction in every possible way, are abundant in Targums, but cases also occur, by no means infrequently, where human actions and passions are ascribed to God. The explanation of this phenomenon is to be found in the fact that anthropomorphism was here considered, and that the higher law of prophecies was not thought of in those cases where they might be misunderstood by the people.

(2) In addition to the Targum of Onkelos two other Targums to the Pentateuch are the Targum Jerusalem and the Targum of Jonathan ben Uziel. Of these the former contains only portions of the Pentateuch, and is therefore usually designated the Fragmentary Jerusalem Targum. In a large number of cases this Targum gives merely a variant rendering of single words: where longer passages are given it presents a very paraphrastic translation, and bears all the marks of a late Haggadic composition. Its fragmentary character arises from the fact that it was used as a "sacred library," and its additions to the version of Onkelos, intended possibly for use at public services. That this Targum was really intended to supplement, rather than to supplant, the supplementary material that is required to restore sense to the shorter text. Moreover, in not a few cases the Fragmentary Targum itself attaches to its variant rendering the succeeding word from Onkelos, thus indicating that from this point onwards the latter version is to be followed. More conclusive is the fact that in a number of old Masorah MSS. we find Targums to the Song of Moses and to the Decalogue, in which this process has been fully carried out, the text of Onkelos being given in full and that of the Fragmentary Targum added to it. The second Jerusalem Targum, or the so-called pseudo-Jonathan, admittedly owes its ascription to Jonathan ben Uziel to the interest felt in a later period in the Targum of Onkelos, which was held to be that predicated of God and man; and the later the more perfect form in which it frequently cited, viz., "ז" or Targum Jerusalem (פָֹּרְשִׁי הָאוֹלָלֶה). This Targum represents a later and more successful attempt to correct and supplement the Targum of Onkelos by the aid of variants derived from another source. It is not, however, a revision of the Fragmentary Targum. Clearly it is a development of that version—but is rather a parallel, if somewhat later, production, in which the text of Onkelos is already combined with a number of variants and additions. It is noticeable that this Targum is of great and obvious importance for the study of Midrash, and in this respect, as others, is far less trustworthy than the Fragmentary Targum, as a witness to the linguistic and other peculiarities of the source from which they were both derived. It evidence of the fact that the Fragmentary Targum was in use in Palestine and by additions of every kind, which has been already noted as characteristic of the later stages of Targumic composition. Homilies, legends, traditional sayings, and explanations, in fact every form of Haggadic expansion are utilized by the Targumist, so that at those times his works convey the impression more of a late Midrash than of a translation. This impression is fully confirmed by (a) a comparison of the Talmud and later Midrashic works with which it has obvious points of contact, and (b) the historical allusions, such as the mention of Constantinople (Num. xxiv. 19), of a wife and daughter of Mahomet (Gen. xxvi. 21), and the references to Exequies at the grave of the expelled queen of Persia (Deut. xxxii. 11; cf. Fragm. Tg. to Gen. xlii. 12; Deut. xxxiii. 21). In its translation of the Hebrew pseudo-Jonathan is careful to avoid the paraphrases and to give the sense of all the most simple metaphors, though his method is not so homely as that of Onkelos. Every endeavour is made to gloss over, or modify, expressions which seemed derogatory to the ancestors of Israel, and to amplify everything which redounded to their credit.

According to Zunz, "Gottesdienerliche Sprüche," 2nd ed., p. 50, its contents belong to six periods:—I to Genesis, II to Exod. and Lev., about 2 to Lev., I to Numbers, and I to Deuteronomy.

Seligsohn, "De duabus Hier. Pent. paraphrasibus" (1858): for a full discussion see Bassfruss, "Das Fragmenten Targum in M.G.W.J. xxii.

The view that Deut. xxxiii. 11 could only have been written by a contemporary of John Hyrcanus cannot be maintained; cf. Dalman, Gnomena, p. 30 f., and, more fully, Bassfruss, M.G.W.J. xlv. (1900), pp. 481 f.

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2 Seligsohn, "De duabus Hier. Pent. paraphrasibus" (1858): for a full discussion see Bassfruss, "Das Fragmenten Targum in M.G.W.J. xxii.


4 Meg. 30a. 5 Meg. 30a.
The school at Pumbedita in the 4th century A.D. both in language and thought naturally there is some variation of vocabulary and style it closely resembles the Targum of Onkelos, and appears to have been modelled on that translation: in certain passages, indeed, it appears to be practically identical with Onkelos; but, like Onkelos, it did not assume its final form in Babylon before the 2nd century B.C.

It naturally follows from the character of the original that the rendering of this Targum is less literal than that of Onkelos, especially in idioms, but, as a compromise allowance is made for the difficulty of the Hebrew, it may be described on the whole as a faithful reproduction of the original text. Its peculiarities of rendering are due to the same principles which were noted as underlie the changes of the Palestinian Targums, as a rule, are avoided by means of the same expedients as those employed by Onkelos, expressions derogatory to the dignity of God, and hence softened down. The figurative language is either boldly transposed or the character clearly shown by the introduction of the particle "as" or "like". There is, further, a tendency to narrow down the scope of the prophetic utterances, and to limit their application to Israel and its immediate enemies. Lastly, in the obscurer passages the Haggadic method of interpretation is employed to its fullest extent, while the translation throughout shows a marked tendency to explanatory additions.

Of a Targum Jerusalmi to the Prophets but little is known, though it is hardly doubtful that such a Targum existed, if only in the form of a list of readings, this view has been advanced by Bacher in the variants attached to the margin of the Codex Reuchlinianus, and printed by Lagarde in his edition of Prophetae Chaldaeae (1872). These fragments, which have been preserved under the name of the Targum Jerusalmi Apocryphon, are certain to have existed at any rate with the Jerusalem Targums to the Pentateuch, and are demonstrably of post-Talmudic date. According to Kohut's list of Targum quotations in 'Arakh, a Jerusalem Targum existed also for the five Megilloth. Central quotations, Ecclesiastes and Esther, but this list is scarcely reliable, and, as Dalman has pointed out, the quotations in 'Arakh to Kings, Ezekiel, Proverbs and Lamentations are the only ones that point with certainty to the existence of a Targum Jerusalmi.

III. TARGUMS TO THE HAGIOGRAPHIA

These Targums possess but little interest for the student of Jewish literature, as they are already the work of individual, made in imitation of the older Targums. Despite the reference to a Targum of Job in the 1st century (see above), all the extant Targums to the Hagiographa are later in date than the Targums to the Law and the Prophets.

(1) Targums to the Psalms and Job.—These Targums present certain features in common and may therefore be treated under the same heading. Like all the later Targums they exhibit a large amount of explanatory addition, chiefly Haggadic in character. At the same time the translation of the original is not neglected; and, when separated from the later accretions, this is found to follow the Hebrew text closely. Peculiar to these Targums are the two translations, which they give to many verses, one of which is usually Haggadic in character, while the other is more literal. Bacher would assign these Targums to the 4th or 5th century, but Dalman has pointed out that there is textual evidence in common with the Jerusalem Targums to the Pentateuch. They cannot be earlier than the 7th century A.D., and possibly are of a comparable date.

(2) The Targum to the Proverbs stands apart owing to the peculiarity of the language in which it is written. The influence of the Peshitta version is so clearly marked, that Dalman (loc. cit.) describes it as a Jewish revision of that version. But setting aside the Syræans due to the use of the Peshitta, the Targum shows affinity to the Targums to the Psalms and Job. The translation is literal and almost entirely free from Haggadic additions.

The characteristic peculiarity of these Targums is their exaggerated use of paraphrase. They mark the final stage in the development of Haggadic interpretation, in which the Targum has so completely disappeared in a mass of fantastic and irrelevant matter. The Targum of Esther is known to us in three recensions (1) of the Antwerp Polyglot, almost a literal translation; (2) that of the London Polyglot, which gives paraphrase only; (3) a Copenhagen manuscript, which has a Haggadic A.B. acter; (3) the so-called second (sheni) Targum, a much larger work, containing a collection of later Midrashim to this book. According to Zunz "this second" Targum is quoted by Rashi to Deut. iii. 3. as a Jerusalem Targum, and also (1 Kings x. 13) as a Targum of the Megilloth Esther. Dalman assigns these Targums to a date before the Babylonian Targums (Onkelos and Ion at a from a Cambrian manuscript was edited by D. Wilkins in 1715. In the translation, which at times is fairly literal, use is made of the Jerusalem Targums to the Pentateuch, and of the Targums to the books of Samuel and Kings. The text represented by the Erfurt manuscript is assigned to the 8th, that of the Cambridge manuscript to the 9th century A.D.

No Targums have so far been discovered to Daniel and Ezra and Nehemiah.

(T. F. St.)

TARIFA, a seaport of Spain, in the province of Cadiz, at the extreme south point of the Peninsula, 12 m. by rail S.W. of Gibralta. Pop. (1900) 11,723. The town is nearly quadrangular, with narrow, crooked streets, and is still surrounded by its old Moorish walls. On its east side, just within these, stands the citadel. The rocky island in front of the town, connected with the mainland by a causeway, is strongly fortified; on the south side there is a modern lighthouse. Anchovy and tuna fishing is carried on, and there is some coasting trade, chiefly in live stock, salt fish and fruit. The manufactures (leather and earthenware) are unimportant. The oranges of Tarifa are famed for their sweetness.

Tarifa is the Juliàmega of the Itinera, between Gades and Belon.

According to that writer, it was colonized by Romans and the removed inhabitants of Zelis in Mauretanit Tingitana. The Julià Transducta or Traducta of coins and of Ptolemy appears to be the same place. Its present name, dating from early in the 8th century, is derived from Tarif, whom Tariq sent to Spain in command of the advance-guard of the Moorish invaders (see Caliphate and Spain: History). In 1292 Tarifa was taken by Sancho IV. of Castile from the Moors, who made several subsequent attempts to recapture it. In the defence of Tarifa Alphonso XI. gained the battle of Salado, a short distance to the westward, in 1340. In 1512 a French force of 16,000 men under Generals Victor and Laval vainly endeavoured to capture Tarifa, which was garrisoned by 2500 troops (mostly British) under General Gough.

TARIF (adapted in English from the French; the word comes through the Spanish tarifa, a list or schedule of prices, from the Arabic, ta'rif, information, an inventory, 'orf, knowledge), a table or list of articles on which import or export duties are levied, with the amount of the duty specified, hence often used as a collective term for the duties imposed, or for the law or code of regulations imposing such duties or varying the scale of charges. The word is also used quite widely of any schedule of prices or charges, and, particularly in America, of the freight or other charges of a railway or steamship line.

Resort is made to tariffs, or duties on imports, partly to secure revenue, partly to affect the course of industry within a country. Strictly speaking, these two objects are inconsistent with each other; since a customs duty, in so far as it causes a domestic industry rather than a foreign supply to influence the market, ceases to be a source of revenue. But in a great number of cases the imposition of a customs duty only a part of the foreign supply, and hence brings some revenue from that which remains. This circumstance strengthens the hold of the protective system, especially in countries where customs duties are an important source of revenue, the combination of fiscal convenience and of protection to home industry being a highly attractive one. Where tariff duties are imposed solely for revenue, an equivalent excise tax is imposed within the country, so as to put the domestic producer precisely on the footing of his foreign competitor.

G. V. p. 83.

* Rosenfeld and Kohler in Geiger's Jüdische Zeitschrift, 1870.
competitor; and tariffs so maintained are in complete conformity with the principle of free trade.

Great Britain.—Between the close of the Napoleonic wars of 1815 and the year 1860, the tariff system of Great Britain was changed from elaborate protection to practically complete free trade. An attempt had indeed been made in 1786 to modify the rigidly protective legislation of the 18th century. In that year Pitt concluded a commercial treaty with France, providing for large reductions of duties in both countries. But the treaty was swept away with the outbreak of the wars with France, and accordingly the old system was still in force in 1815. The first important step, and in some respects the decisive step, towards modifying it was taken in 1824, under the policy of Huskisson. In that year, and again in 1829, great reductions were made in the duties on raw materials, especially on wool, raw silk, flax and iron, while considerable reductions were also made in the duties on manufactured goods. The most sharply contested of the changes was in regard to silks, which had been completely prohibited, and were now admitted at a duty of 30 per cent. A considerable breach was thus made in the protective system; and some further changes in the same direction were made in the next decade, especially under Lord Althorp in 1833. But in the decade from 1830 to 1840 the Corn Laws were the chief subject of contention. The great increase in population since the middle of the 18th century had made England a corn-importing country, especially with the rapid growth of manufactories in the early years of the 19th century. The first systematic Corn Laws imposing duties on grain had been passed in 1773. From 1815 onwards a series of measures were passed, all designed to maintain the high price of grain. The Act of 1816 prohibited the importation of wheat when the price was less than 8s. a quarter (≈$2.50 a bushel). In 1822 the prohibitive point was lowered to 7s. In 1828 the sliding scale was introduced, under which the duty went up and down as the price of grain went down and up; and it was against this form of the Corn Laws that the Cobden-Calderwood Treaty was directed after 1839. For a long time the anti-Corn Law agitation seemed to have no effect, although conducted with extraordinary skill and enthusiasm.* In 1842, however, Sir Robert Peel made the first important concession, by modifying the sliding scale, his opponent, Lord John Russell, having proposed in the previous year a fixed duty of 8s. a quarter. In view of the bad harvest of 1845-46, and the famine in Ireland in 1846, Peel surrendered, and proposed in 1846 the admission of grain with only a fixed duty of 1s. a quarter as a registration fee. This change was carried, but Peel, by the strong enemy of his party, Sir Robert Peel himself, was compelled shortly afterwards to resign. The Corn Laws had great political strength, serving as they did the interests of the landowners, whose hold on parliament was still very strong; but the general economic situation in Great Britain, from the rapid growth of the manufacturing population and the imperative need of more food, made the abolition inevitable. After having been maintained till the middle of the century, apparently with irresistible support, they suddenly collapsed under the strain of a season of exceptionally short crops. Both their continued maintenance and their final sudden abolition are in some respects divergent from the general course of British tariff history.

The remodelling of the tariff system in the direction of free trade went on, little retarded by the maintenance of the Corn Laws and not much accelerated by their abolition. In 1842 great reductions of duty were made on a large number of articles; in 1846 still further reductions of duty were made; another series of changes came in 1853; and finally, in 1860, the last remnant of protective duties disappeared. The four acts of 1842, 1846, 1853, and 1860—the first two under Peel's leadership, the second two under Gladstone's guidance—thus carried out gradually the policy of free trade in regard to other articles than grain. The first of them, in 1842, was signalized by the introduction of the Income Tax as a means of raising revenue to replace that lost by the diminished import duties. The last of them, in 1860, was largely influenced by the great commercial treaty with France. In that treaty the concessions made to France were the reduction by Great Britain of duties on wines and spirits, and the admission, free of duty, of some important French products, notably silk manufactures, gloves, and other products in which the French had superiority. Great Britain, instead of limiting the concessions to France, in 1860 made them applicable to all the world. The silk manufacture, as to which the first great changes had been made in 1824, and on whose products the duties had been kept higher in previous acts than on other manufactures, was thus compelled, notwithstanding violent opposition, to face unfettered foreign competition.

Two general features should be noted in regard to the tariff history of Great Britain. In the first place, most of the reductions of duty on manufactured articles were of little practical significance. The great mass of manufactured commodities were produced in the United Kingdom more cheaply than in foreign countries, and would not have been imported, with duty or without, except in sporadic amounts for some special qualities. The changes hence involved little real readjustment of industry. There is thus some ground for the assertion that the policy of free trade was not adopted by the United Kingdom until its industries had reached the stage of being independent of protection, but this does not hold good of some manufactures; especially not of the silk industry, and some parts of the woollen and linen trades. Still less does it hold good of raw materials, many of which had been really affected by the duties, and were largely imported after their abolition. Such was the case not only with some metals, such as lead, zinc, copper, but still more strikingly with textile materials such as wool, flax, and the like, and most of all with agricultural products such as grain, meat and meat products, timber. In regard to all these, the abolition of protection meant a real sacrifice to domestic industries. The second feature to be noted is the simplification which resulted in the administrative feature of the English tariff. A great number of articles had been enumerated in the earlier tariff acts, each of which was imported in very small quantity and yielded an insignificant revenue. The nature of the changes made between 1842 and 1860 is indicated by the following tabular statement:

<table>
<thead>
<tr>
<th>Duties reduced</th>
<th>Duties abolished</th>
</tr>
</thead>
<tbody>
<tr>
<td>1842-46</td>
<td>503</td>
</tr>
<tr>
<td>1846</td>
<td>112</td>
</tr>
<tr>
<td>1853</td>
<td>123</td>
</tr>
<tr>
<td>1860</td>
<td></td>
</tr>
</tbody>
</table>

After 1860 only forty-eight articles remained subject to duty, a number which has been still further reduced, the most notable change having been free admission of sugar in 1872. Since that date the English customs tariff has been simplicity itself. A very few articles (spirits, beer, wine, tobacco, tea, coffee, cocoa) yield practically all of the customs revenue, and, so far as these articles are produced within the country, they are subject to an excise duty, an internal tax precisely equal to the import duties. In 1901, to aid in meeting the expenses of the South African war, a moderate revenue duty was again imposed on sugar; and in 1902 the shilling duty on corn and flour (abolished in 1869) was restored, but again taken off in 1903. In this year began the "Tariff Reform" movement initiated by Mr. Joseph Chamberlain (q.v.), but Free Trade retained a strong hold on the British electorate, and the return of the overwhelming Radical majority to parliament in 1906 involved its retention under the fiscal policy of that party. In January 1910 the Liberal government was again returned to power; but the Unionist party was now committed to "Tariff Reform," which had made great strides in obtaining popular support.

France.—The tariff history of France in the 19th century divides itself into three periods: one of complete prohibition,
Tariff

lasting till 1860; second, of liberal legislation, from 1860 to 1881; third, of reversion to protection after 1881.

(1) During the first period the prohibitive legislation of the 18th century was retained, largely in consequence of the Na-
poleonic wars. The commercial treaty of 1786 between Great Britain and France has already been referred to as making a breach in the restrictive system of the 18th century; and in the early years of the French Revolution a similar wave of liberal policy is to be seen. But the great wars led to the complete prohibition of the importation of manufactures, reaching its climax in Napoleon's Continental system. The system of prohibitions thus instituted, while aimed at Great Britain, was made general in its terms. Hence the importation into France of virtually all manufactured articles from foreign countries was completely interdicted; and such was the legislation in force when peace came in 1815. This system doubtless was not expected to last after the wars had ceased, but, as it happened, it did last until 1860. Successive governments in France made endeavours to break with the prohibitive system, but naturally met with strong opposition from the manufacturing interests, not prepared to meet the competition of Great Britain, whose industries had made, and were continually making, rapid strides. The political position of the governments of the Restoration and of Louis Philippe was such that they were unwilling to forfeit support by protecting the industries in which, after all, they were not themselves deeply interested.

(2) It was not until Napoleon III. believed it to be to his political advantage to strengthen friendly relations with Great Britain by the moderation of the import duties that the change was finally made; while the despotic character of his government enabled him, when once the new policy was entered on, to bring about a radical change. After some secret negotiations, in which the English Corn Law agitator, Cobden, and the French economist, Cherbuliez, took an active part, Napoleon was persuaded to enter on the famous commercial treaty of 1856, and virtually to forgo its acceptance by the French legislature. In the treaty as finally framed duties on most manufactured commodities were reduced to a range of 10 or 15 per cent., some iron manufactures, however, being left at slightly higher rates. Before the treaty, all woollen and cotton manufactures, all manufactures of leather, of hardware, pottery, all glass ware, had been prohibited, while raw materials and such manufactures as were not prohibited had been subject to heavy duties. The treaty thus made a radical change, revolutionizing the tariff system of France. It did so with relation not only to the United Kingdom, but, in its after effects, to the world at large. The French government at once set to work to enter into similar arrangements with other countries, and treaties were successively concluded in 1860-66 with Belgium, with the Zollverein (Germany), Italy, Switzerland, Sweden and Norway, Holland, Spain, Austria. All these countries made reductions of duty on French products, while France admitted other products at the rates of the British treaty tariff. Thus a network of treaties was spread over Europe, leading to much great freedom of trade and opening an era of freer international exchange.

(3) This more liberal policy, however, probably never had deep root in French public opinion. It received a check from the Franco-German War of 1870-71. The treaty of Frankfurt in 1871 contained, in place of the previous detailed commercial treaty with Germany, the simple "most favoured nation" proviso. The guarantee which each country thus gave to the other of treatment as favourable as that given elsewhere became irksome to France, sore after her defeat in the war. More important, however, in undermining the liberal system, was the change in agricultural conditions which began to set in in the decade of 1878-88. Then the great improvements in transportation caused competition in agricultural products to be felt, especially from the United States. Agricultural prices declined; agricultural depression set in. The agricultural interest in France, hitherto indifferent about duties, now began to demand protection against competition from beyond the sea. To this factor was added the revival of national feeling and prejudice, with growing political complications and jealousies. Hence, by gradual steps, the customs policy of France has become more and more strongly distinctive. The first important step was taken in 1881, when a new general tariff was established, in which specific duties replaced the ad valorem duties chiefly applied in the treaty tariffs of 1860-66. The new rates were supposed to be no more than equivalent to those replaced by them, but in fact were in some cases higher. New treaty tariffs, less liberal than the earlier ones, were concluded with Belgium, Switzerland and Spain; while with other countries (e.g. Great Britain) a "most favoured nation" arrangement was substituted for the previous treaty régime. These new treaty arrangements expired in 1892 even before that date, duties and bed duties, on grain and meats; and finally, in 1892, a new and more highly protective general tariff was established on the recommendation of M. Meline, with high duties on agricultural products and raw materials as well as on manufactures, and with provisions for limited domestic bounties on silk, hemp and flax. Nevertheless, some provision was made for negotiations with foreign countries by establishing a minimum tariff, with rates lower than those of the general or maximum tariff, the rates of this minimum tariff being applicable to countries which might make concessions to France. As a rule the minimum tariff has been applied, at an even rate, and thus is the tariff in practical effect; yet its rates are still high, and, most significant of all, agricultural products are granted no reductions whatever as compared with the maximum tariff, there being heavy and unrelaxed duties upon grain, animals, meats and the like.

Germany.—The tariff history of Germany, up to the foundation of the German Empire, is the history of the Zollverein or German customs union; and this in turn is closely connected with the tariff history of Prussia. In 1818 Prussia adopted a tariff with much reduced duties, under the influence of the Liberal statesmen then still powerful in the Prussian government. The excitement and opposition in Germany to the Prussian tariff led to customs legislation by the other German states, some smaller states joining Prussia, while the southern states endeavoured to form independent customs unions. Finally, by gradual steps between 1831 and 1834, the complete Zollverein was formed, notwithstanding popular opposition. All the German states formed a customs union, with free trade between them, except the Free City of Hamburg and some of the smaller states which had not joined the Zollverein. These remaining states had duties equal to the Zollverein duties on imports, but much reduced in comparison with the duties levied on domestic productions. The customs duties were divided among the several states in proportion to population. The tariff of the Zollverein was, in essentials, the Prussian tariff of 1818, and was moderate as compared with most of the separate tariffs previously existing. Within the Zollverein, after 1834, there was an almost unceasing struggle between the Protectionist and Free Trade parties, Prussia supporting in the main a Liberal policy, while the South German states supported a Protectionist policy. The trend of the tariff policy of the Zollverein for some time after 1834 was towards protection; but as the Zollverein duties were no longer so heavy as manufactured commodities fell in price, partly because some actual changes in rates were made in response to the demands of the Protectionist states. In 1853 a treaty between the Zollverein and Austria brought about reciprocal reductions of duty between these two parties. After 1860 a change towards a more liberal policy was brought about by the efforts of Prussia, which concluded independently a commercial treaty with France, forcing on the other members of the Zollverein the alternative of either parting company with Prussia or of joining in her relations with France. The second alternative was accepted, largely because Austria did not vigorously support the South German states, and in 1865 the Zollverein as a whole concluded a commercial treaty with France, bringing about important reductions of duty. The régime of comparatively free

Tariff of 1892.

The Zollverein, 1834.
trade thus established lasted for about fifteen years. After the foundation of the German Empire, the duties of the Zollverein became those of Germany, and for a time the liberal régime was maintained and extended, with respect to the tariff as with respect to other matters. But in Germany, as in France, a combination of political and of economic forces led before long to a reaction towards protection. Bismarck broke with the National Liberals, who were the champions of free trade; at the same time the agricultural depression set in, and the agricultural interest demanded protection against American and other foreign products. The manufacturers, especially of iron, also manoeuvred for protection. The liberal régime of 1879, when duties were increased on manufactured articles as well as on agricultural articles. Other advances of duty were made in later years, especially on grain; and thus the policy of Germany has become distinctly Protectionist, though not to the same degree as in France. In 1892, however, the precise year in which France gave up her system of commercial treaties, some moderation was brought about in Germany's protective system by commercial treaties with Austria, Italy, Belgium, Switzerland, and shortly afterwards, with the United States. Hence, an attempt was made to secure concessions for reductions of duties in all directions, the most important concessions being on certain agricultural products. Thus the duty on wheat, which had been gradually raised as high as 5 marks per hundred kilogrammes (roughly 18. 3d., or about 30 c. a bushel) was reduced to 3.50 marks by the treaties. The rates of these treaties were extended to a number of other countries having "most favoured nation" relations with Germany. The tariff system of Germany, however, at the beginning of the 20th century, remained definitely Protectionist.

In other important countries changes in policy have taken place similar to those noted in Germany and in France. The era of moderate tariffs, which began with the great treaty of 1860, lasted for about twenty years, and was followed in Italy, Austria, Belgium, Switzerland, and of a Frenchman and protectionist in France, usually to a less high system of protection than had prevailed before 1860. The United Kingdom and Holland alone held consistently and unalteringly to the principle of free trade. The factors which have brought about this reaction have been, as was already noted, partly economic, partly political: on the one hand, the pressure of competition from distant countries in agricultural products, a consequence chiefly of improved transportation; on the other hand, the revival of national sentiment and prejudice.

The United States.—The tariff history of the United States, like that of European countries, divides itself into two great periods, before and after the year 1860. But it is no more than an accident that this year constitutes the dividing line in both cases, the change in the United States being due to the Civil War, which so profoundly influenced the fiscal, economic and political history of the country in all directions. The period before 1860 may again be divided into three sub-periods, the first extending from 1789 to 1816, the second from 1816 to about 1846, the third from 1846 to 1860.

(1) The Tariff Act of 1789 was the first legislative measure passed by the United States. The Protectionists have pointed to it as showing the disposition of the first Congress to adopt at once a policy of protection; the Free Traders have pointed to it similarly as showing a predilection for their policy. Each had some ground for the claim. The duties of the act of 1789 were very moderate, and, as compared with those which the United States has had under any subsequent legislation, may be described as free trade duties. On the other hand, the spirit of the act of 1789 was protective. It had been the design of Madison, and of other firm supporters of the new constitution, to adopt in 1789 a very simple measure, designed solely to secure revenue. But the pressure from the representatives of some of the manufacturing States, Pennsylvania, and Massachusetts, compelled him to incorporate in the Tariff Act certain specific duties borrowed from the Tariff Acts then in force in these states, which had a distinctly protective aim. Thus the act of 1789, although the duties levied by it were moderate, yet had a protective intent. Such in the main remained the situation until 1816, duties being indeed raised from time to time in order to secure more revenue, but the arrangement and the general rate of the duties not being sensibly modified. There was not at this time any considerable public feeling on the subject of protection, chiefly because during most of the years of this period the Eastern states, and especially New England, where manufactures might be expected to develop first, were profitably engaged in an extensive export and carrying trade.

(2) After the close of the War of 1812, however, a new spirit and a new policy developed. With the end of the Napoleonic wars, the opportunities for American commerce became greater, while at the same time the sanding of the population necessarily led to diversified interests at home. A demand arose for two closely connected measures: protection to domestic manufactures, and internal improvements. Protection was demanded as a means both of aiding young industries and of fostering a home market for agricultural products. The chief spokesman of the new movement was Henry Clay, who remained throughout his life the constant advocate of this so-called "American system." Some disposition in this direction showed itself as early as 1816, when tariff duties were increased. Still greater changes were made in 1824, 1828, and 1832. In 1816 the West, the South and the West Indies were restored and thereunder the New England states, which so far had been lukewarm in supporting the movement, joined in it unreservedly. The tariff of 1828 was affected by some political manipulation, which caused it to contain objectionable provisions, and to be dubbed "the tariff of abominations." But the so-called abominations were removed in 1832, when the protective system was deliberately and carefully rearranged. By this time, however, the opposition to it in the South had reached a pitch so intense that concessions had to be made. As a planting and slave-owning region, the South inevitably had no manufactures: it felt that its cotton was sure to find a foreign market, and would gain little from the establishment of a domestic cotton manufacture within the country; and it judged, rightly, that the protective system brought it only burden and no benefit. The extent of the burden was greatly exaggerated by the leaders of the South, especially in the heat of partisan controversy; and the subject was closely connected with the controversy as to the rights of the states, and the endeavour of South Carolina, under the influence of Calhoun, to nullify the Tariff Act of 1832. The nullification movement led in 1833 to the well-known compromise, by which the rates on manufactures as established by the Act of 1832 were to be gradually reduced, reaching in 1842 a general level of 20 per cent. The compromise served its turn in allaying political bitterness and staying off a direct conflict between the United States and South Carolina. But the reductions of duty made under it were never effectively carried out. In 1842, when the final 20 per cent. rate was to have gone into effect, the Protectionists again had control of Congress, and after a brief period of two months, during which this 20 per cent. rate was in force, passed the Tariff Act of 1842, which once more restored the protective system in a form not much less extreme than that of 1832.

(3) Four years later, however, in 1846, a very considerable change was secured by the South, and a new era was entered on. The Democratic party now was in control of legislation, and in the Tariff Act of 1846 established a system of moderate and purely ad valorem duties, in which the protected articles were subjected, as a rule, to a rate of 30 per cent., in some cases to rates of 25 and 20 per cent. The system then established has often been spoken of as a free trade system, but was in reality only a system of moderated protection. In 1857 duties were still further reduced, the rate on most protected commodities going down to 24 per cent., and remaining at this comparatively low level until the outbreak of the Civil War.

The second great period in the tariff history of the United States opens with the Civil War. It is true that the first steps towards a policy of higher protection were taken just before the war began. In the session of 1860-61, immediately preceding the outbreak of the conflict, the Morrill Tariff Act was
passed by the Republican party, then in control because the defection of Southern members of Congress had already begun. It substituted specific duties for the ad valorem duties of 1846 and 1857, and made some other changes of significance, as in the higher duties upon iron and steel. Nevertheless, the advances then made were of little importance as compared with the far-reaching increases of duty during the Civil War. These formed part of the general resort to every possible fiscal device. The great intragovernmental resource to be strained to the utmost: the issue of long-time bonds, continual borrowing in very large amounts on short-time inconvertible paper money, an elaborate and all-pervading system of internal taxes, and, finally, heavy import duties. The internal taxes of the war were applied not only in the form of income taxes, stamp taxes, licence and gross receipts taxes, but also as direct excise taxes on many commodities. The import duties were correspondingly raised, partly by way of off-set to the internal taxes, partly as a means of getting additional revenue, and finally in some degree because of a disposition to protect domestic industries. The most important acts were the great revenue acts of 1862 and 1864. Some further changes were made in 1865, and the close of the war thus left the United States with a complicated system of very high taxes both on imported duties and on domestic products.

The main features of the tariff history of the United States since the Civil War have been that the internal taxes have been almost entirely swept away, the import duties on purely revenue articles similarly abolished, while those import duties that operated to protect domestic industries have been maintained, and indeed in many cases increased. The situation has had some analogy to that of France from 1815 to 1860, when similarly a highly restrictive system established during a period of war was unexpectedly retained long after peace had been established. This result in the United States came about by gradual steps and without premeditation. After the close of the war efforts were first directed to clearing the financial situation by funding the floating debt, and taking steps (never fully consummated) towards contracting the currency. Next the internal taxes were gradually done away with, until nothing was left except the excise on beer, spirits and tobacco. No further resort was made to internal taxes until the revenue act of 1868 was passed, at the outbreak of the Spanish War. Efforts were made also to reduce the tariff duties, but these naturally came last: they met with strong opposition, and in the end they were almost completely frustrated, thus leaving as the basis of the tariff the rates which had been levied in the course of the war. In 1870 some rearrangements were made, the duties on iron and on some other articles being reduced. In 1872 a more general reduction was carried out, strongly resisted by the Protectionists, and finally ending in a uniform cutting off of 10 per cent. from all the import protective duties. In 1875, however, when the revenue had become deficient after the crisis of 1873, the 10 per cent. reduction was repealed, and duties restored to their previous amounts. It deserves to be noted that in 1872 an important step was also taken towards removing entirely the duties on purely revenue articles, tea and coffee being then admitted free of duty. On the other hand, the maintenance of the protective duties, and the gradual consolidation of feeling in favour of a permanent policy of strong protection, led to other rearrangements, and new protective duties were enacted. In 1867 an important act on wool and woollens was passed, largely increasing the duties on both. In 1869 the duty on copper was raised. In 1870, while some duties were lowered, others were raised, as, for instance, those on steel rails and on marble. Thus the ten years immediately following the close of the war brought about the gradual transformation of the high duties levied on all commodities for revenue purposes into a system of high duties almost wholly on protective commodities. This transformation met with much opposition, not less in the Republican party than in the Democratic party. While the feeling in the Republican party had been from the outset in favour of protection, so high a range of duties met with much opposition. This opposition led to an important general revision in 1883, largely influenced by the recommendations of a special Tariff Commission which Congress created in 1882. The act of 1883 was passed in the main as a party measure by the Republicans, and on the whole served rather to put in order the protective system as it stood than to make any change of policy. Duties were reduced (though in no case greatly reduced) such as those upon wool, some woollens, cheaper grades of cotton cloths, iron, steel rails, copper. On the other hand, on many articles duties already high, but believed to be insufficient for the effective protection of the domestic producer, were raised; e.g., on finer woolens and cottons, on some iron and steel manufactures.

The tariff system as revised and codified in 1883 would probably have remained unchanged for many years had it not been for the turn taken by political and financial history. The decade from 1880 to 1890 was one of great prosperity, consequently of high imports, consequently of swelling customs revenue. In the second half of the decade a continuous large surplus in the Treasury necessarily directed attention to the state of the revenue, and gave strength to the protests against excessive taxation. In addition, the Democratic party, which had long been committed, though in a half-hearted way, against the policy of high protection, was brought to a vigorous and uncompromising attack on it through the leadership of President Cleveland. In his Presidential Message of December 1887 he attacked the protective system in unqualified terms; and in the session of 1888–9 the Democratic party in the House of Representatives prepared a bill providing for great reductions. The control of the Senate by the Republicans prevented any legislation. But the Republicans, as is almost inevitable under a party system, championed the policy opposed by the other side, and declared themselves not only in favour of the maintenance of existing duties, but of the consistent and unqualified further application of protection. The protection question thus became the main issue in the Presidential election of 1888, which resulted in the defeat of the Democrats. In the next ensuing session of Congress, in 1889–90, the Republicans passed a new tariff act, known as the McKinley Tariff Act, because Mr McKinley was then chairman of the House Committee in charge of the bill. It advanced duties materially on a considerable number of commodities, both raw materials and manufactured articles. The duties on wool were raised, corresponding changes made on woollen goods, the duties on cottons, linens, some silks, and velvets considerably raised. A further step towards consolidating the protective system was taken by abolishing the duty on sugar, mainly a revenue duty. The necessity for reducing the revenue and cutting down the continued surplus was met in this way rather than by lowering the protective duties. For consistency in maintaining the protective principle a direct bounty was given to the domestic producers of sugar in Louisiana. A turn in the political wheel brought an abrupt change four years later, in 1894. The tariff question was again the issue in 1892: President Cleveland, defeated four years before, was now again elected, and the Democratic party came into power, pledged to change the tariff system. Accordingly in the first ensuing session of the Congress elected in 1892 the tariff act of 1894 was passed, known as the Wilson Tariff, because of the directions given by the Democratic party for change. The Wilson Act, however, was less inclusive than its chief sponsors had planned, because of the narrow majority commanded by the Democrats in the Senate. Some of the Democratic senators were lukewarm in their support of the party policy of tariff reduction, and joined with the Republicans in mitigating the changes. Nevertheless some crucial changes were made. The duty on wool, typical among the duties on raw materials, was completely abolished, and with this change came a great reduction in the duties upon woolen goods. Changes, but of less importance, were made on other
textile goods. The House had proposed to remove also the duties on coal and on iron ore, but the Senate permitted only a reduction in these. A duty was reimposed on sugar, chiefly as a means of securing needed revenue, but at a less rate than had existed before 1890. At the same time the differential duty on refined sugar, which operated as protection to the sugar manufacturers, was abolished. The hard-key system for the duties on sugar was also abolished, but kept in substance not greatly changed. This circumstance, as well as the failure to make other desired reductions, caused the ardent tariff reformers to be greatly disappointed with the act of 1894 as finally passed, and led President Cleveland to permit it to become law without its endorsement by his signature. The next election in 1896 brought still another turn in the political wheel, the Republicans being once more brought into power under the leadership of President McKinley. The currency issue had been foremost in the campaign, but the Republicans had also promised changes that would em- prove in favour of a return to the unqualified protective system. At the extra session which President McKinley called in 1897, almost the sole measure considered was the tariff act, known (again from the name of the chairman of the House Committee) as the Dingley Act. This reimposed the duties upon wool, on most qualities at the precise rates of 1890, on some qualities at even higher rates. Neces- sarily the duties on woollens were correspondingly raised, and here again made even higher than they had been in 1890. On other textiles, particularly on silks and linens, similar duties were put on the rate of 1890, or duties retained or somewhat advanced. To this policy, however, there was a significant exception in the iron and steel schedule, where the reduced duties of 1894 were left mainly unchanged. The iron industry in the United States had made extraordinary advances, and confessedly was not in need of greater protection than had been given in 1894. Some provisions for reciprocity arrangements with other countries, opening the way for possible reductions of duty by treaty arrangements, were also incorporated in the act of 1897, though with limitations which made it improbable that any considerable changes would ensue from this policy. Some such provisions had also been contained in the act of 1890, but here also without important results. The tariff system of the United States at the beginning of the 20th century thus remained rigidly and unqualifiedly protective, with rates higher than those of even the most restrictive tariffs of the countries of the European continent.

It leaves numerous interfacing branches behind it, like the Kunche-
darya, the Cherchen-darya, and the Ak-su-darya, and the Kurgat.
None of its marginal lakes is round in shape, but all are elongated,
from N. to S. or from N.W. to S.E. This is the general rule, but
there is a second series of lakes beside the river which are drawn
out in a more or less straight line. The great accumulation of
water is already at any rate very considerable. And the direction
of the wind. Here too, in its delta, the Tarim overflows
into more than one chain of a third category of lakes (e.g. Avulhu-
kol, Kara-kol, Tayek-kol, and Arka-kol), strung on one or other
of the branches of the Tarim. These lakes, which are mainly actu-
ally actuates, and clarifies, the river emerging from them with crystal-bright
water.
Near the head of its delta the Tarim is joined from the N. by
theKoncheh-darya, a stream which issues from the lake of Bagrash-kul,
it ultimate source being the Khaidu-gol or Khaidy-gol, which
drains the Yulduz valleys of the eastern Tian-shan Mountains.
This lake is about 30 m. above the Bagrash-kul on the great
Kara-koshun, serves, with the help of the poplar forest which grows
along its left bank, as a dam to check the westward movement
of the desert sands. Finally the Tarim enters, by a number of arms,
the series of shallow, dwindling lakes of Kara-buran, which serve
as a sort of lacustrine ante-room to the real terminal basin of the river,
the Kara-koshun, which lies a little farther to the E., in
46° 00' 30" N., at an altitude of 2675 feet above

TARKANI—or TARKALIANI, a Pathan tribe inhabiting the
whole of Bajour (q.v.), on the border of the North-West Frontier Province of India. Subdivided into Mammuds, Isazal,
and Ismazal, the tribe numbers some 100,000 persons.

TARLTON, SIR BANASTRE (1754-1833), English
soldier, was a son of John Tarlton (1717-1739), a Liverpool
merchant, and was born in Liverpool on the 21st of August 1754. Educated
at Oxford he entered the army, and in December 1775 he sailed as
a volunteer to America with Earl, afterwards Marquess,
Cornwallis, and his services during the American War of Inde-
pendence in the year 1776 gained for him the position of a
brigade major of cavalry. He was present at the battle
of Brandywine and at other engagements in 1777 and 1778,
and as the commander of the British legion, a mixed force of cavalry
and light infantry, he proceeded at the beginning of 1780 to
South Carolina, rendered serious service in the operations which culminated in the capture of Charleston.
He was responsible for a British victory at Waxhaw in May
1780, and he materially helped Cornwallis to win the battle
of Camden in the succeeding August. He was completely
victorious in an engagement with Thomas Sumter at Fishing
Creek, or Catawba Fords, but was not equally successful when
he encountered the same general at Blackstock Hill in November
1780; then in January 1781, in spite of much personal value,
he was defeated with heavy loss at Cowpens. Having
been successful in a skirmish at Tarrants House, and having taken
the battle of Kings Mountain in October 1780, with Cornwallis
to Virginia, and after affording much assistance to
his commander-in-chief he was instructed to hold Gloucester.
This post, however, was surrendered to the Americans with
Yorktown in October 1781, and Tarlton returned to England
on parole. In 1790 he entered parliament as member
for Liverpool, and with the exception of a single year he remained
in the House of Commons until 1812. In 1794 he became
a major-general; in 1812 a general; and he held a military
command in Ireland and another in England. In 1815 he was
made a baronet. He died without issue to Sir Henry Clinton
in Shropshire on the 23rd of January 1833.

For some time Tarlton lived with the actress Mary Robinson
(Perdita), and his portrait was painted both by Reynolds and by
Gainsborough. Sir Banastre wrote a History of the Campaigns
of 1780 and 1781 in the Southern Provinces of North America (London,
1781), which, although of some value, is marred by the author's
vanity and by his attacks on Cornwallis. It was criticized by
Colonel Roderick Mackenzie in his Strictures on Lieutenant-Colonel
Tarlton's History (1781) and in the Cornwallis Correspondence.

TARLTON, RICHARD (d. 1568), English actor, was probably
at one time an inn-keeper, but in 1563, when he is mentioned
as one of the original company of the celebrated moralities of
Shakespeare, he acquired a great popularity as a witticisms,
and his talent for impromptu doggerel on subjects suggested
by his audience has given his name to that form of verse.

To obtain the advantage of his popularity a great number of songs
and witticisms of the day were attributed to him, and after
his death Tarlton's Jests, many of them older than he, made
several volumes. Other books, and several ballads, coupled
his name with their titles. He is said to have been the
Yorkick of Hamlet's soliloquy.

TARN, a river of southern France, tributary to the Garonne,
was the name of the departments of Lozère, Aveyron, Tarn, Haute-
Garonne and Tarn-et-Garonne. Length, 234 m. Area of basin,
5733 sq. m. Rising on the southern slope of Mt. Lozère at a
height of 3249 ft., the Tarn flows westward, and having received
the Tarnon, enters the gorge, famed for its beauty, which
separates the Cause de Sauveterre from the Cause Mijan.
Emerging from this cain after a course of 37 m. it receives
the Jonte on the left and, still flowing through gorges, passes
between the Cause Noir, the Larzac plateau and the Cause de
St Affrique (at the foot of which it receives the Dourde du Vahre)
on the left and the Eyousou range and the Bazard, on the right.
The most important town is Millau, where it receives the Dourbie.
At the cascade of Sabo, above Albi, the river enters the plains and
flowing in a deep bed, passes Albi and Gaillac, some distance below which, at the confluence of the Agout, it exchanges a east-south-westerly for a north-westerly course. At Montauban the Tarn receives the Tescou and 6 m. farther on unites with the Aveyron. It then reaches Moissac, 2½ m. below which it flows into the Garonne.

TARN, a department of south-western France, formed in 1790 of the three dioceses of Albi, Castres and Lavaur, belonging from 1454 to 1790 to the province of Quercy, and from 1790 to 1814 to the department of Lot. It is bounded N. and E. by Aveyron, S. by Aude, and W. by Haute-Garonne, N.W. by Tarn-et-Garonne. The slope of the department is from east to west, and its general character is mountainous or hilly; its three principal ranges, the Mountains of Lacaune, the Sidobre, and the Montagne Noire, belonging to the Cevennes, lie on the south-east. This and the wind-blowen slopes of the first-named are used for pasturage. The highest point of the range and of the department is the Pic de Monteault (about 4,150 ft.); several other summits are not much short of this. The granit-strown plateaus of the Sidobre, from 1,600 to 2,000 ft. high, separate the valley of the Agout from that of its left-hand affluent the Thoré. The Montagne Noire, on the southern border of the department, derives its name from the forests on its northern slope, and some of its peaks are from 3,000 to 3,500 ft. high. The limestone and sandstone foot-hills are clothed with vines and fruit trees, and are broken by deep alluvial valleys of extraordinary fertility. With the exception of a small portion of the Montagne Noire, which drains into the Aude, the whole department belongs to the basin of the Garonne. That western portion of the department has the reputation of Albigensia, the severest in France, but that of the plain is Girondin. At Albi the mean temperature is 55°. The rainfall, 29 or 30 ins. at that place, exceeds 40 ins. on the Lacaune and Montagne Noire.

The most noteworthy places in the department are Albi, the capital, Castres, Gaillac, Lavaur, Mazamet and Cordes, which are separately treated. Other places of interest are Burlsats, which has a part of its place-name in the name of Albi; bastide with a church of the 14th century; and Penne, which has ruins of a fine medieval chateau.

TARN (O. Eng. tarne, Scand. tjarn, tjårn, tjôrn, &c.), a name applied in England (especially in the Lake District) and in Scotland to small lakes or pools in mountainous districts, especially such as have no visible affluent streams. The term is sometimes used also of a marsh or bog.

TARN-ET-GARONNE, a department of south-western France, formed in 1868 of districts formerly belonging to Guienne and Gascony (Quercy, Lamogna, Armagnac, Rouergue, Agenais), with the addition of a small piece of Lot. From 1790 to 1814 it was divided between the departments of Lot, Haute-Garonne, Tarn, Aveyron, Gers and Lot-et-Garonne. It is bounded N. by Lot, E. by Aveyron, S. by Tarn and Haute-Garonne, and W. by Gers and Lot-et-Garonne. Area, 1,440 sq. m. Pop. (1906) 888,553. The department is watered by three rivers, the Garonne, the Tarn, which joins the Garonne below Moissac, and the Aveyron, which flows into the Tarn between Moissac and Montauban, dividing it into three distinct regions of hills. Those to the south-west of the Garonne are a continuation of the plateau of Lannemezan; ramifications of the Cevennes extend between the Garonne and the Tarn, and between the Tarn and the Aveyron; the region to the north of the continuous valley formed by the courses of the three rivers belongs to the Central Plateau. The causse or limestone plateau of Quercy occupies the north-east corner of the department and includes its highest point (1,634 ft.). The lowest point (164 ft.) is at the exit of the Garonne. The climate is mild and agreeable; the mean annual temperature being about 56° F. Rain falls seldom, but heavily, especially in spring, the annual rainfall being 28 or 30 ins.

The wide alluvial valleys of the three large rivers are most productive. Cereals, especially wheat, maize and oats, occupy more than two-thirds of the arable land of the department. The vine is everywhere cultivated and large quantities of grapes are exported as table fruit. Potatoes are also grown. Plums and apricots are the best fruit. The broad taxation for cavalry purposes, is actively carried on; and the rearing of horses for draught and for fattening, is also important. Sheep, pigs, poultry and, in a minor degree, silk-worms, are also sources of profit. The manufacture of wine is carried on, and furnishes the most important industries. Imports include rayon, raw silk, wood-pulp, coal and agricultural produce. The canal of the Garonne traverses the department for 48 m. and the Tarn furnishes 82 m. of navigable waterway. The department is served by the Orleans and the Southern railways. The department forms the diocese of Montauban, and belongs to the jurisdiction of the Toulouse court of appeal, to the académie centrale of Agen, and to the division of the XVII. corps d'armée (Toulouse). It has 3 arrondissements (Montauban, Moissac and Castelsarrasin), 24 cantons and 105 communes.

Montauban, Moissac and Castelsarrasin are the principal places. Other towns of interest are St. Antonin, which has manufactures of rough fabrics and is archaeologically important for its possession of a massive hôtel de ville of the 12th century, the oldest in France; Bruniquel, which is splendidly situated over-looking the valleys of the Aveyron and the Verre, and is dominated by a medieval castle with a donjon of the 11th century; Beaumont-de-Lomagne, a curious bastide of the 13th century with a fortified château; and the 14th century church of the same period, containing many precious antiquities; Varen, an ancient town of narrow streets and old houses with a remarkable Romanesque church and the ruins of a castle of the 13th and 15th century; and Cazoulès, where remains the Cistercian abbey of Beaulieu, founded in 1141, are still to be seen.

TARNPOL, a town in Galicia, Austria, 87 m. E.S.E. of Lemberg by rail. Pop. (1900) 30,368, half of which are Jews. Industry consists chiefly in corn-milling and the preparation of wax and honey. The principal trade is in horses, corn and other agricultural produce, and spirits. Tarnopol was formerly a fortress, and rendered valuable services to Polish kings, who in their turn conferred upon it important privileges.

TARNOW, a town in Galicia, Austria, 164 m. W.N.W. of Lemberg by rail. Pop. (1900) 31,651, about 40 per cent. Jews. It is situated on the river Biała, not far from its junction with the Dunajec, and is the seat of a Roman Catholic bishop. It possesses a cathedral in Gothic style, built in the 15th century, with monuments of the Tarnowski and Ostrogski families, to which the town formerly belonged, and another church built in 1454. On the Martinsberg, an eminence near the town, stands the ruins of the old castle of the Tarnowski family, and a small church over 800 years old. Worth mentioning also is the town hall, an old and interesting building. Agricultural implements, glass and chichory are manufactured.

TARNOWSKI, JAN [called MAGNUS] (1488-1561), Polish general. After a careful education beneath the eye of an ex-Nobles, and at the instance of a prince Mathew Drzewicki, bishop of Przemysl, he occupied a conspicuous position at court in the reigns of John Albert, Alexander and Sigismund I. As early as 1509 Tarnowski brilliantly distinguisheil himself in Moldavia, and took a leading part in the great victories of Wisniowiec (1512) and Orsza (1514), where he commanded the flower of the Polish chivalry. To complete his education he then travelled in Palestine, Syria, Arabia, Egypt, and northern and western Europe. While in Portugal he received from King Emanuel the chief command in the war against the Moors in India. In 1535 he was rewarded for his services by being made a member of the Christian cause with the dignity of a count of the Empire. Indeed, the emperor had such a high regard for Tarnowski that he offered him the leadership of all the forces of Europe in a grand expedition against the Turks. On the death of Nicholas Firlej in 1526 Tarnowski became grand hetman of the crown, or Polish commander-in-chief, and in that capacity won his greatest victory at Obertyn (22nd August 1531) over the Moldavians, Turks and Tartars, for which he received a handsome subsidy and an ovation similar to that of an ancient Roman triumphator. Heartily attached to King Sigismund I. and his son Sigismund Augustus, Tarnowski took a royal side during the so-called Kobena wojna, or Poultry War, of 1537;
and also in 1548 when the turbulent szlachta tried to annul by force the marriage of Sigismund Augustus with Barbara Radziwill. In 1553, however, we find him in opposition to the court and thwarting as much as possible, the designs of the young king. Nevertheless Tarnowski was emphatically an aristocrat and an oligarch, proud of his ancient lineage and intensely opposed to the democratic tendencies of the szlachta. A fine example of the szlachta king and the szlachta as his ideal of government. On the other hand, though a devout Catholic, he was opposed to the exclusive jurisdiction of the bishops and would even have limited the authority of Rome in Poland. As a soldier Tarnowski invented a new system of tactics which greatly increased the mobility and the security of the armed camps within which the Poles had so often to encounter the Tatars. He also improved discipline by adding to the authority of the commanders. His principles are set forth in his Consilium Rallantis Bellacce (best edition, Posen, 1870), which was long regarded as authoritative. As an administrator he did much to populate the vast south-eastern steppes of Poland.

See Stanislaw Orzechowski, Life and Death of Jan Tarnowski (Pol.) (Cracow, 1855.)

TAROK, a game of cards very popular in Austria and Germany, and played to a limited extent in some parts of France. Special cards are used, and the rules are complicated. The name Tarok was originally given by the Italians to a certain card in the pack as early as the 13th century, but was afterwards applied to the game itself.

TAROM, a district of Persia, situated on the borders of Gilan, north-west of Kazvin. It is divided into upper and lower Taram; the former, on the right bank of the Kizil Uzain (Seid Rud) river, is a crown domain; the latter, on the left bank, forms part of the province of Kazvin. It produces much cotton and fruit, and derives a considerable revenue from its alum mines at Zajkanin. Most of the alum is exported to Russia. It also has a few olive groves. The inhabitants are Turks.

TARPALUN, or TARPALING (as tarpaulin, from tar, and palling, a covering, Lat. palla, a mantle), a heavy, well-made, double warp plain fabric, of various materials, used chiefly in the manufacture of covers for railway and other wagons and for protecting goods on wharves, quays, &c. To make it proof against rain and other atmospheric influences it is generally treated with tar, though various compositions of different kinds are also employed, especially for the finer fabrics such as are used for covering motor-cars. These covers are generally made of flax, hemp and cotton, and are very similar to canvas—indeed, large quantities of canvas are made waterproof, and then called tarpaulin. A very large quantity of tarpaulin is made entirely of jute. The chief seats of manufacture are Dundee, Arbroath and Kirkcaldy. Formerly the word was used as a sort of nickname for sailors, the modern "tar" in the same sense being an abbreviation of it.

TARPEIA, in Roman legend, daughter of the commander of the Capitol during the war with the Sabines caused by the rape of the Sabine women. According to the common story, she offered to betray the citadel, if the Sabines would give her what they wore on their left arms, meaning their bracelets; instead of this, keeping to the letter of their promise, they threw their shields upon her and crushed her to death. Similus, a Greek elegiac poet, makes Tarpeia betray the Capitol to a king of the Gauls. The story may be an attempt to account for the Tarpeian rock being chosen as the place at which execution of traitors. According to S. Reinach, however, in Revue archéologique, xi. (1908), the story had its origin in a rite—the taboo of military spoils, which led to their being heaped up on consecrated ground that they might not be touched. Tarpeia herself is a local divinity, the manner of whose death was suggested by the tumultus or shields on the spot devoted to her cult, a crime being invented to account for the supposed punishment.


TARQUINI (mod. Corneto Tarquinia, q.v.), an ancient city of Etruria, Italy, situated on a hill overlooking the S.W. coast of Italy, about 5 m. N.W. of it. The site of the Roman town is now deserted, its last remains having been destroyed by the inhabitants of Corneto in 1907. Scanty remains of walls and of buildings of the Roman period exist above ground; traces of a large rectangular platform were found in 1875, and part of the thermae in 1879; it occupied the summit of a hill defended by ravines, called Pian di Civita. It seems probable, however, that the original settlement occupied the site of the medieval town of Corneto, to the W.S.W., on the further side of a deep valley. Some authorities indeed consider, and very likely with good reason, that this was the site of the Etruscan city, and that the Pian di Civita, which lies further inland and commands but little view of the sea, was only occupied in Roman times. The case would be parallel to others in Etruria, e.g. Civita Castellana (anc. Falerii) which also occupies the site of the Etruscan city, while the Roman site, some distance away, is now abandoned. The importance of Tarquini to archaeologists lies mainly in its necropolis, situated to the S.E. of the medieval town, on the hill which, from the tumuli raised above the tombs, bears the name of Monterozzi. The tombs themselves are of various kinds. The oldest are tombe a pozzo, or shaft graves, containing the ashes of the dead in an urn, of the Villanova period, the oldest of them probably pre-Etruscan; in some of these tombs but urns, like those of Lahum, are found. New to the Etruscans are the various kinds of inhumation graves, the most important of which are rock-hewn cist graves, which contain well-preserved paintings of various periods; some show close kinship to archaic Greek art, while others are more recent, and one, the Grotta del Tifone (so called from the typhons, or winged genii of death, represented) in which Latin as well as Etruscan inscriptions appear, belongs perhaps to the middle of the 4th century B.C. Fine sarcophagi from these tombs, some showing traces of painting, are preserved in the municipal museum, and also numerous fine Greek vases, bronzes and other objects.

Tarquinii is said to have been already a flourishing city when Demaratus of Corinth brought in Greek workmen. It was the chief of the twelve cities of Etruria, and appears in the earliest history of Rome as the home of two of its kings, Tarquinius Priscus and Tarquinius Superbus. From it many of the religious rites and ceremonies of Rome are said to have been derived, and even in imperial times a collegium of sixty haruspices continued to exist there. The people of Tarquinii and Veii attempted to restore Tarquinii Superbus to the throne of Italy. In 356 B.C. the citizens of Tarquinii captured and put to death the Romans; the resulting war ended in 351 with a forty years' truce; he succeeded for another period in 308. When Tarquinii came under Roman domination is uncertain, as is also the date at which it became a municipality; in 181 B.C. its port, Graviscae (mod. Porto Clementino), in an unhealthy position on the low coast, became a Roman colony. It exported wine and carried on coral fisheries. Nor do we hear much of it in Roman times; it lay on the hills above the coast road. The flax and forests of its extensive territory are mentioned by classical authors, and we find Tarquinius offering to furnish Scipio with sailcloth in 195 B.C. A bishop of Tarquinii is mentioned in A.D. 456.


TARQUINIUS PRISCUS, LUCIUS, fifth legendary king of Rome (616–578 B.C.). He is represented as the son of a Greek refuge, who was removed from Tarquinii in Etruria to Rome, by the advice of his wife, the prophetess Tanagi. Appointed guardian to the sons of Aeneas Marcius, he succeeded to his throne and planting them on the throne on their father's death. He laid out the Circus Maximus, instituted the "great" games, built
the great sewers (doacae), and began the construction of the temple of Jupiter on the Capitol. He carried on war successfully against the Sabines and subjugged Latium. He is said to have raised the number of the senators to 300, and to have doubled the number of the knights (see NAUSIC, ATTUS). The introduction of many of the insignia both of war and of civil office is assigned to his reign, and he was the first to celebrate a Roman triumph, after the Etruscan fashion, in a robe of purple and gold, and bore a spatha, a chasuble drawn by four horses. He was assassinated at the instigation of the sons of Ancus Marcius.

The legend of Tarquinii Priscus is in the main a reproduction of those of Romulus and Tullus Hostilius. His Corinthian descent, invented by the Greeks to establish a close connexion with Rome, is impossible for chronological reasons; further, according to the genuine Roman tradition, the Tarquinii were of Etruscan, not Greek, origin. There seems to have been originally only one Tarquinii; later, when a connected story of the legendary period was constructed, two (distinguished as the “Elder” and the “Proud”) were introduced, separated by the reign of Servius Tullius and then the force of both connected with the same events. Thus, certain public works were said to have been begun by the earlier and finished by the later king; both instituted games, acquired the Silviany books, and reorganized the army.

For the constitutional reforms attributed to Tarquinii, see Rome: Ancient History, for a critical examination of the story, Schwäger, Römische Geschicht, bk. xv.; Sir George Cornewall Lewis, Critédité Storia di Roma, I. (1898); and, for the political character of his reign, Rome: Ancient History, Ancient authorities. — Livy i. 21; Dion. Hal. v. i-vi. 21.

TARQUINIUS SUPERBUS, LUCIUS, son of Lucius Tarquinii Priscus and son-in-law of Servius Tullius, the seventh and last legendary king of Rome (534–510 B.C.). On his accession he proceeded at once to repeal the recent reforms in the constitution, and attempted to set up a pure despotism. Many senators were put to death, and their places remained unfilled; the lower classes were deprived of their arms and employed in erecting splendid monuments, while the army was recruited from the king's own retainers and the hereditary forces of his foreign allies. The completion of the fortress-temple on the Capitoline confirmed his authority over the city, and a fortunate marriage of his son to the daughter of Octavius Mamilius of Tusculum secured him powerful assistance in the field. His reign was characterized by bloodshed and violence; the outrage of his son Sextus upon Lucretia (q.v.) precipitated a revolt, which led to his expulsion from the city.

In the story certain Greek elements, probably later additions, may easily be distinguished. Tarquinii appears as a Greek “tyrant” of the ordinary kind, who surrounds himself with a bodyguard and erects magnificent buildings to keep the people employed; on the other hand, an older tradition represents him as more like Romulus. This twofold aspect of his character perhaps accounts for the making of two Tarquinii out of one (see TARQUINIUS PRISCUS). The stratagem by which Tarquinii obtained possession of the town of Gabii is a mere fiction, derived from Greek and Oriental sources. According to arrangement, his son Sextus requested the protection of the king in infancy against his father. Having obtained their confidence, he sent a messenger to Tarquinii to inquire the next step. His father made no reply to the messenger, but walked up and down his garden, striking off the heads of the tallest poppies. Sextus thereupon put to death all the chief men of the town, and thus obtained the mastery. The stratagem of Sextus is that practised by Zopyrus is the case of Babylon, while the episode of the poppy-heads is borrowed from the advice given by Thrasylbus to Periander (Herodotus iii. 154, v. 92). On the other hand, the existence in the time of Dionysius of Halicarnassus of a treaty concluded between Tarquinii and the inhabitants of Gabii, shows that the town came under his dominion by formal agreement, not, as the tradition states, by treachery and violence. The embassy to Delphi (see Brutus, Lucius Junius) cannot be historical, since at the time there was no communication between Rome and the mainland of Greece. The well-known story of Tarquinii's repeated refusal and final consent to purchase the Sibylline books has its origin in the fact that the building of the temple of Jupiter Capitolinus, in which they were kept, was attributed to him. The fact that his expulsion can hardly be historical. A constitutional revolution, involving such far-reaching changes, is not likely to have been carried out in primitive times with so little disturbance by a simple resolution of the people, and it probably points to a rising of Romans and Sabines against the dominion of an Etruscan family (Tarquinii, Tarchna) at that time established at Rome.

For a critical examination of the story see Schwäger, Römische Geschichte, bk. xviii.; Sir George Cornewall Lewis, Critédité Storia di Roma, I. (1898); and, for the political character of his reign, Rome: Ancient History, Ancient authorities. — Livy i. 21; Dion. Hal. v. i-vi. 21.

TARRAGONA, a maritime province in the north-east of Spain, formed in 1833 from the southern part of the province of Catalonia, and bounded on the S.E. by the Mediterranean, N.E. by Barcelona, N. by Lerida, W. by Saragossa and Teruel, and S.W. by Castellon de la Plana. Pop. (1900) 337,964; area, 2,505 sq. m. The Ebro flows through the southern portion of the province, and the other chief streams are the Gaya and the Francoll. These three rivers flow south into the Mediterranean. Below Tortosa, the Ebro forms a conspicuous delta. It is said that the even south-westward curve of the coast-line is unbroken by any noteworthy headland or indentation. The province, although mountainous, is naturally fertile. The hills are clothed with vineyards, which produce excellent wines, and in the valleys are cultivated all kinds of grain, vegetables, rice, hemp, flax and silk. Olive, orange, filbert and almond trees reach great perfection, and the mountains yield rich pastures and timber trees of various kinds. The climate is temperate on the coast and in the centre, cold in the highlands, very warm and damp in the valleys and on the banks of the rivers as they near the sea. Manufactures are well advanced, and comprise silk, cotton, linen and woollen fabrics, velvet, felt, soap, leather and spirits. There are also many potteries and cooperages, and flour, paper and oil mills. Silver, copper, lead and other minerals have been found, and quarries of marble and jasper are worked in the hills. The fisheries produce more than 20,000 yearly. There are upwards of 250 m. of railways, which link together all the large towns, and include the important main lines along the coast and up the Ebro valley. The cities of Tarragona (pop. 1900, 23,423) and Tortosa (24,452), which are the principal seaports, and the towns of Reus (26,681) and Valls (12,625) are described in separate articles. Montblanch (543) is the only other town with a population exceeding 2,000. The people of Tarragona are, like almost all the inhabitants of Catalonia (q.v.), hardy, enterprising and industrious. Although the birth-rate considerably exceeds the death-rate, the population tends to decrease slightly, as many families emigrate.
TARRASA—TARRING AND FEATHERING

partly of Roman masonry; one such fragment, immured in the palace wall, is inscribed with the epitaph of a charioteer (auriga) who, it says, would rather have died in the circus than of fever. Massive ruined walls encircle the old town. Their lowest course is "Cyclopean," consisting of unhewn blocks about 12 ft. long and 6 ft. wide; Roman masonry of the Augustan age is superimposed. The eight gates and the square towers, characteristic of the Roman city, are also a great extant. "Cyclopean." The palace, itself a building of the early 19th century, has an old fortified tower, and there are barracks and forts in the city; but Tarragona can no longer be regarded as a fortress capable of standing modern artillery, although it is officially classed as such.

The new town, divided from the old by one broad and shady avenue, the Rambla de San Carlos, and intersected by another, the more modern Rambla de San Juan, extends to the west and south along a low promontory which juts out into the Mediterranean. Its outlying districts merge into the Camp de Tarragona, a plain planted with vines and walnut, almond and olive groves. Tarragona cathedral is one of the noblest examples of early Spanish art. It is 320 ft. long and 103 ft. broad, and consisted originally of a nave, aisles, transepts with an octagonal lantern at the crossing, and an apsidal chancel. Several exterior chapels were added in later times, and on the south-east stands a 14th century steeple raised on a Romanesque tower. The east end was probably begun in 1331 on the ruins of an earlier church, but the main body of the building was from the 12th century and the first half of the 13th, and it is of transitional character,—the exuberant richness of the sculptured capitals being admirably kept in subordination by the Romanesque simplicity of the general design. Considerable changes were introduced at a later date; and the present west end of the nave cannot have been completed till late in the 14th century. On the north-east side is a cloister contemporary with the church, with which it communicates by a very fine doorway. The cloister contains much remarkable work, and the tracery of the windows bears interesting marks of Moorish influence. Two other noteworthy churches in the city are San Pablo and Santa Tecla la Vieja, both of the 12th century. There is a fine Roman aqueduct; the Roman amphitheatre was dismantled in 1491 to furnish stone for the eastern mole, though a few rows of seats are left near the sea-shore; and the museum contains a large collection of Roman antiquities. The Torreón de Pilatos is said to have been the palace of the Emperor Augustus; it was partly destroyed by the French in 1811 and now serves as a prison. Its name is connected with an old tradition that Pontius Pilate was a native of the building. It has also many public buildings, including the law courts, several hospitals, a provincial institute, training schools for teachers, and offices of the provincial and municipal governments. When the monks of the Grande Chartreuse were compelled to leave France, they settled at Tarragona in 1903, and established a liqueur factory; 20,000 cases of liqueur were exported in 1904 and 39,000 in 1905. A characteristic feature of Tarragona is the number of its underground storeshouses for wine (bodegas); wine is exported in large quantities. There is a British steel file factory, and in the port, fish, fish-fillets, salted and smoked fish, salted fish are also manufactured. The harbour is at the extreme south-west of the new town. It was originally protected by a Roman breakwater, which was destroyed in the 19th century. The eastern mole, founded in 1491 and frequently enlarged, terminates in a lighthouse. Its length was 1400 yards in 1904, when the construction of a new section was begun. In each of the five years 1901-5 about 870 ships of 580,000 tons entered the port. Wine, oil, nuts, almonds and small quantities of lead and pig iron are exported; the imports include coal from the United States, dried codfish from Norway and Iceland, guano and phosphates. Close to the harbour and at the mouth of the Francoli is the fishermen's quarter (barrio de pescadores), in which most of the houses are coloured pale blue.

History.—Tarraco, the capital of the Iberian Cessetani, many of whose coins are extant, was one of the earliest Roman strongholds in Spain. It was captured in 218 B.C. by Gnaeus and Publius Cornelius Scipio, who improved its harbours and enlarged its walls. A Roman monument on a hill 37 ft. E. is known as the Sepulcro de los Escipiones, and locally believed to be the tomb of the Scipios, who were defeated and slain by the Carthaginians under Hasdrubal Barca in 212 B.C. The battle took place at Antioigis, the modern Alcaniz in the province of Teruel; there is no good reason to believe that the bodies of the Scipios were conveyed to Tarragona for burial, nor is the monument older than the 1st century A.D. As the Colonia Triumphalis, so called to commemorate the victories of Julius Caesar, Tarraco was made the seat of one of the four assize courts (conventus juridici) established in Hispania Citerior Augusti. It was a bishopric from the 1st century A.D. onwards, under which the city is called Tarraco by the Christian church until the 17th century, when it was made a diocese, and by the French.

TARRASO, a town of north-eastern Spain, in the province of Barcelona, 6 m. W.N.W. of Sabadell on the Barcelona-Lérida railway, and in the midst of a narrow plain surrounded by mountains. Pop. (1900) 15,956. Tarrasa was a Roman municipality, and a bishopric from the 5th century to the Moorish invasion in the 8th. It was razed by the Moors and rebuilt later by the Christians. There are three ancient Romanesque churches, in one of which, San Miguel, some Roman masonry is still visible. Tarrasa is now a modern industrial town, with fine public buildings, including the royal college, built in 1864 for 450 students besides day scholars, the school of arts and handicrafts, the industrial institute, chamber of commerce, hospitals, town hall, clubs, theatres and many large textile factories. Grain, wine, oil and fruit are produced in the district, and there is a municipal farm, founded in 1885, for experiments in viticulture.

TARRING AND FEATHERING, a method of punishment at least as old as the Crusades. The head of the culprit was lopped, the hair removed, and a long straight quill or feather, several feet long, was fixed to the top of the head, and the effects shaken over him. The earliest mention of the punishment occurs in the orders of Richard Coeur de Lion, issued to his navy on starting for the Holy Land in 1191. "Concerning the lawes and ordinances appointed by King Richard for his navie the forme thereof was this . . . item, a thief or felon that hath stolen, being lawfully convicted, shall have his head shorn, and boyling pitch poured upon his head, and feathers or downe strawed upon the same whereby he may be known, and so at the first landing-place they shall come to, there to be cast up." (trans, of original statute in Hallam's Vocab., ii. 21.) A later instance of this penalty being inflicted is given in Notes and Queries (series 4, vol. v.), which quotes one James Howell writing from Madrid, in 1623, of the "boisterous Bishop of Halverstadt," who, "having taken a place where there were two monasteries of nuns and friars, he caused divers feather
beds to be ripped, and all the feathers thrown into a great hall, whether the nuns and friars were thrust naked with their bodies oiled and pitched and to tumble among these feathers, which makes them here (Madrid) press him an ill-death." In 1669 a London bailiff, who attempted to serve process on a debtor who had taken refuge within the precincts of the Savoy, was tarred and feathered and taken in a wheelbarrow to the Strand, where he was tied to the Maypole which stood by what is now Somerset House. It is probable that the punishment was never regarded as legalized, but was always a type of mob vengeance.

TARRYTOWN, a village of Westchester county, New York, on the E. bank of the Hudson river, opposite Nyack, with which it is connected by ferry, and about 25 m. N. of New York City. Pop. (1850) 3562; (1900) 4770, of whom 984 were foreign-born and 191 were negroes; (1910, U.S. census) 5000.

Tarrytown is served by the New York Central and Hudson River railroad, and by interurban electric lines connecting it, via White Plains, with New York City. It is situated on a sloping hill that rises to a considerable height above Tappan Zee, a large expansion of the Hudson river, and is built principally of a local limestone. Its main post road (laid out in 1723) from New York to Albany, called the King's Highway until the War of Independence, then called the Albany Post Road, and now known (in Tarrytown) as Broadway. South of the village is "Lyndhurst," the estate of Miss Helen Miller Gould, and to the N.E. is Kaakout (originally "Kikuit," that is, "lookout," the name of a high promontory), the estate of John D. Rockefeller. In the latter the Hackley School (1890), Irving School (1837), Repton School and the "Castle" School for girls; a Young Men's Lyceum (1859), with a public library (Soozo volumes in 1910), and the Tarrytown Hospital (1893). In the vicinity there are large nurseries and market-gardens, and automobiles are manufactured in the village. Tarrytown stands on the site of a Weequaesgeek Indian village, Alipconk (the place of elms), burned by the Dutch in 1644. The first settlement of whites was made about 1645. There were perhaps a dozen Dutch families here in 1680, when Frederic Phillipe (formerly known as Vredyk, Flypse) acquired title to several thousand acres in Westchester county, called Phillipe Manor. He built, partly of brick brought from Holland, a manor-house (on a point of land, now known as the Manor's Point, and in the harbor of the present village), a mill and a church, at the mouth of Sleepy Hollow, some three-quarters of a mile above the village; Dr Hamilton Wright Mabie has written: "There is probably no other locality in America, taking into account history, tradition, the old church, the manor-house and the mill, which so entirely conserves the form and spirit of Dutch civilization in the New World." During the War of Independence Tarrytown was the centre of the "Neutral Territory" between the lines of the British and Continental forces, and was the scene of numerous conflicts between the "cowboys" and "skinners," bands of unorganized partisans, the former acting in the name of the colonies, and the latter in that of the king. On the post road, on the 24th of September 1780, Major John Andre was captured by three Continentals, John Paulding, David Williams and Isaac Van Wert; to commemorate the capture a marble shaft surmounted by a bronze statue of a Continental soldier has been erected on the spot.

Tarrytown is described in the Sketch Book of Washington Irving, who lived and died at "Sunnyside," within the limits of Tarrytown, was long warden of Old Christ Church, and is buried in the Old Sleepy Hollow burying-ground, which adjoins the Dutch Church, and in which Carl Schurz also is buried. Tarrytown was incorporated as a village in 1870. Its name is probably a corrupt form of the Dutch "Tarwen dorp" (wheat town).

See H. B. Dawson, Westchester County in the American Revolution (New York, 1886); and an article by H. W. Mabie in L. P. Pollen's Historic Towns of the Middle States (New York, 1889).

TASRIER, the Anglicized form of the scientific name of a small and aberrant lemur-like animal, Tarsius spectrum, inhabiting the Malay Peninsula and islands, and typifying a family. The name tarsier refers to the great elongation of two of the bones of the tarsus, or ankle, and spectrum to the huge goggle-like eyes and attenuated form which constitute two of the most distinctive features of this weird little creature. In organization the tarsier departs markedly from other lemurs as regards several particulars, and thereby approaches to monkeys and apes. Rather smaller than a squirrel, with dusky brown fur, the tarsier has immense eyes, large ears, a long thin tail, tufted at the end, a greatly elongated tarsal portion of the foot, and disc-like adhesive surfaces on the fingers, which assist them in maintaining its position on the boughs. Four species of the genus are now recognized, whose range includes the Malay Peninsula, Java, Sumatra, Borneo, Celebes and some of the Philippines. The tarsier feeds chiefly on insects and lizards, sleeps during the day, but is tolerably active at night, moving chiefly by jumping from place to place; an action for which the structure of its hind-legs seems particularly well adapted. It is rare, not more than two being generally found together, and only brings forth one young at a time. (See Primates.)(L.)

TARSUS, (Tarsus, Tarsus), an ancient city in the fertile plain of Cilicia. The small river Cydnus flowed through the centre of the town, and its cool swift waters were the boast of the city (though visitors like Dion Chrysostom thought it far inferior to the rivers of many Greek cities). The harbour, Rhicma, below the city, was originally a lagoon, though it is said also to be supplied by springs of its own. The Cydnus flowed into the lake (where were the arsenals) and thence into the sea, about 10 m. from Tarsus. The city is first mentioned on the Black Obelisk, as captured by the Assyrians along with the rest of Cilicia about 850 B.C. It was probably an old Ionian colony, settled (like Mallus) under the direction of Clarian Apollo. Its importance was due (1) to its excellent and safe harbour, (2) to its possession of a fertile territory, and (3) to its command of the first waggon-road made across Mount Taurus, which was cut through the Cilician Gates, a narrow gorge 100 yards in length, originally only wide enough to carry the waters of a small affluent of the Cydnus. The greatness of Tarsus rested therefore mainly on the two great engineering works, the harbour and the road. That the latter was due to Greek influence is shown by the village Mopsucrene on the southern approach to the Gate. A jumble of Greek, Roman and Byzantine coins, the mountain passes have been so important in history as this road (seventy miles in length) over Taurus. Many armies have marched over it; those of Cyrus the Younger, Alexander the Great, Cicero, Septimius Severus and the First Crusade may specially be mentioned.

Tarsus is most accessible from the sea or from the east. Even after the "Cilician Gates" were cut, the crossing of Taurus was a difficult operation for an invading army (as Xenophon and Arrian show). Hence Tarsian history (where not determined by Greek maritime relations) has been strongly affected by Semitic influence, and Dion Chrysostom, about A.D. 110, says it was more like a Phoenician than a Hellenic city (which it claimed to be). After the Assyrian power decayed, princes, several of whom bore the name or title Syeneusis, ruled Tarsus before and under Persian power. Persian satraps governed it in the 4th century B.C.; and struck coins with Aramaic legends there. The Seleucid kings of Syria for a time kept it in a state of servitude; but it was made an autonomous city with additional citizens (probably Argive Greeks and Jews) by Antiochus IV. Epiphanes in 171 B.C.; and then it began to strike its own coins. It became one of the richest and greatest cities of Asia Minor. It was East under the Romans after 104 B.C., and was favoured by both Antony and Augustus: the reception there by the former of Cleopatra, who sailed up to the city in a magnificent vessel, was a striking historic event. In spite of its oriental character, it maintained a university where Greek philosophy was taught by a series of famous Tarsians, who influenced Roman history. Chief among them were Athenodorus Cananites, teacher and friend of Augustus for many years, a man of courage and
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power, who remodelled the Tarsian constitution (making it timocratic and oligarchic). The picture which Philostratus, in his biography of Apollonius Tyanaeus, draws of the Tarsians as vain, luxurious and illiterate, represents the general Graeco-Roman conception of the city. The legend which was believed to be graven on the statue of Sardanapalus at Anchialae (12 m. S.W. from Tarsus) might have been the motto of most Tarsians: "Eat, drink, play, for nothing else is worth this (gesture)" (referred to by St Paul, 1 Cor. xv. 32). The statue was probably the ancient Hittite or cuneiform inscription, representing a figure with right hand raised; the letters and the attitude were misunderstood; the figure was supposed to be snapping the fingers and uttering this expression of effeminate and weedy sensuality.

Tarsus depended for its greatness on commerce, peace and orderly government. It was not a strong fortress, and could not be defended during the decay of the empire against barbarian invasion. The Arabs captured the whole of Cilicia shortly after A.D. 660; and Tarsus seems to have been a ruin for more than a century after the conquest. But Harun al-Rashid rebuilt its walls in 789, and made it the north-western capital of the Arab power in the long wars against the Byzantine empire. All the raids, which were made in Asia Minor regularly, year by year, sometimes twice in one year, through the Cilician Gates and past the fortress Lounlon, issued through the north gate of Tarsus, which was called the "Gate of the Holy War." The western gate is still standing, and is named "St Paul's Gate." The caliph Mamun died on such a foray in A.D. 833, having caught a chill at a great spring north of the Cilician Gates beside Ak-Keupreu. He was brought to Tarsus where (like the emperor Tacitus) he died, and (like the emperor Julian) was buried. His illness recalls the fever which Alexander the Great contracted from bathing in the Cydnus. Nicephorus Phocas reconquered Tarsus and all Cilicia for the empire in A.D. 965. In the First Crusade Baldwin and Tancred captured Tarsus A.D. 1099, and there the two leaders had a serious quarrel. It formed part of the kingdom of Lesser Armenia for great part of the three centuries after A.D. 1180, and it was fortified by Leo II. and Hethoum I. But Turchomans and Egyptian invaders disputed its possession with the Greek emperors and Armenian kings and with one another. It finally passed into Ottoman hands about the beginning of the 16th century.

Most of the successive masters of Tarsus had their own legends about its origin, usually with a religious character justifying and explaining their possession of the city. The Assyrian Sardanapalus, the native god Sandan, the Greek hero Perseus, the Greek god Heracles, are all called founder of Tarsus by later writers. Javan, the Ionian chief, was called the grandfather of Cydnus, who gave name to the river. A curious ceremony was practised in honour of Sandan (identified with the Greek Heracles): a pyre was periodically erected and the god was burned on it. It is said that the original name of the city was Partenia, which suggests that a virgin goddess was worshipped here as in so many shrines of Asia Minor and Syria: the virgin goddess Athena appears on Tarsian coins. The Baal of Tarsus is named in Aramaic letters on many of its coins in the Persian period.

The ruins of the ancient city are very extensive, but they are deeply buried, and make little or no appearance above the surface except in the Dunuk Tash (popularly identified as the "Tomb of Sardanapalus," a monument which, however, was at Anchialae, not at Tarsus). This shapeless mass of concrete was probably the substructure of a Graeco-Roman temple, from which the marble coating has been removed. The modern town has considerable hazzars and trade; but the climate is very oppressive, owing to the proximity of vast marshes which occupy the site of the harbour and the lower part of the original Cynthus. The river was diverted from its former course by Justinian in the 6th century so as to carry off the surplus waters in time of flood and prevent inundations in the city, not to deprive Tarsus of what was its chief pride and boast; but gradually the neglect of subsequent centuries allowed the channel in the city to become blocked by accumulation of soil, and now the whole body of water flows in the new channel east of the city, except what is drawn off by an artificial irrigation course to water the gardens on the western side of the city. The population is about 25,000, including, besides Turks and Syrian Moslems, also Armenians, Greeks, Syrian Christians, Persians, Afghans, Aniaria (mostly gardeners) and even Hindus. There is a large American mission school called St Paul's Institute, giving a very comprehensive education to Armenians and Greeks drawn from an extensive district.


TART, a dish of baked pastry containing fruit, a fruit pie; also a small open piece of baked pastry with jam placed upon it. The word was adapted from the O.Fr. tart: the older form turte or tortel, is found in the 11th century. Fr. torarte and the diminutive tortel or tortes, the origin is the Latin turrare (tortare, to twist), used of a cake in Med. Lat., the paste or dough of cakes or tarts being rolled or twisted. The alteration of the vowel is also seen in Ital. tartaro. In English there is some confusion with "tart," sharp, acid, bitter, which comes from O.E. tcart, sharp, severe, properly "tearing," from teran, to tear; cf. "bitter," from "to bite."

TARTAGLIA, or TARTALEA, NICOLÒ (c. 1506-1559), Italian mathematician, was born at Brescia. His childhood was passed in dire poverty. During the sack of Brescia in 1512, he was horribly mutilated by some French soldiers. From these injuries he slowly recovered, but he long continued to stammer in his speech, whence the nickname, adopted by himself, of "Tartaglia." Save for the rarest rudiments of reading and writing, he tells us that he had no master; yet we find him at Verona in 1521 an esteemed teacher of mathematics. In 1534 he went to Venice. For Tartaglia's discovery of the solution of cubic equations, and his contests with Antonio Marie Floridas, see ALGEBRA (History). In 1548 Tartaglia accepted a situation as professor of Euclid at Brescia, but returned to Venice at the end of eighteen months. He died at Venice in 1559.

Tartaglia's first printed work, entitled Nuova scienza (Venice, 1537), dealt with the theory and practice of gunnery. He found the elevation giving the greatest range to be 45°, but failed to demonstrate the correctness of his intuition. Indeed, he never developed the erroneous ideas of his time regarding the paths of projectiles, further than to see that no part of them could be a straight line. He nevertheless inaugurated the scientific treatment of the subject. His Questi et invensioni diverse, a collection of the questions he answering or addressing to himself by perusing the most varied conditions, was published in 1546, with a dedication to Henry VIII. of England. Problems in artillery occupy two out of nine books; the sixth treats of fortification; the ninth gives several examples of the solution of cubic equations. He published in 1551 Regola generale per sollevare ogni offensore nave, intitulata la Tragagliata Invenzione (an allusion to his personal troubles at that time) containing for the first time a description of the describing the, bell, little known in western Europe. He pursued the subject in Raggionamenti sopra la Tragagliata Invenzione (May 1557). His largest work, Trattato generale di numeri e misure, an comprehensive mathematical treatise, including arithmetic, geometry, mensuration, and algebra as far as quadratic equations (Venice, 1555, 1600). He published the first Italian translation of Euclid (1543), and the earliest version from the Greek of some of the principal works of Archimedes (1544). The tract De insidiis aquae, of which his Latin now holds the place of the lost Greek text. Tartaglia claimed the invention of the gunner's quadrant.
TARTAN—TARTAR

Tartaglia’s own account of his early life is contained in his <i>Questii</i>, lib. vi, p. 74. See also Buoncompagni, <i>Intorno ad un testimoni incerto di N. Tartaglia</i> (Milan, 1831); Rossi, <i>Elogi di Girolamo Cardano</i> (P. 386). Tartaglia’s writings on gunnery were translated into English by Lucar in 1588, and into French by Rieffel in 1845.

**TARTAN** (from F. <i>tiréilain</i>, “linis-wolsie,” Sp. <i>tirilán</i>, a kind of woollen cloth, perhaps so called from its thinness and lightness, cf. Sp. <i>tirar</i>, to tremble with cold), a worsted cloth woven with alternate stripes or bands of coloured warp and weft, so as to form a chequered pattern in which the colours alternate in “sets” of definite width. The worsted yarn used in the manufacture of striped cloth cannot be claimed as peculiar to any special race or country, for indeed such checks are the simplest ornamental form into which dyed yarns can be combined in the loom. But the term tartan is specially applied to the variegated cloth used for the principal portions of the distinctive costume of the Highlanders of Scotland. For this costume, and the tartan of which it is composed, great antiquity is claimed, and it is asserted that the numerous clans into which the Highland population were divided had each from time to time a special tartan by which it was distinguished from the tartans of the other clans. In 1745 soldiers of the parliament were passed for disarming the Scottish Highlanders and for prohibiting the use of the Highland dress in Scotland, under severe penalties. These acts remained nominally in force till 1782, when they were formally repealed, and since that time clan tartan has, with varying fluctuations of fashion, been a popular article of dress, by no means confined in its use to Scotland alone; and many new and imaginary “sets” have been invented by manufacturers, with the result of introducing confusion in the heraldry of tartans, and of throwing doubt on the reality of the distinctive “sets” which at one time undoubtedly were more or less recognized as the badge of various clans.

Undoubtedly the term tartan was known, and the material was worn, “of one or two colours for the poor and more varied for the rich,” as early as the middle of the 15th century. In the accounts of John, bishop of Glasgow, treasurer to King James III., in 1471, there occurs, with other mention of the material, the following—“<i>Ane elne and ane halve of blue Tartane to lyne his gowne of cloth of Gold.”</i> It is here obvious that the term is not restricted to particoloured chequered textures. In 1538 accounts were incurred for a Highland dress for King James V., on the occasion of a hunting excursion in the Highlands, in which there are charges for “<i>variant cullor velvet</i>,” for “<i>ane schort Heland colt</i>,” and for “<i>Heland tartane to be hose to the kinge’s grace”</i>. John Buchanan, in his <i>De Tradicione Tartarorum</i>, published in 1578, says of the ancient and still-used dress of the Highlanders and Islanders, “all, both noble and common people, wore mantles of one sort (except that the nobles preferred those of <i>masse</i>), and the foot soldiers wore the same.” The <i>scotorum historia</i> (1582), as translated by Monypenny (1612), says of the Highlanders, “They delight in marled clothes, specially that have any long stripes of sundry colours; they love chiefly purple and blue. Their predecessors used short mantles or plaid of divers colours sundry ways divided; and amongst some the same custom is observed to this day.” A hint of clan tartan distinctions is given by Martin Martin in his <i>Western Isles of Scotland</i> (1708), which work also contains a minute description of the dress of the Highlanders and the manufacture of tartan. “Every isle,” he observes, “differs from each other in their fancy of making plaid, as to the stripes, the width of the placings, and the quality of the colours.” It is thus clear that the Highland tartans, as the Highlanders, in so far that they who have seen those places are able at the first view of a man’s plaid to guess the place of his origin.”

The following lines give a brief description of the colours of the tartans of the principal clans. The kit-tartan colour is given in each case; the plaid-tartans vary in slight particulars.

**Campano** yellow, light green crossed with darker green, the stripes broad with narrow edging of yellow. **Campbell of Argyll** yellow, light green crossed with dark green, narrow independent cross lines of white. **Cameron** brick-red with broad chequered cross lines of yellow; red and white with broad centre of ground colour, two independent cross lines of green. **Forbes** yellow, green, crossed with broad dark-green lines, centred black, independent cross lines yellow. **Frezer** red ground, main cross lines red with descending edging, with plaid chequers black and white. **Gordon** dark blue-green ground, with broad cross lines of lighter green, narrow centre line yellow. **Grayne** light green ground, crossed with darker green in small chequers, independent cross lines dark green. **Grant** scarlet, with broad black-edged scarlet crossings, black independent cross lines. **Macdonald of Glengarry and Ketchop** red, with other broad cross and cross lines, and two independent blue crossings along the bottom. **Macdonald of Glengrove** black, broad crossing, the whole covered with fine red lines. **Macdonald of Clanranald** light green with broad dark-green crossing, the whole covered with fine red lines.

When the process of fermentation wines deposit a crystalline crust of argol; this, after being roughly purified by recrystallization, is known as tartar, and when further purified and crystallized it is called “potassic tartar.” Tartar “colouring lines” is also called technically “cream.” With the iatrochemists tartar was a generic term which included both this tartarus vini and various substances obtained from it, and even salts, such as salt of sorrel (potassium oxalate), that resembled it. Thus <i>sal fixum tartari</i> was potassium carbonate, which on exposure to the air dislocuses to <i>oleum tartari per deliquium</i>; neutral potassium tartrate was called <i>tartar turtarotarisut</i>, because it was prepared by neutralizing ordinary tartar with the sal fixum; <i>tartar chalybeatus</i> was a preparation with iron; and <i>spiritus tartari</i>, used by Paracelsus, was prepared by dry distillation of tartar. Paracelsus also used the tanins also used in the ablation of abnormal precipitates or sediments deposited from animal secretions; the same idea is apparent in the popular application of the word to the salivary calculus which forms on the teeth.

**Cream of tartar** is prepared by dissolving granulated argol in boiling water and allowing the solution to stand. The clear liquid is then drawn off and crystallized. The slightly coloured crystals thus obtained are redissolved in hot water, the colouring matters get rid of by means of pipelays or egg-albumen, and the solution filtered and crystallized, the name “cream of tartar” being originally applied to the crystals that formed when the solution cools. The salt crystallizes in masses of small, hard, colourless, transparent, rhombic prisms. It is precipitated when an excess of a potassium salt is added to a solution of tarratic acid, but it dissolves on the addition of a solution of boric acid or boric acid or borax dissolve it freely, forming soluble cream of tartar, which is a white powder permanent in the air when made with the acid, but disintegrates when borax is employed. Its slight solubility in alcohol explains why it is deposited by wines as they mature. One part by weight of the salt dissolves in 15 parts of boiling water, but at lower temperatures the solubility is greatly diminished, and at 0° C. about 476 parts of water are required. When heated it is decomposed with formation of potassium carbonate and carbon, inflammable gases having an odour of burnt bread being evolved. The salt is used for the manufacture of *potassium alum* by heating with potassium carbonate, and for dyeing, with powdered chalk and alum for cleaning silver, and for the preparation of effervescing drinks and baking-powder. In medicine as *potasii tartar actis* it is of some slight importance as a diuretic and purgative. The more soluble normal salt, K2(HCO3), is used for the same purposes; it is formed by dissolving powdered cream of tartar in a hot solution of potassium carbonate. If sodium carbonate is substituted the result is KNa(HCO3), or Rochelle salt.

**Tartar emetic (potassium antimonyl tartarate)<sup>K</sup>(SbO)C,H,O,H<sub>3</sub>.</sup>

This substance has been known for a long period, being mentioned by Paracelsus. It may be prepared by warming 3 parts of anitomonic oxide with 4 parts of cream of tartar, in the presence of water, replacing the water as it evaporates; after digestion complete, the solution is filtered hot. Powder of algarum (q.v.) is then added with plagioclases, which forms a crystallizing mass. This is filtered, dried, ground up and compressed into tablets. The salt crystallizes in small octahedra, which lose their water of crystallization gradually on exposure to air, and become opaque. It is solubile in 14-5 parts of cold water and 19 parts of hot, the solution showing
an acid reaction to litmus. It possesses a nauseous metallic taste and produces vomiting when taken internally, whilst in large doses it is poisonous. It is used medicinally, and also as a mordant in dyed cloth calicoes and mordants.

**TARTARIC ACID** (dihydroxy-succinic acid), $\text{C}_4\text{H}_4\text{O}_6\text{H}_2$ or $\text{HO}_2\text{C}(-\text{OH})\text{C}(-\text{OH})\text{CO}_2\text{H}$. Four acids of this composition are known, namely dextro- and laevo-tartaric acids, racemic acid and mesotartaric acid, the last two being optically inactive (see STEREO-ISOMERISM). Their constitution follows from their formation from dibromosuccinic acid and from their synthesis from glyoxal cyanhydrin, these two methods producing the inactive racemic form which may then be resolved into the active components. Dextro-tartaric acid occurs in the free state in the juice of boysenberry or calcium salt in grape juice and in various unripe fruits. During the alcoholic fermentation of grape juice it is deposited in the form of an impure acid potassium tarteate which is known as argol, and when purified as cream of tartar. For the preparation of the acid the crude argol is boiled with hydrochloric acid and afterwards precipitated as calcium tarteate by boiling with milk of lime, the calcium salt being afterwards decomposed by sulphuric acid. It may also be obtained (together with racemic acid) by boiling milk sugar, saccharose, &c., with nitric acid, and by the reduction of a compound with sodium amalgam (H. Debus, *Ann.*, 1873, 166, p. 109). It crystallizes from water in large prisms which melt at 165–170°C, and, on further heating gives an anhydride and finally chars, emitting a characteristic odour and forming pyroameric and pyrotartaric acids. It behaves as a reducing agent. Chromic acid and potassium permanganate oxidize it to formic and carbonic acids, whilst hydrogen peroxide in the presence of ferrous salts gives dihydroxymalonic acid (H. J. H. Fenton, *Jour. Chem. Soc.*, 1894, p. 899; 1895, pp. 48, 774; 1896, p. 546). Hydrochloric acid and phosphorus reduce it to anhydride and finally to succinic acid. Calcium chloride gives a white precipitate of calcium tarteate in neutral solutions, the precipitate being soluble in cold solutions of caustic potash but re-precipitated on boiling. It prevents the precipitation of many metallic hydroxides by caustic alkalis. It carbonizes when heated with strong sulphuric acid, giving, among other products, carbon monoxide and carbon dioxide. A small crystal of oxalic acid added to concentrated sulphuric acid containing about 1 per cent. of resorcin gives a characteristic violet red coloration.

Laevo-tartaric acid is identical in its chemical and in many of its physical properties with the dextro-acid, differing chiefly in its action on polarized light, the plane of polarization being rotated to the left. By mixing equal quantities of the two forms a new compound is formed, the players of which not being $\text{C}_4\text{H}_4\text{O}_6\text{H}_2$ but $\text{C}_4\text{H}_4\text{O}_6\text{H}_2\text{O}$, is obtained. This variety is also formed by the hydrolysis of glyoxal cyanhydrin (F. Pollak, *Monatsh.*, 1894, 15, p. 456); by heating a solution of desoxalic acid; by the oxidation of lumaric acid with potassium permanganate; by the action of silver oxide on dibromosuccinic acid, and by the oxidation of mannite, dulcete, inulin, &c., with nitric acid. In the anhydrous state it melts at 205–206°C. Mesotartaric acid is formed when cinchonine tarteate is heated for some time at 170°C (L. Pasteur, *Ann.*, 1853, 88, p. 212;) by heating tartaric or racemic acid for some time with water to 165°C; by the oxidation of phenol or maleic acid with an alkaline solution of potassium permanganate (O. Doebner, *Ber.*, 1891, 24, p. 1755; A. Kekulé and R. Anschatz, *ibid.*, 1881, 14, p. 714). It crystallizes in prisms, and in the anhydrous state melts at 140°C. On prolonged boiling with aqueous hydrochloric acid it yields racemic acid. The sodium ammonium salt is not capable of decomposition into its optical antipodes, as is sodium ammonium racemate.

This acid as used in medicine is derived from potassium acid tarteate. Its impurities are lead, oxalic acid, lime and potassium tarteate. It is incompatible with potassium, calcium, mercury and vegetable astringents. Tartaric acid is rarely used alone, but is combined with some of the other salts we have considered (see SODIUM), and is a constituent of many proprietary granular effervescent preparations. If taken in overdose or in a concentrated form tartaric acid produces severe gastro-enteritis. In these cases lithium carbonate is the proper drug. Tartaric acid is used as antidesitics, and opium may be required.

**TARTARUS**, in Greek mythology, the son of Aether and Gaia, father of Typhoeus and the giants. In the *Iliad* the word denotes an underground prison, as far below Hadess as earth is below heaven, in which those who rebelled against the will of Zeus were confined. In later writers Tartarus is the place of punishment of the wicked after death, and is used for the underworld generally.

**TARTINI, GIUSEPPE** (1692–1770), Italian violinist, composer and musical theorist, was born at Tirano in Istria on the 12th of April 1692. In early life he studied, with equal want of success, for the church, the law courts, and the profession of arms. As a young man he was wild and irregular, and he crowned his impurities by clandestinely marrying the niece of Cardinal Cornaro, archbishop of Padua. The cardinal sent the marriage as a disgraceful mésalliance, and denounced it so violently that the unhappy bridegroom, thinking his life in danger, fled for safety to a monastery at Assisi, where there were character undeviating. His theory of the harmony of human organs. The obverse of this fact is that of any sound being deepened by an 8th if the length of the string or pipe which
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produces it be doubled. The law is without exception throughout the compass in which our ears can distinguish pitch, and so, of necessity, a string of twice the length of that whose vibrations indicate the deepest sound must stir the air at such a rate as to cause a tone at an 8th below that lowest audible note. It is hence manifest that, however limited our sense of the range of musical sound, this range extends upward and downward to infinity. Tartini made his observations the basis of a theoretical system which he set forth in his Trattato di Musica, secondo la vera scienzia dell'Armonia (Padua, 1754) and Dei Principjedi'Armonia Musicale (Padua, 1765). He also wrote a Trattato delle Appoggiature, posthumously printed in French, and an unpublished work, Delle Ragioni e delle Proporzioni, the MS. of which has been lost.

TAS-DE-CHARGE, a French term in architecture, for which there is no equivalent in English, given to the lower courses of a Gothic vault, which are laid in horizontal courses and bonded into the wall, forming a solid mass; they generally rise about one-third of the height of the vault, and as they project forwards they lessen the span to be vaulted over.

TASHKENT, or TASHKEND, one of the largest and most important cities of Russian Central Asia, and capital of Russian Turkestan, situated in the valley of the Chirchik, some 50 m. above the banks of the rivulet, about 2405 m. above sea level. It is connected by rail with Krasnovodsk (1085 m.) on the Caspian, and since 1805 with Orenburg (1150 m.). The city, formerly enclosed by walls (now ruined), is surrounded by luxuriant gardens, and its houses are buried among the fruit and other trees which grow alongside of the irrigation canals. The buildings, which are of stone and sun-dried bricks, are mostly low, on account of the earthquakes which frequently disturb the region. The native city in 1871 had 75,130 inhabitants, and in 1897 196,414, mostly Sarts, with Uzbekis, Kirghiz, Jews, Russians, and Germans. The Russian city, to which vast extensions from 1865 has been made, is served by broad streets lined with poplars, and canals, the low, pleasant-looking houses being surrounded by gardens. In 1875 its population, exclusive of the military, was 4860, mostly Russians, and in 1900 about 25,000. Tashkent has a public library containing a valuable collection of works on Central Asia, an astronomical observatory and a museum.

TASHKURGHAN, or KHULM, a khanate and town of Afghan Turkestan. The khanate lies between Kunduz and Balkh. The ancient town of Khulm stood in the Oxus plain, surrounded by orchards of famous jujube-trees, and was destroyed by Ahmad Shah Abdali, who founded Tashkurgan in the middle of the 18th century, and took all the inhabitants away from Khulm to populate it. Ancient Khulm is now only a mass of ruins; but Tashkurgan, lying two or three miles to the south of it, has become the great trade-mart of Afghan Turkestan and second only in importance to Mazar-i-Sharif, the military centre of the province; while it is much larger and more prosperous than the latter place. At Tashkurgan the caravans from India and Bokhara meet, and from here the merchandise is distributed all over the country. A hill fortress dominates the town and overlooks the debouchment of the road from Haibak and Kabul into the plains of the Oxus.

TASMAN. ABEL JANSZON (c. 1603-1659), the greatest of Dutch navigators, the discoverer of Tasmania, New Zealand, the Tonga and the Fiji Islands, and the first circumnavigator of Australia, was born at Lutjegast in Groningen, about 1603. In 1634 we first meet with him in the East Indies, sailing from Batavia (Feb. 18) to Amboyna. On the 30th of December 1630 he sailed from Batavia for home; reached Holland August 1, 1637; started on his return to the East April 15, 1638; and reappeared at Batavia October 11, 1638. On the 2nd of June 1639 he and his ship (Diemen, 80 tons, 42 fathoms) Quast, was despatched by Antony Van Diemen, governor-general of the Dutch East Indies (1636-43), on a voyage to the north-western Pacific, in quest of certain "islands of gold and silver," supposed to lie in the ocean east of Japan. On this voyage Tasman and Quast visited the Philippines and improved Dutch knowledge of the east coast of Luzon; they also discovered and mapped various islands to the north, apparently the Bonin archipelago. Sailing on to N. and E. in search of the isles of precious metals, they ranged about fruitlessly in the northern Pacific, at one time believing themselves to be 600 Dutch miles east of Japan. After this the voyage was continued almost constantly westward, but in varying latitudes, reaching as high as 42° N., always without success. On the 15th of October the navigators decided to return, and, after touching at Japan, anchored at the Dutch fortress-station of Zeelandia in Formosa on the 24th of November 1639. After this Tasman was engaged in operations in the Indian seas (sailing to Formosa, Japan, Cambodja, Palembang, etc., as a merchant captain in the Company's service), and returned to England (43° 30' N.) until 1642, when he set out on his first great "South Land" expedition. This was planned and organized by Governor Van Diemen, who cherished great schemes for the extension of the Dutch colonial empire. Several Dutch navigators had already discovered various portions of the north and west coasts of Australia (as in 1603-06, 1616, 1618-19, 1632-37, 1637-38, etc.), but Tasman now first showed that this great South Land did not stretch away to the southern pole, but was entirely encircled by sea within comparatively moderate limits. On the 25th of August 1642, with two vessels, the "Heemskerk" and "Zeelandia," anchored at Mauritius (September 5 to October 5), Tasman sailed first, then E., almost seven weeks, and on the 24th of November sighted (in 42° 25' S., as he made it) the land which he named Anthoony van Diemen's landt after Van Diemen, now called Tasmania. He doubled the land, which he evidently did not perceive was an island, coasting its southern shores, and, running up Storm Bay, anchored on the 1st of December in Frederick Henry's Bay, on the east coast of Tasmania (in 43° 10' S., according to his reckoning)—so named after Prince Frederick Henry of Nassau, then the head of the Dutch republic. There he set up a post on which he hoisted the Dutch flag. Quitting Van Diemen's Land on the 5th of December, Tasman steered E. for the Solomon Islands, and on the 13th of December discovered (in 42° 10' S., as he reckoned) a "high mountainous country," which he called Staten landt ("Land of the States," i.e., of Holland, now New Zealand). Tasman and his company believed the newly discovered land to form part of the same great antarctic continent as the other Staten landt which Schouten and Lemaire had sighted and named the Landt van di Eerenaerd (1616). Along the west coast of the South Island, he anchored on the 18th of December in 49° 50' S., at the entrance of a "wide opening," which he took to be a "fine bay" (Cook's Strait). He gave the name of Moerdervaars (Murderers, now softened to Massacre) Bay to this spot, where several of his men were killed by the natives (December 19). From Murderers' Bay Tasman sailed S.E. along the south shore of Cook's Strait, apparently getting into Blind or Tasman Bay, but not discovering the full extent of the strait here dividing New Zealand into two main islands. Returning westward he then coasted the west side of the North Island, till, on the 4th of January 1643, he came to the northern extremity of New Zealand, in 34° 35' S. (in his reckoning). Thence he bore away to N.N.E., at first intending to keep that course for 30° of longitude from North Cape, New Zealand. On the 19th to 25th of January, in 22° 35', 21° 20', and 20° 15' S. (Tasman's reckonings), he discovered various islands of the Tonga or Friendly group, especially Amsterdam (Tongatapu), Middelburg (Eva), and Rotterdam. Here the ships took in water and provisions, which they had not done since leaving Mauritius, and both ships, which was the second time since leaving Van Diemen's Land, Rotterdam Island they explored with some care. Thence Tasman steered N. and W., reaching on the 6th of February the eastern part of the Fiji archipelago (in 17° 20' S., by his reckoning), which he called Prince William's Islands and Heemskerk's Shoals; on the 22nd of March he sighted the islands of Ontong Java (in 5° 2' S., according to Tasman, and in 150° 30' E., Greenwich). On the 1st of April he was near the north-eastern extremity of New Ireland (Neu Mecklenburg), mistaken by him for a part of New Guinea, in 40° 30', off a
point known to the Spaniards as Cabo S. Maria. Thence he passed westward along the north of New Ieland, New Hanover, New Britain (Neu Pommern) and New Guinea. He reached the western extremity of New Guinea on the 18th of May; Schouten's Islands were noted to the south of the vessel's course on the 12th of May. Tasman's track, lying between New Guinea and Halmahera (Giliolo), then brought him south to Ceram; he passed through the narrow strait between Celebes and Bintan on the 17th of May, and arrived at Batavia on the 13th of June 1643 after a ten months' voyage. The materials for an account of Tasman's important second voyage in 1644 are scanty, but we know he was instructed to obtain a thorough knowledge of Staten Land and Van Diemen's Land, and to find out "whether New Guinea is a continent with the great Zuidlank, or separated by channels and islands," and also "whether the new Van Diemen's Land is the same continent with these two great countries or with one of them." In this voyage Tasman had three ships under his command, the "Limmen," "Zeeemeuwen" (or "Meew"), and "Brak" (or "Braarq"). His course lay along the south-west coast of New Guinea; he mistook the western opening of Terres Straits for a bay, but explored (and perhaps named) the Gulf of Carpentaria; for the first time the coast-line of this great bay was mapped with fair accuracy. Though preceded by Jansz (1606) and Carstensz (1623) on the east shore of the gulf as far as 17° S., Tasman first made known the south, and most of the west, coast. Beyond this he explored the north and west coasts of Australia as far as 25° S., and established the absolute continuity of all this coast-line of the "Great Known South Continent"; his chart gives soundings for the whole of this coast. Tasman's achievements were coldly received by the Dutch colonial authorities; but on the 4th of October 1644 they rewarded him with the rank of commander (he had frequently enjoyed the use of the title already). On the 2nd of November 1644 he was also made a member of the Council of Justice of Batavia. He was a member of the committee appointed on the 18th of April 1645 to declare a truce between the Dutch East India Company and the viceroy of Portuguese India. In 1647 he commanded a trading fleet to Siam, and in 1648 a war-fleet sent against the Spaniards of the Philippines (May 15, 1648, to January 1649). By 1653 he had quitted the company's service, but still lived, apparently as one of its wealthiest citizens, in and near Batavia. His will, made the roth of April 1657, seems to have but slightly preceded his death, which probably happened before October 22, 1659, and certainly before February 5, 1661.

See Siebold's paper in Le Moniteur des Indes Orientales et Orie-

Hindustani, 1848-49, pt. 1, p. 390; the paper on Tasman by C. M. Dozy in Bijdragen tot de Taal-, Land-, en Volkenkunde van

dansch-Indie, 5th series, vol. ii. p. 308; R. H. Major, Early Voyages in Australia (London, Hakluyt Society, 1859), especially pp. xxii-xxiii, 43-58 (here are printed the instructions for Tasman and his colleagues on the voyage of 1644); G. Collingridge, Discovery of Australia (Sydney, 1898), especially pp. 238-40, 279-80; Cuming, above all, J. E. Heeres and others, Tasman's Journal, facsimiles of the original MS., with... life... of... Tasman, &c. (Amsterdam, 1898)—here the Life of Tasman, with its appendices, is separately pagd (163 pp.). See also Aandrl der Nederlanden voor de Oost-Indische Meren (Amsterdam, 1768-76); Ludolf, Nederlanden, and English, Leiden and London, 1890), especially pp. vii., viii., xix.-xx., 72; the valuable summary of the voyage of 1642-43 in the anonymous Acqueru; and Tasman's account of the voyage of 1644 (beginning with Sir John Narborough's), London, 1711, with sub-
title, Relation of a Voyage... of Captain Abel Jansen Tasman (originally extracted from his journals by Dirk Rembrandt in Dutch, published in English in Dr Hook's collections); also The Discovery of Van Diemen's Land in 1642, by James Backhouse Walker (Hobart, 1891). A draft journal of the voyage of 1642-43, probably written by Tasman on the expedition, is in the state archives at The Hague. There are also several copies made from Tasman's official journal; the best of these (the original fair copy) is repro-
duced in Heeres' Tasman's Journal, 1898, noted above.

Although Tasman's map of the voyage of 1644, has been discovered and is in the possession of Prince Roland Bonaparte. Before this discovery reliance was placed on an ex-
cellent copy, probably made out 1687, by Captain Thomas Bowrey, (art. 12 in the miscell. MS. collection marked 5222 in the
British Museum, London). This gives the tracks of both the voyages

1642-43 and 1644, and the soundings of the latter. Burgnmaster Witsen, of Noord en Oost Teriare's fame (1709), preserved a brief record of certain observations made in Tasman's voyage of 1644, between 13° 8' and 19° 35' S. (and approximately between 129° 30' and 120° E. Greenwitch). This was translated by A. Dalrymple in his Papus (reprinted in R. H. Major, Early Voyages to... Australia, xcvi.-xcix.). Basil Thomson, Diversions of a Prime Minister (Edinburgh, 1894), p. 311, &c., records that the remembrance of Tasman's visit to the Tonga Islands still remains "fresh to the smallest details among the natives."

**TASMANIA.** a British colonial state, forming part of the Australian Commonwealth. It is composed of the island of Tasmania and its adjoining islands, and is separated from the Australian continent on the south-east by Bass Strait. The island of Tasmania is triangular in shape, area 24,331 sq. m. (with the other islands 26,215 sq. m.), 200 m. from N. to S., and 245 m. from E. to W.

**Coastal Features.**—The southern portion of the eastern shore of Tasmania is remarkable for its picturesque inlets and bold headlands. The principal inlet is Storm Bay, which has three well-defined arms. The most easterly is Norfolk Bay, enclosed between Forester's Peninsula and Tasman Peninsula. The middle arm is Frederick Henry Bay, and the western the estuary of the Derwent. It is on this estuary that Hobart, the capital of the island, is situated. Besides the main entrance to Storm Bay, between Cape Raoul and Tasman Head, there is D'Entrecasteaux Channel, which divides North and South Brunni Island from the mainland. This channel has two branches, the easterly forming the entrance into Storm Bay, and the western being the estuary of the Huon river. On the east coast lies the peculiarly-shaped Maria Island, almost severed by deep indentations on the east and west. Above this island is Oyster Bay, formed by the projection, Freycinet Peninsula. On the south are some very prominent headlands. In the south-west lies the fine harbour of Port Davey, which receives several small rivers. Proceeding northward along the west coast the most conspicuous headlands are Rocky Point, Point Hibbs and Cape Sorell, which stands at the entrance of Macquarie Harbour, the deep inlet receiving the waters of the river Gordon
TASMANIA

and several smaller streams. North of this there are several prominent headlands. The west coast terminates at Cape Grim, opposite which are the group known by the name of Hunter's Islands. Going eastward along the north coast, Circular Head is met with, a narrow peninsula running out for six miles and terminating in a rocky bluff 400 ft. high. Further east are Emu Bay, Port Frederick, Port Sorell and Port Dalrymple, into which flows the Tamar river, on which Launceston is situated. In Bass Strait are several large islands belonging to Tasmania; King's, Flinders, Cape Barren and Clarke Islands. These are the largest, the Flinders Island having an area of 513,000 acres. Among the rivers flowing northward to Bass Strait are the Tamar, Inglis, Cam, Emu, Blyth, Forth, Don, Mersey, Piper and Ringarooma. The Macquarie, receiving the Elizabeth and Lake, falls into the South Esk, which unites with the Tamar to form the Tamar river at Launceston. Westward, falling into the ocean, are the Hellyer, Arthur and Pieman. The King and Gordon gain Macquarie Harbour; the Davey and Spring, Port Davey. The central and southern districts are drained by the Derwent from Lake St Clair—its tributaries being the Nive, Dee, Clyde, Ouse and Jordan. The Huon falls into D'Entrecasteaux Channel. The main axis of the Great Cordillera—so termed originally by Sir Roderick Murchison—bordering the eastern coast-line of Australia, may be traced across Bass Strait in the chain of islands forming the Furneaux and Kent group, which almost continually link Tasmania with Wilson's Promontory, the nearest and most southerly part of the Australian mainland. Tasmania is wholly occupied by the ramifications of this chain, and in itself may be said to embrace one and all of its characteristic features.

Taking a stand on Lake Fergus, to the east of Lake St Clair, the observer will find himself nearly in the centre of an extensive plateau, with an elevation, especially on the northern side, of between three and five thousand feet above the sea-level. This elevation is maintained from Dry's Bluff, in the north, to Denison Range in the south-west, and although often receding at points adjacent to the sources of the principal rivers, invariably presents a bold crested front to the north and west. At its greatest elevation it is comparatively level, and contains many extensive freshwater basins, such as Lake Augusta, Lake St Clair, Lake Sorell, Lake Echo, Lake Crescent, Arthur's Lake and the Great Lake. The marginal crests of this mountain tableland, together with its upper surface, are known locally as "Tiers," and have a commanding aspect in the neighbourhood of Longford, Westbury, Deloraine and Chudleigh. The extent of the principal elevated plateau is very great, though not so extensive as was formerly believed. It is maintained at an altitude in a westerly direction from Dry's Bluff (4257 ft.) on the north to Cradle Mountain (5096 ft.) at the south, a distance of nearly 50 miles; from Dry's Bluff in a south-westerly direction to Table Mountain, a distance of about 65 miles; and from Table Mountain to Bluff to Table Mountain in a southerly direction, a distance of above 40 miles. This plateau itself again rests upon a more extended tableland, stretching westwards, and, with the Middle Plains, the Derwent valley and the East Coast, forms the uninterrupted tableland of 1200 to 2000 ft. Its limits follow the coast-line more or less closely, the space between it and the sea often broadening out into low-lying tracts not much raised above the sea-level. Here and there, rising abruptly from its surface, are to be seen isolated peaks, the most characteristic of which are Valentine's Peak (3637 ft.) and Mount Peares. Ridges and plateaus of a similar character, but of smaller size, as Dry's Bluff from Denison Range to Mount Wellington (4166 ft.), are to be found in the north-east and south-west of the island. Towards the extreme west and south, anticlinal and synclinal ridges trend north and south, the most conspicuous of all being the Mt. Field group, the Huon, the Bay of Fires, and the Arthur Ranges. Settlement of population has taken place principally among the plains and lower elevations of the north-western, midland and south-eastern parts of the island, following in the main across the plateau from Pinnaclers Wells to the Tamar. In the Tertiary period the soils of these plains and valleys have been greatly enriched by extensive outbursts of basalt with accompanying tuffs and ashes, and, in the course of time, are being converted into rich lands. Not for their influence, the greater part of what is now the most fertile part of the island would have been comparatively poor or altogether sterile.

The coasts of the island throughout is wonderfully beautiful, with its open plains, bordered by far-extending precipitous mountain tiers, its isolated shaggy peaks and wooded ranges, and its many noble rivers and lakes. Its coasts for the most part, especially towards the north, are well supplied with inlets, bays and harbours, affording ample shelter and safe anchorage for ships. On the western side one is reminded of scenes in the highlands of Ross-shire and Inverness-shire in Scotland, from the picturesque character of the blue, white, and pinkish crystalline peaks and the fantastic outlines of the mountain ranges which rise abruptly to a height of from 2000 to nearly 3000 feet above the Button Grass Plains.

Geology.—Tasmania is, geologically, an outlier of the Australian continent. It is most intimately connected with Victoria, from which it was only separated by the founding of Bass's Strait in an earlier period of geological time. In each a precise date of the separation is fixed as later than the Miocene, since a part of the marine Miocene deposits along the southern coast of Victoria is broken, from Flinders to Alberton; and this gap was no doubt due to the separation of the islands, the recent separation of the two being the result of the Arrivals of those animals in south-eastern Australia. That it was not much earlier is shown by the fact that some still living species of mammals, such as the thylacine, existed before the separation.

The geological sequence in Tasmania is full, and the island contains a better series of Carboniferous rocks than is found in Victoria. The nucleus of the island is a block of Archean rocks, which are not intruded by the superficial rocks. These are rich in flours and claystones, and contain banded rocks, schists, phyllites and slate. The characteristic rock of the Archean is met with in the form of beds of quartzite varying in thickness from a few inches to a few feet, and belonging to a type known as a quartzitic formation. The most prominent formation of this kind is the quartzite of the Tamar river, which is found in the river valleys on the margins of the central plateau. The Morwell swell appears to mark the site of an ancient mountain range, and the quartzites of Port Davey on the western coast, have also been regarded as Archean. The Lower Palaeozoic systems begin with the Ashwoodian, which is characterized by the presence of the greenstone, and contains Cambrian fossils such as Dikleophalides and Conoccephalus steptensi. The Ordovician system has not been definitely identified; but probably many of the slates and quartzites belonging to the Lower Palaeozoic systems, as well as to the Silurian, are of Ordovician age. The Silurian system, however, is well developed in north-western Tasmania, and is represented by slates, limestones and sandstones yielding a distinct Silurian fauna. The rocks are best known by the limestone in the lead mining field at Zeehan, and the slates, including the tin mine of Mount Bischoff. The most prominent tectonic features of the Ordovician and Silurian systems are the Carboniferous systems of the Palaeozoic, and are characterized by the presence of the Coal Measures. The Coal Measures of the Tamar are covered by marine shales with Carboniferous bryozoa; and, on the horizon of the Greta Coal Measures of New South Wales, is a bed of Carboniferous glacial deposits.

The Mesozoic system is not well developed. It is usually regarded as beginning with a fresh-water series containing the remains of older beds on the contact, while the quartz-porphyry dikes, which are intrusive in the Silurian rocks at the Mount Bischoff tin mine, doubtless belong to this period. The Carboniferous system begins with the Carboniferous beds of the Tamar, and contains the Silurian limestone, which is produced by the silica diversification of the Silurian fauna. The Carboniferous rocks occupy the whole of the south-eastern corner of Tasmania, and one outlier occurs on the northern coast in the Mersey Valley. This formation is about 1200 ft. thick, and is separated from the Carboniferous rocks by a fault. The Upper Carboniferous includes beds of shale and coal; but though the coal is good, the seams are thin and have not been much worked. The Coal Measures are covered by marine shales with Carboniferous bryozoa; and, on the horizon of the Greta Coal Measures of New South Wales, is a bed of Carboniferous glacial deposits.

The Tertiary period the soils of these plains and valleys have been greatly enriched by extensive outbursts of basalt with accompanying tuffs and ashes, and, in the course of time, are being converted into rich lands. Not for their influence, the greater part of what is now the most fertile part of the island would have been comparatively poor or altogether sterile.
extensive series of glaciers, of which the lower moraines were de-
posed only about 400 feet above sea level.

The information as to the geology of Tasmania up to 1888 is collected in "A Systematic Account of the Geology of Tasmanien, which gives a bibliography up to that date. A later
sketch of the island is by W. H. Twelves, "Outlines of the Geology of Tasmania," April 1891, pp. 101, &c., and in papers of
mining literature is given in the reports of the Mines Depart-
ment, and special reports issued in the Parliamentary Papers; and
the economic and general geology are described in publications of
the Royal Society of Tasmania. The Mount Lyell mining field is described, with
some account of it, in "The Mount Lyell Mining Field (Melbourne, 1904).

The glacial geology, with a summary of the literature thereon, is
described by the same writer in the Quarterly Journal of the Geol-

Climate.—Tasmania possesses a very temperate and healthy
climate. The mean temperature of the year, as estimated from
observations extending back to 1841, is 51°. July and January are
the hottest month, 45°. The western prevailing winds—
particularly the north-western—carry the rain-bearing clouds.
The elevation-divide between the western and eastern parts of the
island is about 1000 feet, and consequently the parts to the east of such heights receive much less precipitation than those to the westward. The general average
for the eastern district over a period of years was 22.07 inches; for
the western district, 49.52 inches, and for Tasmania 26.60 inches.

Flores.—The vegetation which prevails among the other schistose rocks of the west and extreme south presents a totally different appearance from that already described of the east.

The western vegetation, as compared with that of the east, presents as marked a contrast as do the prevailing rocks upon which it flourishes. The characteristic trees and shrubs of the west include the following genera, viz.: Fagus, Cenchrus, Anaphalis, Eucryphia, Bauera, Boronia, Agagachys, Richea, Telopea, Grevillea, Orion, Athrotaxis, Dacrydium, Phyllocladus. On the eastern side the plains and rocky ridges, where the vegetation is chiefly of the
occa, have manuka or blackberry scrub, and on some forests thinly composed of
the following genera: Eucaleyptus (gum tree), Casuarina, Bursaria, Acacia, Leptospermum, Drimys, Melaleuca, Dodonaea, Notodina, Eucalyptus, Ilex, Epacris, Xanthorrhoea, Persoonia. The mountain
slopes and ravines of the east have a well-marked vegetation.
In character it is more akin, and in many cases identical with, that
of the west. The fern (Dicksonia antarctica) in the mountain
ravines is especially remarkable. The following genera are also
found in such positions in great luxuriance, viz.: Fagus, Anaphorus, Phebalium, Eucaleyptus, Richea, Cynocholes, Pomaderris, Prostan-
thera, Boronia, Cytisus, Collectoria, Lomatia, Drimys, Hakea, etc. In the extreme west the trees and larger shrubs
do not appear to ascend the schistose rocky mountain slopes of the central and eastern parts.

Flora.—The flora of Tasmania is similar to that in Australia.
The dingo or dog of the latter is wanting; and the Tasmanian devil
and tiger, or wolf, are peculiar to the island. The Marsupials include the
d micros or kangaroo; the opossums, Phalangeria vulpinis and
P. Cookii; the opossum-mouse, Dromia taeniata; Peromyscus and band-
coot; Hypsiprymnus or kangaroo rat; Phacoemos or wombat;
while of Menodromata there are the Echidna or porcupine ant-eater;
and the duck-billed platypus. The marsupial tiger or Tasmanian wolf
(Tyloailus cynocephalus), 5 ft. long, is yellowish brown, with several stripes across the back, having short stiff hair and very
short legs. Very few of these nocturnal carnivores are now alive to pounce Rock wallabies, which, with white spots and nocturnal habits, is a large species of the untameable
cat family. The devil (Dasyurus or Sarcophilus chrusinus) is black,
with white bands on neck and haunches. The covering of this
savage beast is under a thick layer of short hair. The tail is thick, and the bull-dog mouth is formidable. Among the birds of
the island are the eagle, hawk, petrel, owl, finch, pewee, diamond fly, fire-tail, black, emp-wingedcrow, swallow, magpie, blackcap, goatsucker, quill, ground dove, parrot,
lark, mountain thrush, cockoo, wattlebird, whistling duck, honey-
bird, Cape Barren goose, penguin duck, waterhen, snipe, albatross and
duck. Of the insects, two species only are in abundance—the lizards are harmless. Insects, though similar to Australian
ones, are far less troublesome; many are to be admired for their
great beauty.

Inhabitants.—At the beginning of 1900, the state contained
181,100 people, giving a density of 69 persons per square mile.
The population in 1870 was 106,765. The discovery of Mount
Bischoff one year later, though it greatly stimulated speculation
and induced a large influx of immigrants, did not put a stop to
outflow, for in 1880 the population was still below 115,000.
During the next ten decades there was a substantial advance; in
1880 it had reached 145,200, and in 1900, 172,980. Like all the
Australian states, Tasmania shows a decline in the birth-
rate; in 1905 the births were 52,565—36 less than in 1904—which
gives a rate of 29.32 per 1000 of population.

The climate is probably more healthy than that of any of the
Australian states, although owing to the large number of old people in
the colony, the death-rate would appear to put Tasmania on
a par with New South Wales and South Australia. The death-rate
per 1000 of population, which was 16.6-62 in the period 1901-3,
has therefore been a gradual and substantial improvement in the health
condition of the state. The annual marriage-rate was for many years consider-
able below the average for the state; it has, however, been restored for by the continued emigration of men unmarried and of
marriageable ages; this emigration had ceased in 1900, and the
marriage-rate may be taken as 7.8 per thousand. The chief towns
are Hobart (pop. 35,300) and Launceston (pop. 22,500).

Administration.—As one of the states of Australia, Tasmania
returns six senators and five representatives to the federal
parliament. The local constitution resembles that of the other
Australian states inasmuch as the executive government of
four ministers is responsible to the legislature, which consists
of a legislative council and a house of assembly. The form
is composed of eighteen members elected for three years. Eletors
of the council must be natural-born or naturalized subjects of
the king, twenty-one years of age, resident in Tasmania for
fourteen months, and possessing a freehold of the annual value
of £50 or a leasehold of the annual value of £50 within the
electoral district; the property qualification being waived in
the case of persons with university degrees or belonging to
professions. Members of the council must be not less than
thirty years of age. The house of assembly consists of
35 members elected for three years. Every resident of Tasmania
for a period of twelve months who is twenty-one years of age,
and natural-born or naturalized, is entitled to have his name placed
on the electoral roll, and to vote for the district in which he
resides. The franchise has been conferred on women.

Education.—Half the population are adherents of the Church
of England, and about 18 per cent. Roman Catholics; Wesleyans
number nearly 16 per cent. and Presbyterians about 6½ per cent.
The school system is compulsory upon children over seven years of age
and under thirteen years in the towns of Hobart and Launceston,
but not in the rural districts. Special religious instruction is
lawfully given, and the religious houses for the education of
students (chiefly by the various religious denominations, and this privilege is some-
what extensively used by the Church of England.
The schools are not free, as small fees are charged; but these are not enforced
when parents can make other arrangements for the education of
their children. There are 434 state schools, with 19,000 pupils on the roll, and
administered by 600 teachers; there were also 180 private schools, with 310 teachers
and 9000 scholars. The net expenditure averages £13,752. ed.
per annum. The average attendance being the same, the number of degree
of the state was 180, the great majority of these degrees being granted at eudem
Finance.—The revenue is chiefly obtained through the custom-
house, but the federal tariff has had the effect of considerably
reducing the receipts from this source. In 1905 the state raised
82,000s. on account of the public revenue, which is equal to
4½. 13s. 3d. per inhabitant; of this sum £29,009 was the excess of
Commonwealth collections over expenditure, and £26,933 from
other taxation; the railways returned £25,693, while from public
lands and mineral rights £2,062. The expenditure was £40,185,
thus distributed: railway working expenses, £17,619; public instruction, £6,403; interest and charges on debt, including sinking fund, £16,970; public works £25,075. The state debt and other debt charges come to
£1,185. 9d. per inhabitant, and represent 47.55 per cent. of the
expenditure of the state. The public debt in the year 1906 stood at
£5,071,000, in which £5,028,000 was due to the Commonwealth,
£52,650 to the South Australian Government, £3,011,760 to the
london Government, £18,165 to the State Bank of Victoria, £45,987
to the Chief Commissioner, £47,950 to the Colonies Office, £17,620
to the Treasury Department, £11,310 to the State Bank of New
South Wales, £2,000 to the Colonial Office, £1,872,500 to the
Chamber of Commerce, £1,300 to the Government Savings Bank and
other public works. The expenditure upon works may be
TASMANIA

Commerce.—The shipping increased considerably after 1896. Hobart is now a place of call for several of the European steamships. The state is becoming increasingly popular as a summer resort for the residents of New South Wales. The growth of the shipping trade will be seen in the following table, which also gives the imports and exports at ten-yearly intervals:

<table>
<thead>
<tr>
<th>Year</th>
<th>Shipping entered</th>
<th>Imports</th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1861</td>
<td>115,710</td>
<td>9,547</td>
<td>9,547</td>
</tr>
<tr>
<td>1871</td>
<td>107,271</td>
<td>7,587</td>
<td>7,503</td>
</tr>
<tr>
<td>1881</td>
<td>192,024</td>
<td>1,394,144</td>
<td>1,394,144</td>
</tr>
<tr>
<td>1891</td>
<td>514,760</td>
<td>2,051,664</td>
<td>2,049,488</td>
</tr>
<tr>
<td>1900</td>
<td>3,052,256</td>
<td>2,651,754</td>
<td>2,731,616</td>
</tr>
</tbody>
</table>

Tasmania does a trade with New South Wales as well as with Great Britain. The principal exports in 1905 and their values were: wool, £401,958; gold, £187,573; tin and ore, £257,450; silver and ore, £126,971; copper, £159,052; fruit, farm and vegetable produce, £1,775,789; timber, £78,380. The imports represent £14,113, and the exports £20,146 per inhabitant.

The chief ports of the state are Hobart, where the shipping entered in 1905 amounted to 645,000 tons, and Launceston, 292,000 tons.

Railways.—The railways open for traffic in 1905 had a length of 619 miles, of which 465 were government and 154 private lines. The progress of railway construction will be seen from the following table:

<table>
<thead>
<tr>
<th>Year</th>
<th>Kilometres Opened</th>
</tr>
</thead>
<tbody>
<tr>
<td>1895</td>
<td>183</td>
</tr>
<tr>
<td>1896</td>
<td>266</td>
</tr>
<tr>
<td>1897</td>
<td>342</td>
</tr>
<tr>
<td>1898</td>
<td>435</td>
</tr>
<tr>
<td>1899</td>
<td>526</td>
</tr>
<tr>
<td>1900</td>
<td>619</td>
</tr>
</tbody>
</table>

The railways, both state and private, are of 3 ft. 6 in. gauge. The capital expended on government lines to 1905 was £3,424,666, and the working expenses £1,713,076, leaving £1,711,590 as the net earnings.

Mining.—Mining is now the foremost industry, the gross production in 1905 being valued at £1,958,218 as compared with £1,200,000, the value of agricultural production, which is next in importance. Tasmania produces gold, silver, tin, copper, coal, and so on. In 1905 the production of these minerals was valued at: gold, £3,521,380; silver and silver-lead, £65,004; copper, £87,010; tin, £256,092; and coal, £14,194. Beaconsfield is the chief goldfield, 26 miles north-west of Launceston. There are about 1,500 persons employed mining gold on the various fields. The Mount Zeeland and Dundas districts produce almost the whole of the silver at present, and much of the ore is sold to agents in the Australian and New Zealand markets. The largest producer of tin in Australia is, and a very large proportion of the tin hitherto produced has been obtained from alluvial deposits, the lodes, except at Mount Bischoff, having been almost wholly neglected. The Mount Bischoff mine, which is worked as an open quarry, is the largest producer of tin, and (with an original capital of £30,000) has paid out over two millions sterling in dividends. The number of miners employed in tin-mining has been increasing, was 159 in 1896, 279 in 1905. Tasmania takes the lead amongst the states in copper production; in 1896 there was a small production of £169; in 1897 it grew to £1,471,437. In 1898 to £378,565, in 1899 to £671,880, and in 1900 to £507,680. Although the production has since been comparatively reduced it is still a great industry. This expansion was chiefly due to the enterprise of the Mount Lyell Mining and Railway Company, whose mines are situated at Gormantson. Coal-mining is carried on in various districts of the island, but the principal mines are at Mount Nicholas and Cornwall, in the Mount Nicholas Range; the output of the field is increasing, but no export trade is at present. Some coal, 161,180 tons, was sold in 1905 to 4,000 factories, retail and wholesale.

The number of men employed in coal-mining is 150, and the output about 52,000 tons per annum.

Manufactures.—Most of the leading manufactories are small, the number of establishments being about 1,000, the hands employed about 6,000.

Agriculture.—After being much neglected, agriculture received renewed attention in 1892 and the following years up to 1901, when the area under crop reached a total of 325,611 acres; since the year named agriculture has taken first place in the area cultivated, the area cultivated being placed at about 250,000 acres. The area under crop, at intervals of ten years, was as follows: 1861, 163,385 acres; 1871, 155,046 acres; 1881, 146,494 acres; 1891, 168,121 acres; and 1901, 224,852 acres. While the area under crop has been increasing, the number of principal crops has been much larger proportionately than that of the Australian states: for the fifteen years ending with 1905 the average yield was 18-9 bushels per acre, ranging between 9-9 and 27-3 bushels in different seasons. The oat crop is also much more above the Australian average, and may be set down at 30 bushels an acre, but an average of 5 bushels higher is not infrequent. Tasmania is renowned for its fruit crops, and now that this fruit has found an opening in the British market, renewed attention is being devoted to the industry. In 1905 there were 12,683 acres of apples, 2098 acres of pears, 11,11 acres of apricots, 1123 acres of plums, 426 acres of cherries, 498 acres of peaches, 2000 acres of strawberries, gooseberries and raspberries, and 2,250 acres of currants. The crop for the same year included 1,100,000 bushels of apples, 75,000 bushels of pears, and nearly 170,000 bushels of other fruits. The fruit finds a ready sale by means of the canneries, which have been established in New South Wales and in Great Britain. The total value of the produce of Tasmanian farms now exceeds £1,250,000, which is equivalent to £1,178. 5s. per acre cultivated.

Of the general line in sheep-breeding, yet the state is certainly well adapted for sheep-raising, and its stud flocks are well known and annually drawn upon to improve the breed in the other states. Nor have the other branches of the pastoral industry shown much expansion, as the flocks are hardly increased by the indebtedness of the two chief cities, Hobart and Launceston.

Defence.—Tasmania being a portion of the Commonwealth of Australia, its defence is undertaken by the federal government. The strength of the permanent forces is 1,500, and the efficiency of the local defence bodies is represented by the indebtedness of the two chief cities, Hobart and Launceston.

History.—Tasmania, or, as it was originally called, Van Diemen's Land, was discovered in 1642 by the Dutch navigator Tasman (q.t.) who named the territory after his patron, Van Diemen. The island was subsequently visited in 1772 by a French naval officer, Captain Marion du Fresne; in 1773 by Captain Furneaux, of the British man-of-war "Adventure"; in 1777 by the great circumnavigator Captain Cook; by Bligh in 1788, and again in 1792, when he planted fruit trees. In the same year the French navigator D'Entrecasteaux visited the south portion of the island and surveyed the coast. In 1793 Bligh sailed from the south coast with the fruit, and the island was discovered Van Diemen's Land was an island. In 1800 the French explorer Baudin, in command of the ships "Géographe" and "Naturaliste," surveyed the south of the island, and reports of his proceedings having reached the British officials at Sydney, they determined to forestall the French and take possession of Van Diemen's Land.

In 1802 the "Cumberland," a small schooner, landed at King's Island in Bass Strait, and in 1803 Lieutenant Bowen was sent by Governor King of New South Wales to form a settlement on the south coast of Van Diemen's Land. In 1804 Bowen aboard his two ships, the "Lady Nelson" and the whaler "Albion," of 760 tons, and the whaler "Albion," of 760 tons, three officials, a lance-corpsal and several privates of the New South Wales Corps, six free men and twenty-five convicts, together with an adequate supply of live stock, and
TASSIE

landed at Risdon, near Hobart, where he was joined shortly afterwards by fifteen soldiers and forty-two convicts. In 1807, Colonel Paterson occupied Port Dalrymple on the north side of the island. During the same year Colonel Collins, who had failed in an attempt to colonize the southern part of Port Phillip, was transferred to Macquarie Island, and for the time being the settlement of Hobart, and was appointed commandant of the infant settlement. Provisions were scarce and dear, communication with the rest of the world was infrequent, and in 1807 the community was threatened with starvation, and flour was sold at £2.00 per ton. The difficulties of the settlers were increased by the hostility of the blacks. The first collision took place at Risdon, a few days after the landing of Lieutenant Bowen's expedition, and for this the white settlers were entirely responsible. Hostilities between the races were incessant from 1802 till 1830. An attempt was made in the year 1830 to drive the natives to one corner of the island, but without success. In the following year, however, Mr George Robinson induced the remnant of the blacks to leave the mainland and take refuge, first in South Brunni and subsequently in Flinders Island, their numbers having then diminished from 3000, the original estimate of the aboriginal population, to 203. In 1842 there were only 44, in 1854 they had diminished to 16, and the last pure-blooded Tasmanian died in 1876, at the age of seventy-six. There are, however, a few persons possessing him or less aboriginal blood in some of the islands of the Bass Strait.

Some persons who had settled at Norfolk Island when that island became a penal depot were transferred to Van Diemen's Land in 1805. But the growth of population was extremely slow, and in 1808 a census showed that there were only 3240 people on the island, including officials, military and convicts, and whatever measure of prosperity was enjoyed by the free inhabitants arose from the expenditure by the imperial government upon the convict settlement. In 1833 the settlement was made a district, and the government gave to each settler a tract of land in proportion to the amount of capital brought by him to the colony—the possession of £200 entitling the holder to 640 acres, and in proportion, a very liberal view being taken as to what constituted capital. To every free settler was assigned, if desired, the services of a number of convicts proportionate to the size of his holding. These were fed and clothed by the settler in return for their labour, and the government was relieved of the expense of their support and supervision. The assignment system was eventually abandoned in consequence of its moral and economical evils, but it cannot be denied that while it lasted the colony made substantial progress. The population had grown to 7400; the sheep numbered 128,468; the cattle, 34,790; horses, 559; and 14,940 acres of land were under crops. As the number of free settlers in the colony increased an agitation arose for more political freedom and improved administration; especially there was a demand for a free press and for trial by jury. These requests were gradually granted. Courts of justice were substituted in 1822 for courts-martial; and in 1824 the colony was made independent of New South Wales, Colonel Arthur being appointed governor. In 1828 the Van Diemen's Land Company commenced sheep-farming on a large scale in the north-west district of the island under a charter granted three years before, and in 1839 the Van Diemen's Land Establishment obtained a grant of 49,000 acres at Norfolk Plains for agriculture and grazing. In 1834 Portland Bay, on the mainland of Australia, was occupied by settlers from Van Diemen's Land, and in 1835 there was a migration, large when compared with the population of the island, to the shores of Port Phillip, now Victoria. At that date the population was 49,177, a large proportion being convicts, for in four years 15,000 prisoners had been landed. The colony was prosperous, but the free settlers were not at all satisfied with the system of government, and an agitation commenced in Van Diemen's Land, as well as in New South Wales, for the introduction of representative institutions and the abolition of transportation. This system was abolished in New South Wales in 1840, after which date the island was the receptacle for all convicts not only from the United Kingdom, but from India and the colonies, and it was not until 1853 that transportation to Van Diemen's Land finally ceased; in the same year representative institutions were introduced, the name of the colony was changed to Tasmania, and three years later the colony was granted responsible government.

The discovery of gold in Victoria produced a very remarkable effect upon Tasmania. All kinds of produce brought fabulous prices, and were exported to Victoria in such quantities that the exports rose from a value of £665,790 in 1851 to £1,509,883 in 1852, and £1,756,316 in 1853, while the population diminished in almost equal ratio. It was estimated that in 1842 there were 38,000 adult males in the colony, but in 1854 their numbers had diminished to 22,616. For many years the island was inhabited by greybeards and children, young men and women of all classes, so soon as they had reached manhood and womanhood, crossed Bass Strait, and entered upon the wilder life and the more brilliant prospects which first Victoria, and subsequently New South Wales and Queensland, afforded them. It was not till the sixties that Tasmania embarked upon a new period of prosperity. In the early days little was known about the western half of the island. Its mineral wealth was not suspected, although as far back as 1850 coal of fair quality had been found between the Dee and the Mersey rivers, and gold had been discovered in two or three localities during 1852. In 1860 two expeditions were equipped by the government for a search for gold and other minerals, and although it was some years before there was any important result, the discoveries of these explorers directed attention to the mineral wealth of the island.

The political history of the colony after the inauguration of responsible government, until it became in 1901 one of the states of Federated Australasia, was not important. State aid to religion, which was given to any denomination which would accept it, was abolished; local self-government was extended to the rural as well as to the urban districts; and police protection was introduced; the island was connected by a submarine cable to the mainland of Australia, and thence to the rest of the civilized world; and the population, which was only 90,328 in 1870, was nearly doubled. Like her neighbours, Tasmania organized a defence force, and was able to send a contingent to South Africa in 1900.

 Authorities.—J. Bonwick, Daily Life and Origin of the Tasmanians (London, 1870); J. Fenton, A History of Tasmania (Hobart, 1884); J. D. Fergusson, Flora, Fauna, and Physical Features of Tasmania; Sir James F. Fyfe, The Hill, its Origin, Affinities, and Distributions; R. A. I. Carr, A Description of the Island and its Resources (Launceston, 1870); J. R. Fawcett, Historical Sketch of Tasmania (Sydney, 1868); George Thomas Lloyd, Thirty-three Years in Tasmania and Victoria (London, 1862); Mrs Louise Anna Meredith, My Home in Tasmania; or, Nine Years in Australia (New York, 1853); Tasmanian Friends and Foes—Feathered, Furred, and Finned (Hobart, 1881); Royal Society of Tasmania, Papers and Proceedings (Hobart); H. Ling Roth and M. E. Butler, The Aborigines of Tasmania (2nd ed. Halifax, 1899).

TASSIE, JAMES (1735-1799), Scottish gem-engraver and modeller, was born of humble parentage at Pollokshaws, near Glasgow, in 1735. From writings ascribed to himself, as modeller, but, having seen the collection of paintings brought together in Glasgow by Robert and Andrew Foulis, the printers, he removed to Glasgow, attended the academy which had been established there by the brothers Foulis, and became one of the most distinguished pupils of the school. Subsequently he visited Dublin in search of commissions, and there became acquainted with Dr Quin, who had been experimenting, as an amateur, in imitating antique engraved gems in coloured pastes. He engaged Tassie as an assistant, and together they perfected the discovery of an enamel," admirably adapted by its hardness and beauty of texture for the formation of gems and medallions. Dr Quin encouraged his assistant to try his fortune in London, and thither he repaired in 1766. At first he had a hard struggle to make his way. But he worked on steadily with the greatest care and accuracy, scrupulously destroying all
impressions of his gems which were in the slightest degree inferior or defective. Gradually the beauty and artistic character of his productions came to be known. He received a commission from the empress of Russia for a collection of about 15,000 examples; all the richest cabinets in Europe were thrown open to him for purposes of study and reproduction; and his copies were frequently sold by fraudulent dealers as the original gems. He exhibited in the Royal Academy from 1769 to 1791. In particular he published the first catalogue detailing 2856 items. This was followed in 1791 by a large catalogue, in two volumes quarto, with illustrations etched by David Allan, and descriptive text in English and French by Rudolph Eric Raspe, enumerating nearly 16,000 pieces.

In addition to his impressions from antique gems, Tassie executed many large profile medallion portraits of his contemporaries, and these form the most original and definitely artistic class of his works. They were modelled in wax from the life or from drawings done from the life, and—when the wax was impossible—from other authentic sources. They were then cast in white enamel paste, the whole medallion being sometimes executed in this material; while in other cases the head only appears in enamel, relieved against a background of ground-glass tinted of a subdued colour by paper placed behind. His first large enamel portrait was that of John Dolben, son of Sir William Dolben, Bart., modelled in 1793 or 1794; and the series possesses great historic interest, as well as artistic value, including as it does portraits of Adam Smith, Sir Henry Raeburn, Dr. James Beattie, Blair, Black and Cullen, and many other celebrities of the latter half of the 18th century. At the time of his death, in 1799, the collection of Tassie's works numbered about 20,000 pieces.

His nephew, William Tassie (1777-1860), also a gem-engraver and modeller, succeeded to James Tassie's business and added largely to his collection of casts and medallions. His portrait of Pitt, in particular, was very popular, and circulated widely. When the Shakespeare Gallery, formed by Alderman Boydell, was disposed of by lottery in 1805, William Tassie was the winner of the prize, and in the same year he sold the pictures by auction for a sum of over £5000. He was bequeathed to the Board of Manufactures, Edinburgh, an extensive and valuable collection of casts and medallions by his uncle and himself, along with portraits of James Tassie and his wife by David Allan, and a series of water-colour studies by George Sanders from pictures of the Dutch and Flemish schools.

(J. M. G.)

TASSO, TORQUATO (1544-1595). Italian poet, was the son of Bernardo Tasso (1493-1569), a nobleman of Bergamo, and his wife Porzia de’ Rossi. He was born at Sorrento on the 11th of March 1544. His father had for many years been secretary in the service of the prince of Salerno, and his mother was closely connected with the most illustrious Neapolitan families. The prince of Salerno came into collision with the Spanish government of Naples, was outlawed, and was deprived of his hereditary fiefs. In this disaster of his patron Tasso’s father shared. He was proclaimed a rebel to the state, together with his son Torquato, and his patrimony was sequestered. These things happened during the boy’s childhood. In 1552 he was living with his mother and his only sister Cornelia at Naples, pursuing his education under the Jesuits, who had recently opened a school there. The precocity of intellect and the religious fervour of boy attracted general admiration. At the age of eight he was already famous. Soon after this date he joined his father, who then resided in great indigence, an exile and without occupation, in Rome. News reached them in 1556 that Porzia Tasso had died suddenly and mysteriously at Naples. Her husband was firmly convinced that she had been poisoned by her brother with the object of getting control over her property. As it subsequently happened, Porzia’s estate never descended to her son; and the daughter Cornelia married below her birth, at the instigation of her maternal relatives. Tasso’s father was a poet by predilection and a professional courtier. When, therefore, an opening at the court of Urbino offered in 1557, Bernardo Tasso gladly accepted it. The young Torquato, a handsome and brilliant lad, became the companion in sports and studies of Francesco Maria della Rovere, heir to the dukedom of Urbino. At Urbino a society of cultivated men pursued the aesthetic and literary studies which were then in vogue. Bernardo Tasso read cantos of his Amadigi to the duchess and her ladies, or discussed the manuscript for the first time set foot in that with Ferdinand, librarians and secretaries. Torquato grew up in an atmosphere of refined luxury and somewhat pedantic criticism, both of which gave a permanent tone to his character. At Venice, whither his father went to superintend the printing of the Amadigi (1560), these influences continued. He found himself the pet and prodigy of a distinguished literary circle. But Bernardo had suffered in his own career so seriously from addiction to the Muses and a prince that he now determined on a lucrative profession for his son. Torquato was sent to study law in Padua. Instead of applying himself to law, the young man bestowed all his attention upon philosophy and poetry. Before the end of 1562 he had produced a narrative poem called Rinaldo, which was meant to combine the regularity of the Virgilian with the attractions of the romantic epic. In the attainment of this object, and in all the minor qualities of style and handling, Rinaldo showed such marked originality that its author was proclaimed the most promising poet of his time. The flattered father allowed it to be printed; and, after a short period of study at Bologna, he consented to his son’s entering the service of Cardinal Luigi d’Este. In 1565, then, Torquato joined Homer and Virgil, Tassio and Ariosto in the club which was destined for him to be the scene of so many glories, and such cruel sufferings. After the publication of Rinaldo he had expressed his views upon the epic in some Discourses on the Art of Poetry, which committed him to a distinct theory and gained for him the additional celebrity of a philosophical critic. The age was nothing if not critical; but it may be esteemed a misfortune for the future author of the Gerusalemme that he should have started with pronounced opinions upon art. Essentially a poet of impulse and instinct, he was hampered in the pursuits of his own nature.

The five years between 1565 and 1570 seem to have been the happiest of Tasso’s life, although his father’s death in 1569 caused his affectionate nature profound pain. Young, handsome, accomplished in all the exercises of a well-bred gentleman, accustomed to the society of the great and learned, illustrations by his published works in verse and prose, he became the idol of the most brilliant court in Italy. The princesses Lucrezia and Leonora d’Este, both unmarried, both his seniors by about ten years, took him under their protection. He was admitted to their familiarity, and therefore to the more intimate amusement of the court. He had neither of them was indifferent to him personally. Of the celebrated story of his love for Leonora this is not the place to speak. It is enough at present to observe that he owed much to the constant kindness of both sisters. In 1570 he travelled to Paris with the cardinal. Frankness of speech and a certain habitual want of tact caused a disagreement with his worldly patron. He left France next year, and took service under Duke Alfonso II. of Ferrara. The most important events in Tasso’s biography during the following four years are the publication of the Aminta in 1573 and the completion of the Gerusalemme Liberata in 1574. The Aminta is a pastoral drama of very simple plot, but of exquisite lyrical charm. It appeared at the critical moment when modern music, under Palestrina’s impulse, was becoming the main art of Italy. The honeyed melodies and sensuous melancholy of Aminta exactly suited and interpreted the spirit of its age. We may regard it as the most decisively important of Tasso’s compositions, for its influence, in opera and cantata, was felt through two successive centuries. The Gerusalemme Liberata occupies a larger space in the history of European literature, and is a more considerable work. Yet the commanding qualities of this epic poem, those which revealed Tasso’s individuality, and which made it
immediately pass into the rank of classics, beloved by the people no less than by persons of culture, are akin to the lyrical graces of Aminta. It was finished in Tasso's thirty-first year; and when the MS. lay before him the last part of his life was over, his best work had already accomplished. Troubles immediately began to gather round his career. The court of Ferrara, the nest of intrigues, had conceived the Gerusalemme as he had conceived it, and yielded to the critical scrupulosity which formed a secondary feature of his character. The poem was sent in manuscript to several literary men of eminence, Tasso expressing his willingness to hear their strictures and to adopt their suggestions unless he could convert them to his own views. The result was that each of these candid friends, while expressing in general high admiration for the epic, took some exception to its plot, its title, its moral tone, its episodes or its diction, in detail. One wanted it to be more regularly classical; another wanted more romance. One hinted that the Inquisition would not tolerate its supernatural machinery; another demanded the excision of its most charming passages—the loves of Armida, Clorinda and Erminia. Tasso had to defend himself against all these iniquities and pedantries, and to accommodate his practice to the theories he had rashly expressed. As in the Rinaldo, so also in the Jerusalem Delivered, he aimed at ennobling the Italian epic style by preserving strict unity of plot and heightening poetic diction. He chose Virgil for his model, took the first crusade for his subject, infused the fervors of religious interest into the hero Godfrey. But his own natural bias was for romance. In spite of the poet's ingenuity and industry the stately main theme evinced less spontaneity of genius than the romantic episodes with which, as also in Rinaldo, he adorned it. Godfrey, a mixture of pious Aeneas and Tristram Catholicism, is not the real hero of the Gerusalemme. Fiery and passionate Rinaldo, Ruggiero, melancholy impulsive Tancred, and the chivalrous Saracens with whom they clash in love and war, divide our interest and divert it from Goffredo. Armida is a pure creation of his with which, sent forth by the infernal senate to sow discord in the Christian camp, turns the action of the epic. She is converted to the true faith by her adoration for a crusading knight, and quits the scene with a phrase of the Virgin Mary on her lips. Brave Clorinda, donning armour like Martiza, fighting in duel with her devoted lover, and receiving baptism from his hands in her pathetic death; Erminia seeking refuge in the shepherd's hut—these lovely pagan women, so touching in their sorrows, so romantic in their adventures, so tender in their emotions, rivet our attention, while we skip the battles, religious ceremonies, conclaves and stratagems of the conception of the hero. Tasso's great invention as an artist was the poetry of sentiment. Sentiment, not sentimentality, gives value to what is immortal in the Gerusalemme. It was a new thing in the 16th century, something concordant with a growing feeling for woman and with the ascendant art of music. This sentiment, refined, noble, natural, steeped in melancholy, exquisitely graceful, pathetically touching, breathes throughout the episodes of the Gerusalemme; finds metrical expression in the languishing cadence of its mellifluous verse, and sustains the ideal life of those seductive heroines whose names would hold words to all Europe in the 17th and 18th centuries.

Tasso's self-chosen critics were not men to admit what the public has since accepted as incontrovertible. They vaguely felt that a great and beautiful romantic poem was imbedded in a dull and not very correct epic. In their un easiness they suggested every course but the right one, which was to publish the Gerusalemme without further dispute. Tasso, already over-worked by his precocious studies, by exciting court-life and exile with literary task, now grew almost mad with worry. His health began to fail him. He complained of headache, suffered from malignant fevers, and wished to leave Ferrara. The Gerusalemme was laid in manuscript upon a shelf. He opened negotiations with the court of Florence for an exchange of service. This irritated the duke of Ferrara. Alfonso hated nothing more than his courtiers leaving him for a rival duchy. He thought, moreover, that, if Tasso were allowed to go, the Medici would get the coveted dedication of that already famous epic. Therefore he bore with the poet's humours, and so contrived that the latter should have no excuse for quitting Ferrara. Meanwhile, through the years 1575, 1576, 1577, his health grew more broken. jealousies inflamed and calumniated and insulted him. His irritable and suspicious temper, vain and sensitive to slight, rendered him only too easy a prey to their malevolence. He became the subject of delusions,—thought that his servants betrayed his confidence, fancied he had been denounced to the Inquisition, expected daily to be poisoned. In the autumn of 1576 he quarrelled with a Ferrarese gentleman, Maddalo, who had talked too freely about some love affair; in the summer of 1577 he drew his knife upon a servant in the presence of Lucrezia d'Este, duchess of Urbino. For this excess he was arrested; but the duke released him, and took him for change of air to his country seat of Belriguardo. What happened there is not known. Some biographers have surmised that a compromising Haison with Leonora d'Este came to light, and that Tasso agreed to feign madness in order to cover her honour. But of this there is no proof. It is only certain that from Belriguardo he returned to a Franciscan convent at Ferrara, for the express purpose of attending to his health. There the dread of being murdered by the duke took firm hold on his mind. He escaped at the eleventh hour, disdaining himself as a peasant, and went on foot to his sister at Sorrento.

The truth seems to be that Tasso, after the beginning of 1575, became the victim of a mental malady, which, without amounting to actual insanity, rendered him fantastical and insupportable, a misery to himself and a cause of anxiety to his patrons. There is no evidence whatsoever that this state of things was due to an overwhelming passion for Leonora. The duke, instead of acting like a tyrant, showed considerable forbearance. He was a rigid and not sympathetic man, as his treatment of a princeling of that age would bewitch him. But to Tasso he was never cruel—hard and unrelenting, perhaps, but far from being that monster of ferocity which has been painted. The subsequent history of his connexion with the poet, over which we may pass rapidly, will corroborate this view. While at Sorrento, Tasso hankered after Ferrara. The court-made man could not breathe freely outside its charmed circle. He wrote humbly requesting to be taken back. Alfonso consented, provided Tasso would agree to undergo a medical course of treatment for his melancholy. When he returned, which he did with alacrity under those conditions, he was well received by his royal family. All the high society of those days had learned that Tasso had not revived. Scene followed scene of irritability, moodiness, suspicion, wounded vanity and violent outbursts. In the summer of 1578 he ran away again; travelled through Mantua, Padua, Venice, Urbino, Lombardy. In September he reached the gates of Turin on foot, and was courteously entertained by the duke of Savoy. Wherever he went, "wandering like the world's rejected guest," he met with the honour due to his illustrious name. Great folk opened their houses to him gladly, partly in compassion, partly in admiration of his genius. But his heart was weary; he had outlived his youth; for their kindness had outlived his querulous peevishness. It seemed, moreover, that his state of mind was intolerable to him outside Ferrara. Accordingly he once more opened negotiations with the duke; and in February 1579 he again set foot in the castle. Alfonso was about to contract his third marriage, this time with a princess of the house of Mantua. He had no children; and, unless he got an heir, there was a probability that his state would fall, as it did subsequently, to the Holy See. The nuptial festivals, on the eve of which Tasso arrived, were not therefore the occasion of great rejoicing to the elderly bridegroom. As a forlorn hope he had to wed a third wife; but his heart was not engaged and his expectations were far from sanguine. Tasso, preoccupied as always with his own sorrows and his own sense of dignity, made no allowance for the troubles of his master. Rooms below his rank, he thought, had been assigned him.
The princesses did not want to see him. The duke was engaged. Without exercising common patience, or giving his old friends the benefit of a doubt, he broke into terms of open abuse, behaved like a lunatic, and was sent off without ceremony to the mad-house of St Anna. This happened in March 1579; and there he remained until July 1586. Duke Alfonso's long-sufferance at last had given way. He firmly believed that Tasso was insane, and he felt that if he were so St Anna was the safest place for him. Tasso had put himself in the wrong by his intemperate conduct, but far more by that incomprehensible yearning after the Ferrarese court which made him return to it again and yet again. It would be pleasant to assume that an unrequitable love for Leonora led him back. Unfortunately, there is no proof of this. His relations to her sister Lucrèzia were not less intimate and affectionate than to Leonora. The lyrics he addressed to numerous ladies are not less respectful and less passionate than those which bear her name. Had he compromised her honour, the duke would certainly have had him murdered. Custom demanded this retaliation, and society approved of it. If therefore Tasso really cherished a secret lifelong devotion to Leonora, it remains buried in impenetrable mystery. He did certainly not behave like a loyal lover, for both when he returned to Ferrara in 1578 and in 1579 he showed no capacity for curbing his peevish humours in the hope of access to her society.

It was no doubt very irksome for a man of Tasso's pleasure-loving, restless and self-conscious spirit to be kept for more than seven years in confinement. Yet we must weigh the facts of the case rather than the fancies which have been indulged regarding them. After the first few months of his incarceration he obtained spacious apartments, received the visits of friends, went abroad attended by responsible persons of his acquaintance, and corresponded freely with whomever he chose to address. The letters written from St Anna to the princes and cities of Italy, to warm well-wishers, and to men of the highest reputation in the world of art and learning, form our most valuable source. The letters he addressed to numerous ladies are not, but also on his temperament at large. It is singular that he spoke always respectfully, even affectionately, of the duke. Some critics have attempted to make it appear that he was hypocritically kissing the hand which had chastised him, with the view of being released from prison. But no one who has impartially considered the whole tone and tenor of his epistles will adopt this opinion. What emerges clearly from them is that he laboured under a serious mental disease, and that he was conscious of it.

Meanwhile occupied his uneasy leisure with copious compositions. The mass of his prose dialogues on philosophical and ethical themes, which is very considerable, we owe to the years of imprisonment in St Anna. Except for occasional odes or sonnets—some written at request and only rhetorically interesting, a few inspired by his keen sense of suffering and therefore poignant—he neglected poetry. But everything which fell from his pen during this period was carefully preserved by the Italians, who, while they regarded him as a lunatic, somewhat illogically scrambled for the very offscourings of his wit. Nor can it be said that society was wrong. Tasso had, indeed, written and published his last, and in fact his impracticable, impious, irrational, and in an age which no longer remained a man of genius, the most interesting personality in Italy. Long ago his papers had been sequestered. Now, in the year 1880, he heard that part of the Gerusalemme was being published without his permission and without his corrections. Next year the whole poem was given to the world, and in the following six months seven editions issued from the press. The prisoner of St Anna had no control over his editors; and from the masterpiece which placed him on the level of Petrarch and Ariosto he never derived one penny of pecuniary profit. A rival poet at the court of Ferrara undertook to revise and re-edit his lyrics in 1582. This was Battista Guarini; and Tasso, in his cell, had to allow odes and sonnets, poems of personal feeling, occasional pieces of compliment, to be collected and emended, without lifting a voice in the matter. A few years later, in 1585, two Florentine pedants of the Della Crusca academy declared war against the Gerusalemme. They loaded it with insults, which seem to those who read their pamphlets now mere parodies of criticism. Yet Tasso felt bound to reply; and he did so with a moderation and urbanity which prove him to have been "Actum est de poesia Romæ once more: his Muse is no longer the court of noble men or his brothers, but a gentleman of noble manners also. Certainly the history of Tasso's incarceration at St Anna is one to make us pause and wonder. The man, like Hamlet, was distraught through ill-accommodation to his circumstances and his age; brain-sick he was undoubtedly; and this is the duke of Ferrara's justification for the treatment he endured. In the prison he bore himself pathetically, peevishly, but never ignobly. He showed a singular indifference to the fate of his great poem, a rare magnanimity in dealing with its detractors. His own personal distress, that terrible malaise of imperfect insanity, absorbed him. What remained over, untouched by the malady, unoppressed by his consciousness thereof, displayed a sweet and gravely-toned humanity. The oldest thing about his life in prison is that he was always trying to place his two nephews, the sons of his sister Cornelia, in court-service. One of them he attached to the duke of Mantua, the other to the duke of Parma. After all his father's and his own lessons of life, he had not learned that the court was to be shunned like Circe by an honest man. In estimating Duke Alfonso's share of blame, this fruitful idealization of the court by Tasso must be taken into account. That man is his father, whose passion moves heaven and earth to place his sister's sons with tyrants.

In 1586 Tasso left St Anna at the solicitation of Vincenzo Gonzaga, prince of Mantua. He followed his young deliverer to the city by the Mincio, basked awhile in liberty and courtly pleasures, enjoyed a splendid reception from his paternal town of Bergamo, and produced a meritorious tragedy called Torris mondo. But only a few months had passed when he grew discontented. Vincenzo Gonzaga, succeeding to his father's dukedom of Mantua, had scanty leisure to bestow upon the poet. Tasso had written the first act of the Torris mondo, and journeying through Bologna and Loreto to Rome, and taking up his quarters there with an old friend, Scipione Gonzaga, now patriarch of Jerusalem. Next year he wandered off to Naples, where he wrote a dull poem on Monte Olibeto. In 1589 he returned to Rome, and took up his quarters again with the patriarch of Jerusalem. The servants found him insufferable, and turned him out of doors. He fell ill, and went to a hospital. The patriarch in 1590 again received him. But Tasso's restless spirit drove him forth to Florence. The Florentines called him Tornando. Acting on a dream, he set forth to Rome, then Florence, then Rome, then Naples, then Rome, then Naples—such is the weary record of the years 1590-94. We have to study a veritable Odyssey of malady, indigence and misfortune. To Tasso everything came amiss. He had the palaces of princes, cardinals, patriarchs, nay popes, always open to him. Yet he could rest in none. Gradually, in spite of all veneration for the sacer vates, he made himself the laughing-stock and bore of Italy.

His health grew ever feebler and his genius dimmer. In 1592 he gave to the public a revised version of the Gerusalemme. It is called the Compedita. All that made the poem of his early manhood charming he rigidly erased. The versification was degraded; the heavier elements of the plot underwent a dull rhetorical development. During the same year a prosaic composition in Italian blank verse, called Le Sette Giornate, saw the light. Nobody reads it now. We only mention it as one of Tasso's dotages—a dreary amplification of the first chapter of Genesis.

It is singular that just in these years, when mental disorder, physical weakness, and decay of inspiration seemeddooming Tasso to oblivion, his old age was cheered with brighter ways of hope. Clemence VII. ascended the papal chair in 1592. He and his nephew, Cardinal Aldobrandini of St Giorgio, determined to befriend our poet. In 1594 they invited him to Rome. There he was to assume the crown of bays, as Petrarch
had assumed it, on the Capitol. Worn out with illness, Tasso reached Rome in November. The ceremony of his coronation was deferred because Cardinal Aldobrandini had fallen ill. But the pope assigned him a pension; and, under the pressure of pontifical remonstrance, Prince Avellino, who held Tasso's maternal estate, agreed to discharge payment of his claims by paying a yearly rent-chaplet. At no time since Tasso left St Anna had the heavens so smilingly promised him. Capitalian honours and money were now at his disposal. Yet fortune came too late. Before the crown was worn or the pensions paid he ascended to the convent of St Onofrio, on a stormy 1st of April in 1595. Seeing a cardinal's coach toll up the steep Trastevere Hill, the monks came to the door to greet it. From the carriage stepped Tasso, the Odysseus of many wanderings and miseries, the singer of sweetest strains still vocal, and told the prior how he came to die with him. In St Onofrio he died, on the 25th of April 1595. He was then past fifty-one; and the last twenty years of his existence had been practically and artistically ineflectual. At the age of thirty-one the Gerusalemme, as we have it, was accomplished. The world too was already ringing with the music of Amina. More than this Tasso had not to give to literature. But those succeeding years of derangement, exile, imprisonment, poverty and hope deferred endear the man to us. Elegiac and querulous as he must always appear, we yet love Tasso better because he suffered through nearly a quarter of a century of that odium and unexplained misfortune. (J. A. S.)

Taken altogether, the best complete edition of Tasso's writings is that of Rosini (Pisa), in 33 vols. The prose works (in 2 vols., Florence, Le Monnier, 1875) and the letters (in 5 vols., same publisher, 1853) were admirably edited by Cesare Guastati. This edition of Tasso's Letwork forms by far the most valuable source for his biography. No student can, however, omit to use the romantic memoir attributed to Tasso's friend, Marchese Mamo (printed in Rosini's edition of Tasso's works above cited), and the important Vittorio Torquato Tasso by Serassi (Bergamo, 1790). See also Solerti's Life (1895), his editions of the Opere Minori in versi (1891 et seq.), and Gerusalemme (1895), and his bibliography, in the Ristita biblioteca e archivio (1895), on the occasion of the celebration of the tercentenary of Tasso's death.

**TASSONI, ALESSANDRO** (1655-1635), Italian poet, was a native of Modena, where he was born and died. From 1590 till 1608 he was secretary to Cardinal Ascanio Colonna, and in this capacity saw some diplomatic service; he was afterwards employed for some time in similar occupations by Charles Emmanuel, duke of Savoy. His best-known literary work is a burlesque epic entitled La Scocchia Rapita, or "The Rape of the Bucket" (1623), the reference being to a raid of the Modenesi upon the people of Bologna in 1595, when a bucket was carried off as a trophy. As in Butler's Hudibras, many of the personal and local allusions in this poem are now very obscure, and are apt to seem somewhat pointless to the general reader, but, in spite of Voltaire's contempt, it cannot be neglected by any systematic student of Italian literature (see Carducci's edition, 1861). Other characteristic works of Tassoni are his Pensieri Diversi (1612), in which he treats philosophical, literary, historical and scientific questions with unusual freedom, and his Considerazioni sopra il Petrarca (1600), a piece of criticism showing great independence of traditional views. Tasso's chief work, however, is his celebrated poetic drama Diversi, which was published in 1595, on the occasion of the celebration of the tercentenary of Tasso's death.

**TASSONI—TASTE**

in the papillae of the soft palate and uvula, the under surface of the epiglottis, the upper part of the posterior surface of the epiglottis, the inner sides of the arytenoid cartilages, and even in the vocal cords. The taste-bulbs are minute oval bodies, somewhat like an old-fashioned Florence flask, about 1/16 inch in length by 1/18 in breadth. Each consists of two sets of cells—an outer set, nucleated, fusiform, bent like the staves of a barrel, and arranged side by side so as to leave a small opening at the apex (the mouth of the barrel), called the gustatory pore; and an inner set, five to ten in number, lying in the centre, pointed at the end near the gustatory pore, and branched at the other extremity. The branched ends are continuous with non-medulated nerve fibres from the gustatory nerve. These taste-bodies are found in immense numbers: as many as 1760 have been counted on one circumvallate papilla in the ox. The proofs that these are the terminal organs of taste rest on careful observations which have shown (1) that taste is only experienced when the sapid substance is allowed to come into contact with the taste-body; and that the sense is absent or much weakened in those areas of mucous membrane where these are deficient; (2) that they are most abundant where the sense is most acute; and (3) that section of the glossopharyngeal nerve which is known to be distributed to the areas of mucous membrane where taste is present is followed by degeneration of the taste-bodies. At the same time it cannot be asserted that they are absolutely essential to taste, as we can hardly suppose that those animals which have no special taste-bodies are devoid of the sense. Evidence is accumulating that taste depends on nervous impulses excited by chemical change. Substances that have taste must be soluble. Chemical changes are in all probability set up in the taste-cells, or in the processes connected with them. Some progress has been made in the attempt to establish a...
connexion between the chemical composition of sapid substances and the different kinds of taste to which they may give rise. Thus acids are usually sour; alkaboids have a peculiar soapy taste; salts may be sweet, like sugar of lead, or bitter, like sulphate of magnesium; soluble alkaloïds, such as quinine or strychnine, are usually bitter; and the higher alcohols are more or less sweet. Substances which taste sweet or bitter often contain definite groups in the molecule, especially in the hydroxyl (HO) and amido (NH₂) groups. By altering the chemical composition of a substance having a characteristic taste (changing the position or relations of the radicles), the substance may become tasteless or intensely bitter. The sensation of taste may also be excited mechanically, as by smartly tapping the tongue, or by the stimulus of a continuous current. This case electrolytic change may be the exciting cause; but that the sense organs may be affected electrically is proved by the fact that rapidly interrupted induced currents, which produce little or no electrosensation, may also excite taste. Sensations of taste are heightened by increasing the area of the tongue affected, and by mechanical stimulation, as when the tongue is pressed against the lips, cheeks or palate. A temperature of about 40° C. is most favourable, either extreme heat or cold apparently numbing the sense for a time. Gustatory sensations affect each other: that is to say, a strong taste will affect the taste of another body taken immediately after it. Thus, sweetness will modify bitterness, and sourness will modify both. Moreover, the application of a sapid substance to the tongue will affect taste in other parts. If the same taste is excited on each side of the tongue, although there are two sets of gustatory nerves, one for each lateral half, the sensations are blended into one; while if two different substances, say one sweet and the other bitter, are simultaneously applied, one to each side, the observer can distinctly differentiate the one from the other.

Tastes have been variously classified. One of the most useful classifications is into sweet, bitter, acid and saline tastes. Insoluble substances, such as quinine, when brought into contact with the tongue, give rise to feelings of touch or of temperature, but excite no taste. If solutions of various substances are gradually diluted with water until no taste is experienced, G. G. Valentin found that the sensations of taste disappeared in the following order—sugar, common salt, quinine, sulphuric acid; and Camerer found that the taste of quinine still continued although diluted with twenty times more water than common salt. The time required to excite taste after the sapid substance was placed on the tongue varies. Thus saltpetre is tasted most rapidly (17 second), then sweet, acid and bitter (282 seconds). There are many curious examples of substances of different chemical constitution having similar tastes. For example, sugar, acetate of lead and the vapour of chloroform have all a sweetish taste. A temperature of from 50° to 90° F. is the most favourable to the sense, water above or below this temperature either masking or temporarily paralysing it.

As a general rule, bitter tastes are most acute at the back of the tongue, near the circumvallate papillae, and sweet tastes at the tip, but there are considerable individual variations. Some persons taste both harum-scarum and sweet things with the tip, while others taste bitter things at the tip. Many experience salt tastes best at the tip, and acid tastes at the sides of the tongue. When we consider that there are three kinds of papillae on the surface of the tongue, one would expect to meet with different degrees of sensitiveness to different tastes, even while we admit that the papillae may also have to do with sensations of touch and of temperature. By experimenting with fine capillary tubes containing sapid substances, observations have been made with individual papillae. Some are found to be sensitive to many tastes, others to two or three, others to only one, while others are insensitive to taste altogether. Again, it has been found that a mixture of sapid substances, say of quinine and sugar, may taste sweet when applied to one papilla and bitter when applied to another. The inference must be that there are special terminal organs for different tastes. Assuming that there are different kinds of taste-cells, it might be possible to paralyse some without affecting others, and thus different sensations of taste might be discriminated. This has been done by the use of the leaves of a common Indian plant, Gymnema sylvestre. When some of this plant are chewed, it has been found that bitters and sweets are paralysed (Taste of quinine, nor sugar giving rise to sensation), while acids and salines are unaffected. Again, certain strengths of decoctions of the leaves appear to paralyse sweets sooner than bitters. These observations show the existence of different taste-cells for sweets, bitters, acids and salines; and it is clear that the region of the tongue most richly supplied with taste-cells sensitive to sweets will respond best to sweet substances, while another region, supplied by taste-cells sensitive to bitters, will respond best to bitter and salts. In like manner the argument may be applied to other tastes. Suppose, again, a set of taste-cells sensitive to bitter substances: it is conceivable that in whatever way these were irritated, a bitter taste would result. If so, a substance which, applied to one part of the tongue, would cause a sweet sensation, might cause a bitter if applied to a part of the tongue richly supplied with taste-cells sensitive to bitters. This may explain why sulphate of magnesium excites at the root of the tongue a bitter taste, while applied to the tip it causes a sweet or an acid taste. Saccharine, a peculiar taste derivative, in like manner is sweet to the tip and bitter to the back of the tongue. It may be found that if the sweet and bitter taste-cells are paralysed by Gymnema, electrical irritation of the tip by a weak interrupted current does not give rise to an acid taste mixed with sweet, as it usually does, but to sensations somewhat different, which may be described as metallic or salt or acid. This experiment indicates that the action of the interrupted current on the terminal organ is analogous to the action of sweet or bitter substances (Shore). No direct observations of importance have yet been made on single circumvallate papillae. Further observations on the fungiform papillae, the taste buds, and areas of the surface of the tongue having neither papillae nor taste buds, may still, when stimulated by sapid substances, give rise to tastes. Taste is often associated with smell (g.a.). giving rise to a sensation of flavour, and we are frequently in the habit of confounding the one sensation with the other. Chloroform excites taste alone, whilst garlic, asafoetida and vanilla excite only smell. This is illustrated by the familiar experiment of blindfolding a person and touching the tongue successively with slices of an apple and of an onion.

In these circumstances the one cannot be distinguished from the other when the other is absent. When the other is present, a sensation of acidity at the anode (+pole) and of alkalinity at the katode (−pole). This is in all probability due to electrolysis, the decomposition products exciting the taste-bodies. Rapidly interrupted currents fail to excite the sense.

Disease of the tongue causing unnatural dryness may interfere with taste. Substances circulating in the blood may give rise to subjective sensations of taste. Thus santonine, morphia and biliary products (as in jaundice) usually cause a bitter sensation, whilst the sufferer from diabetes is distressed by a persistent sweetish taste. The insane frequently have subjective tastes, which are real to the patient, and frequently cause much distress. In such cases, the sensation is excited by changes in the taste-centres of the brain. Increase in the sense of taste is called hyperguesia, diminution of it hypoguesia, and
its entire loss of *agriculture*. Rare cases occur where there is a subjective taste not associated with insanity nor with the circulation of any known sweetish matters in the blood, possibly caused by irritation of the gustatory nerves or by changes in the nerve centres.

For the anatomy of the organs of taste, see the articles *Mouth and Tongue* (J. G. M.).

**TATA—TATARS**

Pacey, merchant and philanthropist, was born at Nosari, in the state of Baroda, in 1839, and went as a boy to Bombay, where he was educated at the Elphinstone College. In 1858 he entered his father's office, and began a commercial career of the highest eminence, beginning with cotton mills at Bombay and also at Nagpur, and ending with the formation of a company to work the iron ores of the Central Province and the modern blast furnaces. One of his best-known achievements was the lowering of the freights on Indian goods to China and Japan, as the result of a long struggle with the Nippon Yusen Kaisha Co. He also introduced a silk industry after Japanese methods into Mysore, and built the Taj Mahal hotel in Bombay. But his greatest benefaction is the endowment of a research institute at Bangalore. He died at Nauheim, in Germany, on the 19th of May 1904.

**TATAR PAZARJIK, or Tatar Bazaarlik**, a town of Bulgaria in Eastern Rumelia; on the river Maritsa, and on the Sofia-Constantinople railway, 74 m. E.S.E. of Sofia, and 23 m. N.W. of Philippopolis (Pop. 9068) (77). Situated at the junction of several roads, Tatar Pazarjik began to acquire commercial importance in the 15th century. Rice, millet and tobacco are largely cultivated in the surrounding lowlands, and there is some trade in coconuts and wool.

**TATARS** (the common form Tartars is less correct), a name given to nearly three million inhabitants of the Russian empire, chiefly Moslem and of Turkish origin. The majority—in European Russia—are remnants of the Mongol invasion of the 13th century (see Moslem). Among these are, however, two distinct elements, a more numerous Turkish population of the Ural-Altaic region, mixed with some extent with Finns and Samoyedic tribes, as also with Mongols. The name is derived from that of the Ta-ta Mongols, who in the 5th century inhabited the north-eastern Gobi, and, after subjugation in the 7th century by the Khitans, migrated southward, there founding the Mongol empire under Jenghiz Khan (q.v.). Under the leadership of his grandson (Batu) they moved westwards, driving with them many tribes of the Turkic Ural-Altaic and other tribes, which, as their eastern neighbours, were, and still are, a mixture of Mongolian blood, but belong to the Turkish branch of the Ural-Altaic stock, necessitating the conclusion that only Batu, his warriors, and a limited number of his followers were Mongols, while the great bulk of the 15th century invaders were Turks. On the Volga they mingled with remnants of the old Bulgarian empire, and elsewhere with Finnish tribes, as well as with remnants of the ancient Italian and Greek colonies in Crimea and Caucasians in Caucasus. The name of Tatars, or Tartars, given to the invaders, was afterwards extended so as to include different stems of the same Turkish branch in Siberia, and even the bulk of the inhabitants of the high plateau of Asia and its N.W. slopes, described under the general name of Tartary. This last name has almost disappeared from geographical literature, but the name Tatars, in the above limited sense, remains in full use.

The present Tatars of the Russian empire form three large groupings: those of East, or Russian and Poland, those of Caucasus, and those of Siberia. The differentiation of the separate stems included under the name is still far from completion. The following subdivisions, however, may be regarded as established. (1) The Kazakh Tatars, descendants of the Kipchaks settled on the Volga in the 13th century, where they mingled with survivors of the old Bulgarians and partly with Finnish tribes. They number about half a million in the government of Kazakh, about 100,000 in each of the governments of Ural, Simbirsa and Saratov, 300,000 in Vyatka, Saratov, Tambov, Penza, Nizhniy-Novgorod,Perm and Orenburg; some 15,000 belong to the same stem as migrated to Ryazan, or have been settled as prisoners in the 16th and 17th centuries in Lithuania (Vilna, Grodno and Podolia); and there are some 2000 in St Petersburg, where they pursue the callings of coachmen and waiters in restaurants. In Poland they constitute the larger part of the population of various localities. The Tatars speak a pure Turkish dialect; they are middle-sized, broad-shouldered and strong, and mostly have black eyes, a straight-nosed and scanty cheek bones. They are Moslems, except in the three classes and is a waning institution. Excellent agriculturists and gardeners, very laborious, and having a good reputation for honesty, they live on the best terms with their Russian peasant neighbours, especially in the Volga basin. They also are agriculturists and gardeners; while some 12,000 Koundrovsk Tatars still continue the nomadic life of their ancestors. (2) The Crimean Tatars, who are related to the 14th century, have preserved the name of their leader, Nagasi. During the 15th, 16th and 17th centuries they constituted a rich empire, which prospered until it fell under Turkish rule, when it had to suffer much from the wars fought-tenders and Turkish. Although most of its service of the peninsula. The war of 1853 and the laws of 1860-63 and 1874 caused an exodus of the Crimean Tatars; they abandoned their admirably irrigated fields and gardens and moved to Turkey, so that the number of their remains in the Crimea is about 100,000, mixed with Greeks and Italians, are well known for their skill in gardening, their honesty and their laborious habits, as well as for their fine features and especially for their quickness of wit. The Tatars in the Crimea closely resemble those of Caucasus, while those of the steppes—the Nagasi—are decided of a mixed origin from Turks and Mongols. The Tatars of Caucasian, who inhabit the upper Kuthan, the steppes of the Kuma and the Kura, and the Aras, number about 3,500,000. Of these (4) the Nagasi on the Kuma show traces of an intimate mixture with Kalmucks. They are nomads, supporting them by cattle-breeding and fishing; few are agriculturists or cattle-breeding. (5) The Karachais (18,500) in the upper valleys about Elburz live by agriculture. (6) The mountain Tatars (about 850,000), divided into many tribes and of an origin still undetermined, scattered throughout the provinces of Kildari, Tiflis, Kutais, Daghestan, and partly also of Batum. They are certainly of a mixed origin, and present a variety of ethnological types, all the more so as all who are neither Armenians nor Circassians, nor belong to any distinct Caucasian tribes, are often called Tatars. As a rule they are well built and little behind their Caucasian brethren. They are celebrated for their excellence as gardeners, agriculturists, cattle-breeding, and as fishermen; they are on very good terms both with their Sunnite and with their Russian neighbours. Polygamy is rare with them, and their women go out to work. The Siberian Tatars are estimated (1895) at 80,000 of Turkic stock, and about 40,000 of mixed Finnish stock. They occupy three distinct regions—a strip running west to east from Tobolsk to Tomsk, the Altai and its spurs, and South Yeniensis. They are included in the agricultural population of the region north of the Altai reached some degree of culture between the 4th and the 8th centuries, but were subdued and enslaved by the Mongols. They are difficult to classify, for they are the result of a recent mixed race, the Mongol-Tatars, who are more or less in process of being assimilated by the Russians, but the following subdivisions may be accepted provisionally. (1) The Bokhara Tatars, who take their name from one of their stems (Barama), number about 50,000 in the government of Tobolsk and about 5000 in Tomsk. After a strenuous resistance to Russian conquest, and much suffering at a later period from Kirghiz and Kalmuck raids, they now live by agriculture, either in separate villages or along with Russians. (6) The Cholm or Chulyen Tatars on the Cholm and the rivers Yus speak a Turkish language with many Mongol and Yakut words, and are more like Mongols than Turks. In the 14th century they lived on the Volga and the Kazanka, but now are rapidly becoming fused with Russians. (6) The Abakan or Minusinsk Tatars occupied the steppes on the Abakan and Yus in the 17th century, after the withdrawal of the Kirghizes, and remained a pure Turko-Mongol mixture with Kalbaits (whom Castaño considers as partly of Ostiak and partly Samoyedic origin) and Beltars—also of Finnish origin. Their language is also mixed. They are known under the names of Kalmucks, and are the Turkish stem of the Minusinsk Tatars, Kalbaits, and Kizil or Red Tatars. Formerly Shamanists, they now are, nominally at least, adherents of the Greek Orthodox Church, and support themselves mainly by herding of cattle. (7) The Soviet. They have 8000 and live with Turks the Uryankhes of north-west Mongolia, who are of Turkish origin but follow Buddhism, and the Karagasses, also of Turkish
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origin and much like the Kirghizes, but reduced now to a few hundreds, are akin to the above. (10) The Tatars of the northern slopes of the Altai (nearly 20,000 in number) are of Finnish origin. They comprise some 20,000 of Kumandistles, the Lebedi, the Cherniyakha, the Black-Forests and the Shors (11,000), descendants of the Kuznets or Iron-Smith Tatars. They are chiefly hunters, passionately loving their tajga, or wild forests, and have nothing in common with the racial organization of the Kazans; they live partly also on cedar-nuts and honey collected in the forests. Their dress is that of their former rulers, the Kalmucks, and their language contains many Mongol words. (11) The Altai Tatars, who live up in the Mountain Altai (12,000), to whom this name has been given by mistake, and who have nothing in common with the Kalmucks except their dress and mode of life, speak a Turkish dialect, and (6) the Teletuch of Tatar, as they are usually named, is a mainly nomadic or warlike nation who have migrated from the mountains to the lowlands, where they now live along with Russian peasants. Although Turkistan and Central Asia were formerly known as independent Tartary, it is not now usual to call the Sarts, Kirghiz and other inhabitants of those countries Tatars, nor is the name usually given to the Yakuts of Eastern Siberia.

It is evident from the above that the name Tatars was originally applied to both the Turkish and Mongol tribes which invaded Europe six centuries ago, and gradually extended to the Turkish tribes mixed with Mongol or Finnish blood in Siberia. It is used at present, in the books of the Ural-Altaians, to the Ural-Altaians, who, also those of the Russian historians Soloviev, Kostomarow, Bestuzhev-Ryumin, Schapov, and Illovaysky, the former of whom has published a Resume des travaux et des publications of the Russian Geographical Society and its branches; the Russian Etnographicheskiy Sbornik; The Istoria of the Moscow society of the amateurs of natural science; the works of the Russian ethnographical congresses; Kostrov's researches on the Siberian Tatars in the memoirs of the geographical branch of the Russian society; Radlov's Reise durch den Altai, Aus Siberien; "Picturesque Russia" (Zhininskaya Rosiya); Semenov's and Potanin's "Supplements" to Ritter's Asien; Harkavi's report on the Tatars at the congress at Kazan; Hartakhi's "Hist. of Crimean Tatars," in Vjetnik Evrope, 1866 and 1867; "Katchkin Tatars," in Istoria Rus. Acad. s. d.; and V. Volodarsky's article on Volodarsky and the Tatars will be found in the Revue orientale pour les Etudes d'Asie, and in the publications of the university of Kazan. See also E. H. Parker, A Thousand Years of the Tatars, 1895 (chiefly a summary of those of Sir Paul), A. Fish and Tatar to Skrine and Ross, Heart of Asia (1895).

TATE, SIR HENRY, Bart. (1819-1890), English merchant and founder of the National Gallery of British Art, was born at Chorley, Lancashire, in 1819. His father, a minister of religion, put him into business in Liverpool. He became a prosperous sugar-broker, and about 1874 removed to London, where he was afterwards one of his firm's leading members. He was at first merely a regular buyer of pictures, for which he built a large private gallery in his house at Streatham. Gradually his gallery came to contain one of the best private collections of modern painting in England, and the owner naturally began to consider what should be done with it after his death. It had always been his intention to leave it to the nation, but in the way of carrying out this generous desire there stood several obstacles. The National Gallery could not have accepted more than a selection from Tate's pictures, which were not all up to the standard of Trafalgar Square; and even when he offered to build a new gallery for them, it was found difficult to secure a suitable site. What Tate offered was to spend £20,000 upon a building if the government would provide the ground; and in 1892 this offer was accepted. A new gallery, controlled by the Trustees of the National Gallery, was built on the site of Millbank Prison. The gallery was opened on 21 July 1897, and a large addition to it was completed just before the donor died. It contained sixty-five pictures presented by him; nearly all the English pictures from the National Gallery painted within the previous eighty years; the pictures purchased by the Royal Academy under the Chantrey Bequest, of which he had previously bought a set in South Kensington Museum; and seventeen large works given under a will by Mr G. F. Watts, R.A. Mr Tate was created a baronet in the year after the Tate Gallery had been opened. He died at Streatham on the 5th of December 1890.

TATE, JAMES (1771-1843), English classical scholar and schoolmaster, was born at Richmond in Yorkshire on the 11th of June 1771. He was educated at Richmond school and Sidney Sussex College, Cambridge (fellow, 1795). From 1796 to 1833 he held the headmastership of his old school, being then a fellow of Trinity College, Cambridge, and a fellow of Pembroke College, Cambridge, and was appointed headmaster of the University Grammar School, Edinburgh. He died on the 2nd of September 1843. The work by which he is chiefly known is his Horatius Restituitus (1832).

TATE, NAHUM (1652-1715), English poet laureate and playwright, was born in Dublin in 1652. He was the son of Faithful Teate (as the name was spelt), who wrote a quain poem on the Trinity entitled Ter Tria. Nahum Tate was educated at Trinity College, Dublin, graduating B.A. in 1672. He published a volume of poems in London in 1677, and became a regular writer for the stage. Bruius of Alba, or The Enchanted Lover (1678), a tragedy dealing with Dido and Aeneas, and The Loyed General (1680), were followed by a series of adaptations from Elizabethan dramas. In Shakespeare's Richard II. he altered the names of the personages, and changed the text so that every scene, to use his own words, was "full of respect to Majesty and the dignity of courts"; but in spite of these precautions The Sicilian Usurper (1681) was suppressed on the third representation on account of a possible political interpretation. King Lear (1687) was fitted with a happy ending in a marriage between Cordelia and Edgar; and Coriolanus became the Ingratitude of a Commonwealth (1682). From appointed critic he at last returned to his metrical work (1685); from Chapman and Marston's Eastward Ho! he derived the Cuckold's Haven (1683); from John Webster's White Devil he took Injured Love, or The Cruel Husband (pr. 1707); and the As Sir Cockayne's Treapolinn suppord a Prince he imitated in Devil and no Duke (1683). Tate's name is chiefly connected with these adapted versions of other men's plays and with the famous New Version of the Psalms of David (1696), in which he collaborated with Nicholas Brady. A supplement was licensed in 1703. Some of these hymns, notably "While Shepherds watched," and "As pants the hart," rise above the general dull level, and are said to be Tate's work.

Tate was commissioned by Dryden to write the Second Part of Abolse and Achitophel. The portraits of Elkanah Settle and Thomas Shadwell, however, are attributed to Dryden, who probably also put the finishing touches to the poem. Of his numerous poems the most original is Parace, a poem on Tea (1700). In spite of his consistent Toryism, he succeeded Shadwell as poet laureate in 1692. He died within the precincts of the Mint, Southwark, where he had taken refuge from his creditors, on the 12th of August 1715.

TATE, RALPH (1840-1901), British geologist, was born at Alnwick in Northumberland in 1840. He was a nephew of George Tate (1805-1871), naturalist and archæologist, an active member of the Berwickshire Naturalists' Club. He was educated at the Cheltenham Training College and at the Royal School of Mines, and in 1861 he was appointed teacher of natural science at the Philosophical Institution in Belfast. He there studied botany, and published his Flora Balfinesis (1863); and he also investigated the Cretaceous and Liassic rocks of Antrim,
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bringing his results before the Geological Society of London. In 1864 he was appointed assistant in the museum of that society. In 1867 he went on an exploring expedition to Nicaragua and Venezuela. In 1871 he was appointed to the mining school established by the Cleveland ironmasters first at Darlington and then at Redcar. Here he made a special study of the Lias and its fossils, in conjunction with the Rev. J. F. Blake, and in 1883 published an important work, *The Yorkshire Lias* (1876), in which the life-history of the strata was first worked out in detail. In 1875 Tate was appointed professor of natural science in the university of Adelaide, South Australia. He now gave special attention to the recent and tertiary mollusca of Australia. He was the chief founder of the Royal Society of South Australia, and was in 1893 president of the Australian Association for the Advancement of Science. He died at Adelaide on the 20th of September 1901.

TATI, a district of British South Africa forming, geographically, the S.W. corner of Matabeleland, but attached administratively to the BechuanaLand Protectorate. Area about 2500 sq. m. The railway from Cape Town to Bulawayo crosses the territory with a station at Francistown, the principal settlement. Francistown stands 3254 ft. above the sea and is 126 m. S.W. of Bulawayo by rail. The town of Tati, on the river of that name, is 18 m. S.E. of Shashi river railway station.

Tati owes its importance to the presence of gold, first discovered by the German traveler, Karl Mauch, in 1864. Mining began in 1868, but it was not until 1895 that work on a large scale was undertaken, and it has been frequently interrupted since that date. The chief mine is the Monarch, situated by the railway. A concession to work the gold-mines, and for other purposes, was obtained in 1887 by Mr S. H. Edwards from Lobengula, the Matabele chief, and the mining rights are vested in a company, thereafter formed, called the Tati Concessions Company. (See BechuanaLand and Rhodesia.)

TATIAN (2nd cent. A.D.), Christian apologist, missionary and heretic. Such knowledge as we have of his life is derived from (1) his *Sorites Ad Graecos* (mentioned in *Or. 42*); (2) Ireneaus, *Ad. Haereses*, i. 28, 1; (3) Rhodon, quoted in Eusebius's *His. Eccl.* v. 13, 1; (4) Clement of Alexandria, *Strom.* i. 11, 17; (5) Eusebius, *Chronicon anno* a.D. 171; (6) Epiphanius, *Panarion*, i. 3, 46.

Convenient collections of these passages may be found in E. Schwartz's *Tatiani Oratio ad Graecos, Texte und Untersuchungen*, iv. 1, pp. 51-55; and in A. Harnack's *Geschichte der altchristlichen Littératur*, i. pp. 485-96. From these data the following outline of his life can be reconstructed. He was a Syrian1 (Clem. Alex. and Epiphanius) born in Mesopotamia (Or. 41) and educated in Greek, in which he became proficient (Or. i. 42). He was initiated into the Mysteries, though into which is not stated (Or. 28), but after this became acquainted with the Old Testament, and was converted to Christianity. He then went to Rome, where he was a hearer of Justin, and together with the latter incurred the enmity of a certain philosopher Crescens. As this fact is mentioned both in Justin's *Apology* and in Tatian's *Oratio ad Graecos*, and the *Apology* can be dated with fair security about A.D. 152 (see Justin Martyr), the conversion of Tatian must have been before the death of Justin, which occurred about 163 or 165, according to Eusebius's *Chronicon* in 173. Among his pupils were Rhodon, and perhaps Apelles (see Victorinus Reat. schol. 44, in *Ep. Hieronymi ad Asteriun*, ep. 124) and Clement of Alexandria (*Strom.* i. 1, 11). He made a missionary journey to the East and worked in Cilicia and Pisidia, using the Syrian Antioch as the centre of his efforts (Epiphanius).

According to Epiphanius, Tatian went to the East after the death of Justin (c. 163), and then became heretical, and Eusebius states that he was recognized as heretical in 173. Zahn (*Forschungen zur Geschichte des Kanons*, i.) and most writers accept this as in the main correct; it is generally thought that his heresy was recognized in Rome, and it is suggested that this was the reason why he returned to the East. The statement in Epiphanius is capable of being interpreted in this sense, and whereas Tatian was always regarded as heretical in the East, he seems to have been respected in the East.

This fact, however, does more than support the suggestion that Tatian's heresy was recognized before he left Rome: it throws some doubt on the theory that after being turned out of the Church in Rome he worked as a missionary in the East without being suspected. Harnack (Texte und Untersuchungen, i. 1, pp. 196 ff.) once suggested that the missionary work in the East belongs to an earlier period, and that Tatian left Rome and returned to it between his first arrival and the death of Justin Martyr. But in his *Chronologie*, i. pp. 284 ff., he has withdrawn this, and it is probably too hypothetical; it is, however, the only serious effort to deal with the difficulty, which if not insoluble is at least unsolved.

The Heresy of Tatian.—As in the case of most heresies, we have only the partisan statements of opponents. Everything is therefore open to some doubt, but the following points seem fairly certain. The heresy which Tatian either founded or adopted was that of the Encratites. Their main doctrines were the evil nature of matter, an absolute forbidding of marriage, abstinence from wine and perhaps from meat. It would also seem that Tatian believed in the existence of aeons, and the doctrine is in fact based on the Books of Peter and excerpts from them. This doctrine is referred to by Hippolytus in *Refugium S. Spiritus* (C. Alex., *Strom.*, iii. 10, 80): (5) *πῶς ἀγαθοῦ* τῶν ἑλληνίδων τῷ ἀρχαίῳ (mentioned in Or. 40 as a book which Tatian intended to write, but there is no evidence that he carried his plan into effect; (6) *Πρὸς τῷ καθί τοῦ Σωτῆρα καταρρημένον* (Clem. Alex., *Strom.*, iii. 10, 80): (7) *The Dilestassor*; (8) a recession of the Pauline epistles (Eus. *Hist. Eccl.*, iv. 29) says that he was accused of producing a *μεταφράσεως* of the epistles so as to smooth the grammar, and in Justin's presence to St Paul's Epistle to Titus 3:5 is stated that he rejected some of the epistles, but not that to Titus. Of these books only two—the Dilestassor and the πρὸς τοὺς Ἑλληνίδων—are extant.

The Λόγος πρὸς τοὺς Ἑλληνίδων (Oratio ad Graecos) belongs to Tatian's Catholic period. He has the double purpose in view of exposing the weakness of the pagan view of the universe and of refuting the Christian position. It is to this that he seems to have made use of an already existent book, perhaps the Γονήν Θεοῦ of Onoeamus of Gadara, a Syrian who wrote in the time of Hadrian. This same source seems to have been used by Hippolytus Felix and Tertullian, and Eusebius in his *Præp. Evan.*, v. 19, quotes some other fragments of the work of Onoeamus.

The main argument employed is an exposition of the contradictions between the mysteries and immorality of Greek mythology. A special attack is made on the doctrine of Fate or Necessity. Tatian insists that man is a free agent: that his sins and the consequent evils in the world are the result of free choice, and that the same free agents are now responsible for the same consequences. His positive explanation of the universe is rather difficult to follow. He lays great stress on the Logos doctrine; all good is to be found in union with the Logos; all evil is in matter or in separation from the Logos. The material origin of evil in the world seems to be the choice of the latter rather than of the former; and redemption consists in the reverse process. But the choice of evil was not made only by man but by angels, who by their evil choice became the demons, that is, the gods of the heathen world. Both men and angels will be judged at the end of the world, when the good will receive again the immortality which was lost through their wickedness, and the wicked will receive the further loss of immortality (πάναν διὰ γυμνασμοῦ εἰς δαίμονες). Tatian does not deny the stories of the Greek mythology—indeed he protests against attempts to allegorize it—but he insists that these stories are the mistakes of the early interpreters of the Logos doctrine. The truth of his views he rests, rather strangely, on the argument that Moses, the writer of the Pentateuch, lived long before Homer, whom he regards as the earliest Greek religious writer, and to prove this he quotes a series of synchronisms, which were made use of by
The Tatra Mountains, or the High Tatra, the highest group in the central Carpathians, and the central group of the whole Carpathian system. They extend between the rivers Waag, Arva, Dunajec and Poprad, and form a sharply defined and isolated group, rising abruptly like a gigantic wall to an altitude of over 800 ft. in the midst of a high plateau situated 2600 ft. above sea-level. The Tatra Mountains extend through the Hungarian counties of Liptó and Szépes, and with them also the outcrops of the Tatra Mountains of Galicia, and have a length of 40 m. and a width varying between 9 and 5 m. The mean altitude is between 6000 and 7500 ft. The principal peaks are:—the Franz-Josef or Gerlsford (Hung. Gerlachfalvi-CsúcS, 8337 ft.), the highest in the Carpathian system; the Lomnitz (Lomnitz-CsúcS, 8642 ft.); the Eisthal (Jégvolgyi-CsúcS, 8630 ft.); the Tatraspitz or Hohe Visoka (8415 ft.); the Kesmark (8266 ft.); the Meeragenspitze (Tengerszem-CsucS, 8210 ft.); the Schlagenthof (Szláld-CsúcS, 8309 ft.); and the Kriváh (8190 ft.). The principal valleys, which lie at an altitude of 2600 to 3250 ft. above sea-level, and present some of the wildest scenery are: the Kohlbach Valley, the Felka Valley, the Valley of Mengsdorf, the Javorina Valley, the Kotlina Valley, in which is the stalactite cavern of Béla, and the Bielka Valley. One of the characteristics of the Tatra are the numerous mountain lakes (112 in number), called by the people "eyes of the sea." The largest of them are the Lake of Csorba, in the southern part of the group, which has an area of 50 acres; the Grosser Fischsee in the Bielka Valley; and the Wielki Staw, with an area of 85 acres, the largest of the Five Polish Lakes, which lie in the Roztoka Valley. These are many summer resorts in the Tatra Mountains, the most frequented being Tatrafüred (German, Schmack), three small villages situated at an altitude of 3250 ft., at the foot of the Schlagenthof peak; and the environs of the Lake of Csorba, which is called the "Pearl of the Tatra."

TATTA, or THATO, an ancient town of British India, in the Sind province of Bombay, 7 m. from the right bank of the main channel of the Indus and 13 m. from a station on the North-Western railway: pop. (1901) 10,783. Tatta was the capital of the Samma dynasty in Lower Sind in the 16th century, and long continued to be the centre of trade in the country, to which it sometimes gave its name in early European travels. An English factory was established here in 1758, but withdrawn after a few years. There are two old mosques, decorated with the coloured tiles characteristic of Sind.

TATTERSALL'S, the London horse auction mart, founded in 1766 by Richard Tattersall (1724-1795), who had been stud groom to the second duke of Kingston. The first premises occupied were near Hyde Park Corner, in what was then the outskirts of London. Two "Subscription rooms" were reserved for members of the Jockey Club, and they became the rendezvous for sporting and betting men, and those of the fanciers. Dispersal sales conducted by "Old Tatt" were those of the duke of Kingston's stud in 1774 and of the stud of the Prince of Wales (afterwards George IV.) in 1786. The prince often visited Richard Tattersall, and was joint proprietor with him of the Morning Post for several years. He was succeeded by his son, Edmund Tattersall (1758-1810), who extended the business of the firm to France. The third of the dynasty, Richard Tattersall (1785-1859), the eldest of Edmund's three sons, became head of the firm at his father's death. He had his grandfather's ability and tact, and was the intimate of the best sporting men of his time. Another Richard Tattersall (1812-1870), son of the last, then took command of the business. His great-grandfather's 99-year lease having expired, he moved the business to Knightsbridge. Richard was followed by his cousin, Edmund Tattersall (1816-1898), and he by his eldest son, Edmund Somerville Tattersall (b. 1863).

A son of the second Richard Tattersall, George Tattersall (1817-1849), was a well-known sporting artist. In 1836 he compiled a guide to The Lakes of England, illustrated with forty-three beautiful line drawings, and he showed skill as an architect by building the Tattersall stud stables at Willesden. His experience in this and similar undertakings led him to publish Sporting Architecture (1841). In the same year, under the pseudonym "Wildrake," he published Cracks of the Day, describing and illustrating sixty-five race-horses. He also contributed illustrations to the Hunting Reminiscences of Nimrod (Charles J. Apperley), the Book of Sports (1843), and the New Sporting Almanack.

TATTINALL, JOSIAH (1795-1871), American naval officer, was born at Savannah, and was educated in England. He entered the United States navy in 1812, and was actively employed till the beginning of the Civil War. He may be said to have gained a world-wide reputation by his use of the phrase "blood is thicker than water " to justify his intervention on behalf of the British squadron engaged in the operations against the Peiho Forts. Tattinall's flagship the Teyovva had grounded shortly before, and had been helped off by the British squadron. He was in the Peiho river when the unsuccessful attack of the 25th of June 1859 was made. Tattinall not only brought the Teyovva under fire, but lent the aid of his boats to land detachments to turn the Chinese defences. When the Civil War began he took the side of the Confederacy. He was put in command of its naval forces when Franklin Buchanan resigned after he was wounded in the action with the Federal squadron in Hampton Roads. The Confederate States were never able to form a sea-going squadron, and Tattinall had no chance to do more than make a struggle with insufficient resources on its rivers. He died on the 14th of June 1871.

TATTOO, a signal given by beat of drum and call of bugle at nightfall for soldiers to go to quarters when in garrison or to tents when in the field. The earlier word is taptoe or tapfeo, and was borrowed from Du. tapteo; the phrase de tapote sloan, to close the taps, and the parallel Ger. Zapfenstreich, literally "tap-stroke" (ZaOp, a tap of a cask), shows that it meant originally a signal that the "taps" or public-houses were closed for the night.

TATTOOING (Tahitian, latu, from ta, mark), the practice of decorating the skin, by cutting or puncturing, with various patterns into which a colouring matter is introduced. Though the word is Polynesian, the custom appears to have been almost universal, but tends to disappear before the spread of civilization. The prohibition to the Jews (Lev. xix. 28) under the Mosaic Law to "print any marks" upon themselves is believed to have reference to tattooing, which is still common in Arabia. The North and South American Indians, the Chinese, Japanese, Burmese, all tattoo. The origin of the custom is disputed. It was probably at first for purely ornamental purposes and with the idea of attracting the opposite sex. The discovery in the caves of Western Europe of hollowed stones which had been apparently used for grinding up ochre and other coloured clays is thought evidence that prehistoric man painted himself, and tattooing for decorative reasons may easily date back to the cave-dwellers. The modern savage paints himself as a protection against cold, against the bites of insects or the sun's rays, and most of all to give himself a ferocious appearance in battle, as Caesar relates of the ancient Britons. Any of these motives may have shared in originating tattooing. Subsequently the practice assumed religious and social significance, varying with the country and according to the age at which it was.
performed. Thus in Polynesia it is begun in or about the twelfth year, and becomes thus a mark of puberty; while among the Arabs and the Kabyles of Algeria infants are tattooed by their mothers for simple ornament or as a means of recognising them. The American Indians bore from their initiation to puberty the mark of the personal or tribal totem, which at once represented the religious side of their life, and served the practical purpose of enabling them to be known by friendly tribes. Among the Australians tattooing served as a mark of adoption into the family or tribe, the distinctive emblem or kobong being scarred on the thighs.

Tattooing is regarded, too, as a mark of courage. A Kaffir who has been a successful warrior has the privilege of making a long incision in his thigh, which is rubbed with clinders until sufficiently discoloured. Elsewhere tattooing is a sign of mourning, deep and numerous cuts being made on face, breast and limbs. Among the Fijians and Eskimos the untattooed were regarded as risking their happiness in the future world. Some of the most remarkable examples of tattooing are those to be found among the Laos, whose stomachs, thighs, legs and breasts are often completely covered with fantastic animal figures like those on Buddhist monuments.

The rudest form of tattooing is that practised especially by the Australians and some tribes of negroes. It consists in cutting gashes, arranged in patterns, on the skin and filling the wounds with clay so as to form raised scars. This tattooing by scarring as compared with the more common mode of prick- ing is, as a general rule, confined to the blacks. The tattooed races have no special idea of the use of tattooed parts of the body, whether arms, face or limbs. It is simply a mark of distinction marking the different classes of the society.

In Polynesia the art of tattooing reached its highest perfection. In the Marquesas group of islands, for example, the men were tattooed all over, even to the fingers and toes and crown of the head, and as each operation took from three to six months, beginning at virility, a man must have been nearly thirty before his body was completely covered. In New Zealand the face was the part most tattooed, and Maori heads so decorated were at one time in much request for European museums, but they are now no longer obtainable in the colony. In Japan, where it became a high art, tattooing was never used to any extent. In Polynesia the art of tattooing is still carried on, but it is used for ornamental purposes only, and is done by women.

Under the influence of civilization tattooing is losing its ethnological interest and has become an element of eccentrcity, with the result that it is not confined to the lower and often criminal classes of the great cities. Among the eight hundred convict French soldiers Lacassagne found 40 per cent. tattooed. In the British army till 1879 the letters D. and B. C. for Deserted and Bad Character were tattooed with needles and Indian ink; and tattooing has often been used to identify criminals and slaves.

See Lacassagne, Les Tatouages (Paris, 1881); General Rolyer, Moko ou Maori Tattooing (1896).

TAUCHNITZ, the name of a family of German printers and publishers. Karl Christoph Traugott Tauchnitz (1761-1836), born at Grossbardau near Gramma, Saxony, established a printing business in Leipzig in 1796 and a publishing house in 1798. He specialized on the publication of dictionaries, Bibles and stereotyped editions of the Greek and Roman classics. The business was carried on by his son, Karl Christian Philipp Tauchnitz (1798-1884), until 1865, when the business was sold out to O. Holtze. He left large sums to the city of Leipzig for philanthropic purposes. Christian Bernhard, Freiherr von Tauchnitz (1815-1895), the founder of the existing firm of Bernhard Tauchnitz, was the nephew of the first-mentioned. His printing house was established at Leipzig. In 1832 he published an edition of the works of British and American Authors, so familiar to travellers on the continent of Europe, was begun in 1841. In 1890 the collection numbered over 4000 volumes. In 1868 he began the Collection of German Authors, followed in 1886 by the Students' Tauchnitz editions. In 1860 he was ennobled with the title of Freiherr (Baron), and in 1877 was made a life member of the Saxon Upper Chamber. From 1866 to 1895 he was British Consul-General for the kingdom and duchies of Saxony. He was succeeded in the business by his son, Christian Karl Bernhard, Freiherr von Tauchnitz.

TAULANTIL, in ancient geography, an Illyrian people in the neighbourhood of Epidamnus (Thuc. i. 24). They were originally powerful and independent, under their own kings. One of these was Glaucias, who fought against Alexander the Great, and placed Pyrrhus, the infant king of Epirus, whom he had refused to surrender to Cassander, upon the throne (Plutarch, Pyrrhus, 3). Later the Taulantii fell under the sway of the kings of Illyria, and when the Romans were carrying on war against the Illyrian queen, Teuta, they were unimportant.

Tauler, Johann (1300-1358), was born about the year 1300 in Strassburg, and was educated at the Dominican convent in that city, where Meister Eckhart, who greatly influenced him, was professor of theology (1312-1320) in the monastery school. From Strassburg he went to the Dominican college of Cologne, and perhaps to St James's College, Paris, ultimately returning to Strassburg. In 1324 Strassburg with other cities was placed under a papal interdict. Legend says that Tauler nevertheless continued to perform religious services for the people, but though there may be a germ of historical truth in this story, it is probably due to the desire of the 16th-century Reformers to enrol the famous preachers of the middle ages among their forerunners. In 1338-1339 Tauler was in Basel, then the headquarters of the "Friends of God" (see MYSTICISM), and was brought into intimate relations with the members of that pious mystical fellowship. Strassburg, however, remained his headquarters. The Black Death came to that city in 1348, and it is said that, when the city was deserted by all who could leave it, Tauler remained at his post, encouraging by sermons and personal visitations his terror-stricken fellow-citizens. He continued with the same success to publish works, especially with Margaretha Ebner, and the fame of his preaching and other work in Strassburg, had made him known throughout a wide circle. He died on the 16th of June 1361.

The well-known story of Tauler's conversion and discipline by "the Friend of God from the Oberland" (see NICHAULS OF BASEL) cannot be regarded as historical. Tauler's sermons are among the noblest in the German language. They are not so emotional as Suso's, nor so speculative as Eckhart's, but they are intensely practical, and touch on all sides the deeper problems of the middle ages.

Tauler's sermons were printed first at Leipzig in 1348, and reprinted with additions from Eckhart and others at Basel (1522) and at Cologne (1543). There is a modern edition by Julius Hammerber (Frankfort, 1864), and R. H. Hutton published Tauler's Sermons for Festivals under the title of The Inner Way, Sein Denk, Das Buch von gesieltlicher Armuth (Strassburg, 1877); Carl Schmidt, Johann Tauler von Strassburg (Hamburg, 1841); S. Wink- vonka, Tauler's Lyric Poems (1885); A. Vonk, Hours with the Mystics, 3rd ed., vol. i. pp. 214-307; Preger's Gesch. der deutschen Mystik im Mittelalter, vol. iii.; W. R. Inge, Christian Mysticism; R. M. Jones, Studies in Mystical Religion (1909).

TAUNG-GYI, the headquarters of the superintendent and political officer, situated in S. Rangoon State. It is situated in 96° 58' E. and 20° 47' N., at an altitude of about 5000 ft., in a depressed plateau on the crest of the Sintaun hills. It is in
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the state of Yangwhee, 105 m. from Thazi railway station on the Rangoon-Mandalay railway, with which it is connected by a road of Early English work in the north, and there were only a few Taungthu huts on the site. There were in 1906 upwards of a thousand houses, many of them substantially built of brick. Since 1906 the southern Shan States have been garrisoned by military police, whose headquarters are in Taunggyi. The station is to a considerable extent a commercial depot for the country behind, and there are many universal supply shops of most nationalities (except British)—Austrian, Chinese and Indian. The five-day bazaar is the trading place of the natives of the country. A special quarter contains the temporary residences of the chief's people, and the goods, and the bazaar is for their sale, but the foreign商业 culture has met with considerable success.

The average shade maximum temperature is 84°; the minimum 30°.

TAUNTON, HENRY LABOUCHERE, BARON (1798-1869), English politician, came of a French Huguenot family, which, on leaving France, settled in Holland. His father, Peter Caesar Labouclère, merchant, was a partner in the wealthy Amsterdam banking firm of Hope & Company; 1 he went to live in England, and married a daughter of Sir Francis Baring. Henry was his elder son, while a younger son, John, was the father of the Duke of Sutherland, Lord Chief Justice of Scotland, and proprietor of Truth, Henry Labouclère (b. 1831). He was educated at Winchester and Christ Church, Oxford, and entered the House of Commons as a Whig in 1826. From 1830 to 1838 he sat for Taunton, Somerset. After filling various minor offices, he became president of the Board of Trade in 1839-41; and in 1846 he was chief secretary for Ireland. In 1847-52 he was again president of the Board of Trade, and from 1855 to 1858 secretary of state for the colonies. In 1859 he was created Baron Taunton, but on his death, on the 13th of July 1869, the title became extinct.

TAUNTON, a municipal and parliamentary borough and market town of Somersetshire, England, on the river Tone, 163 m. W. by S. of London by the Great Western railway. Pop. (1901) 21,087. Standing in the beautiful valley of Taunton Dene, the town is chiefly built on the south side of the river. Its three main streets, broad and regular, converge upon a triangular space called the Parade, where there is a market cross. The parish church of St. Mary Magdalen is one of the finest and largest Perpendicular churches in England. Remnants of Norman work are preserved in the chancel arch, and the east window of the church, dating from the time of the Britanniawere in a window in the north aisle and transept. The tower, noteworthy for its union of elaborate ornament and lightness of effect, exceeds 150 ft. in height. There are double aisles on each side of the nave, and the whole interior is admirable in its harmony of design and colour. Little is left of an Austin priory established in the reign of Henry I. by William Giffard, bishop of Winchester, who also built the castle, now a museum for prehistoric, Roman and medieval antiquities. Taunton castle, though largely rebuilt in 1496, embodies the remains of a very early fortress, while its walls and a deep ditch date from the 12th century, its towers and gatehouses from the 13th or 14th. At the Restoration it was dismantled and its moat filled in. Among the schools is a grammar school founded in 1522 by Richard Fox, bishop of Winchester. There are also public gardens, assembly rooms, almshouses, a town hall, market hall, a hospital founded in 1819 to commemorate the jubilee of George III., and a shire hall containing a series of marble busts representing, among other Somerset worthies, Admiral Blake, John Locke the philosopher, the Puritan leader Pym, Bishop Ken, and Speke the African explorer. The local industries are silk, linen and glove manufactures, iron and brass founding, Coaching, cabinetmaking, malting and brewing; while Taunton Dene is famous as a rich agricultural district.

1 The Amsterdam Hopes were descended from Henry Hope, son of a Scottish merchant, and younger brother of Sir Thomas Hope (d. 1646), the famous Scottish lord-advocate, ancestor of the earls of Hopetoun (marquis of Linlithgow, etc.). Among his descendants was Thomas Hope (1770-1834), father of J. B. B. Beresford-Hope (1820-1887), politician and author. The parliamentary borough of Taunton returns one member. The town is governed by a mayor, six aldermen and eighteen councillors. Area, 3,933 acres.

There was perhaps the Romano-British village near the suburb of Holway, and Taunton (Tantun, Tontone, Tauntone) was a place of considerable importance in Saxon times. King Ine threw up an earthen castle here about 700, and a monastery was founded before 904. The bishops of Winchester owned the manor, and obtained the first charter for their "men of Taunton" from King Edward in 904, freeing them from all royal and county tribute. At some time before the Domesday Survey Taunton had become a borough with very considerable privileges, governed by a portreeve appointed by the bishops. It did not obtain a charter, however, until that of 1677, which was renewed in 1677. The corporation existed until 1792, when the charter lapsed owing to vacancies in the number of the corporate body, and Taunton was not reincorporated until 1877. Parliamentary representation began in 1299, and two members were returned until 1885. A fair on the 7th of July was held under a charter of 1256, and there are now two fairs yearly, on the 17th of June and the 7th of July. The Saturday market, for the sale of corn, cattle and provisions, dates from before the Conquest. There is also a smaller market on Wednesday. The market, which was celebrated for the sale of woollen cloth called "Tauntons" made in the town. On the decline of the west of England woollen industry, silk-weaving was introduced at the end of the 18th century.

See Victoria County History, Somerset; Toynbee's History of Taunton, edited by James Savage (1830).

TAUNTON, a city and one of the county-seats of Bristol county, Massachusetts, U.S.A., at the head of ocean navigation on the Taunton river, 17 m. above its mouth, about 35 m. S. of Boston, and about 14 m. N. of Fall River. Pop. (1890) 25,448; (1900) 31,156, of whom 940 were foreign-born, 1844 being Irish, 2,966 French-Canadians, 1,144 English, and 804 English Canadians; (1910, U.S. census) 34,759. Taunton is served by the New York, New Haven & Hartford railroad (Old Colony Branch) and by interurban electric railways connecting with Fall River, New Bedford, Providence and Boston. The channel of the Taunton river has been deepened and widened by the Federal government, and in 1910 vessels of 11 ft. draft could reach the city at high water (mean range of tide at Taunton, 3-4 ft.). Within the corporate limits of the city, which has a land area of 44-25 sq. m., there are six villages—Dobewell, Britanniawall, Oakland, Whitinton, East Taunton, and the Weir. Taunton Green, a rectangular stretch of land fringed with lofty elms, the "common" of the New England town, about which is the business portion of the modern city, is 1 m. from the Weir, the port of the city.

The city contains interesting specimens of colonial or early 19th-century architecture. Among the modern public buildings are the handsome granite County Court House (1895), facing the Green, the Public Library building (given by Andrew Carnegie), the registry building, the county gaol, the city hall, the post office, an old ladies' home, an emergency hospital, the Morton Hospital, occupied from 1869 to 1885 by the residence of Governor Marcus Morton, and the Y.M.C.A. building. The Bristol County Law Library and Old Colony Historical Society (incorporated in 1853 and organized in 1854) possess valuable collections of books, and the latter has a collection of portraits and antiquities. Bristol Academy (1792; non-sectarian) is a well-known preparatory school, and there is also a commercial school—the Bristol County Business College. At Norton (pop. in 1910, 2544), directly N. of Taunton, and formerly within its boundaries, is Wheaton Seminary (1834) for girls. Among social clubs are the Winthrop Club, the Bristol Club, the Taunton Boat Club, the Yacht Club, and the Country Club. A good water-supply, owned by the city, is obtained from neighbouring lakes and ponds, along the shores of which are many summer cottages. Taunton was one of the first cities in the United States to own and operate its own electric lighting plant, which it acquired from a private corporation in 1897. Its industrial importance
began with the establishment of ironworks in 1569; the plant then opened continued in active operation for about 225 years. Brick-making and shipbuilding were two of the early industries; the latter, formerly very important, has now been abandoned. The manufactures to-day are extensive and varied. The aggregate value of the factory product in 1905 was $13,644,586, an increase of 18.2 per cent. over that of 1900. Of this amount the value of the cotton manufactured was $6,141,596, or 45 per cent. of the whole. Herring fisheries give occupation during a part of the year to a considerable number of workmen. Taunton has a prosperous fishing trade, and, large shipping interests, the coast trade being particularly important.

Taunton was founded in 1638, when the territory was purchased from Massasoit by settlers from the Massachusetts Bay Colony, and became the frontier town of Plymouth Colony. Myles Standish was engaged on the original survey. But there had been earlier settlers in the region—at "Tecticurt" (Titicut), which later became part of Taunton. The settlement at Taunton was at first known as Cohannet, but the present name—from Taunton, Somerset, England, the home of many of the settlers in the early days—was probably adopted in 1651. In 1671 it was the scene of a meeting between Gov. Thomas Prince and King Philip, at which a treaty was drawn up. During King Philip's War, Taunton was a base of operations for Plymouth Colony troops under Gov. Josiah Winslow. In 1686 Taunton was one of the towns which refused to comply with Sir Edmund Andros's demands for a tax levy. For some years Thomas Coram, the philanthropist and founder of the London Foundling Hospital, was engaged in the shipbuilding industry here. In 1774, after the passage of the Boston Port Bill, the people of Taunton showed their sympathy for Boston by raising on the Green a red flag on which were inscribed the words "Liberty and Union." The leader of the patriotic party at this time was Robert Tread Paine, to whose memory a bronze statue has been erected. During Shays's rebellion the Taunton court-house was twice besieged by insurgents, who were each time dispersed through the resolute action and firmness of Gen. David Cobb, one of the judges. The event is commemorated by a tablet on Taunton Green. In Berkeley, which until 1735 was a part of Dighton (Taunton South Purchase, separated from Taunton in 1712), is the famous Dighton Rock, with inscriptions long erroneously supposed to have been made by Norse discoverers of America, but now known to be the work of Indians. Taunton was chartered as a city in 1864. In 1909 a new city charter was adopted, under which, the mayor and nine councilmen (elected at large) are the only city officers elected at any city election; candidates for these offices are nominated by petition; the mayor appoints, subject to the approval of the council, a chief of police and a city solicitor. See S. H. Emery, History of Taunton from its Settlement to the Present Time (Syracuse, N.Y., 1893); D. H. Hurd, History of Bristol County (Philadelphia, 1883); Quarter Millennium Celebration (Taunton, 1889).

TAUNUS, a wooded mountain range of Germany in the Prussian province of Hesse-Nassau and the grand-duchy of Hesse-Darmstadt. It lies between the Rhine and the Main on the S. and the Lahn on the N., and stretches some 55 m. E. and W. Its southern slopes stand 5 to 10 m. back from the Main, but leave only a very narrow strip of low ground alongside the Rhine, and from Bingen downwards they overhang it with precipitous cliffs, many of which are crowned with picturesque ruins. It has an average elevation of 1500 ft. The loftiest peaks occur in the cast, where the imposing cluster of Grosser Feldberg (2885 ft.), Kleiner Feldberg (2714 ft.) and Altkönig (2618 ft.) dominate the Wetterau and the valley of the Main. Above the Rheingau, or the slopes which stretch down to the Rhine between Biebrich and Bingen, the altitude averages 1300 to 1700 ft. The geological core of the system consists of primitive argillaceous schists, capped by quartzite and broken through in places by basalt. On the northern side, which sinks on the whole gently towards the Lahn, the greywacke formation attains a considerable development. The hills are almost everywhere well wooded, the predominant trees being firs and beeches. The lower slopes are, wherever possible, planted with vineyards, orchards and chestnut and almond groves. The vineyards of the Rheingau are specially famous, and yield brands of wine—e.g. Johannisberger, Steinberger, Rüdesheimer, Marcobrunner, Hochheimer, Raunchtaler, Assmannshäuser, and others—which enjoy the highest reputation amongst the vintages of Germany. The Taunus is also famous for the number and efficacy of its mineral springs, which annually attract thousands of invalids. The numerous districts of Homburg, Em's Schlangenbad, Schwallbach, Soden and Nauheim, while the waters of Selters and other springs are exported in large quantity. The sheltered position and warm climate have led also to the establishment of the health resorts of Falkenstein (1873) and Schmitthen, and of tourist centres at Königstein, Cronberg and Ober Urel.

Above Falkenstein stand the ruins of the ancestral castle of Kuno, the powerful archbishop of Trier; above Königstein are the ancient ramparts of the Inner Rhine fortified, of the outer Rhine or the old Limes of Roman times. All the way from above the Rhine to the Main, the road of Roman communication with the Rhine and the Moselle below the Rhine, the coast highway and the frontier-line, the road of the great Roman conquest. Here are the road of the siren Lurlei or Lorelei; the old castles of Stahleck and Pfalz, which belonged to the Counts Palatine of the Rhine; and the ruins of the Cistercian and Benedictine monasteries at Friedrichshof, at the foot of the Feldberg and Altkönig, immediately north of Kronberg, was built in 1897-99 by the widowized empress Frederick, and is the place where she died in 1901. The railway station, lying 20 m. short of the Feldberg in the direction of Coarshausen, lies at the foot of the range, that from Frankfort to Cassel the eastern side, while the line from Wiesbaden and Hochst to Limburg intersects it from south to north.

Johannes de Trèves, Recherches sur l'histoire du Taunus (published by Grossmann, Wiesbaden, 1887); Sievers, Zur Kenntnis des Taunus (Stuttgart, 1891), and the Taunus Club's Guide (4th ed. Frankfort-on-Main, 1905). For the Taunus see L. Jacobii, Das Römerbastei Saalburg (a vol., Homburg, 1897); also a small guide by the same author (3rd ed. Homburg, 1907).

TAUPO, a township of East Taupo county, New Zealand, in the south-west of the Hot Spring district of North Island. It attracts many visitors as a health resort and on account of the magnificent scenery and remarkable volcanic phenomena of the surrounding district. It lies on the north-east shore of Lake Taupo, the largest lake in the island, having an extreme length of 26 m. and a shore-line, not counting minor indentations, about 150 m., and lying 1200 ft. above sea-level. The river Waikato, which reaches the west coast not far from Manukau Harbour near Auckland, here leaves the lake. The district abounds in geysers, springs, mud volcanoes and other phenomena; some of the waters have petrifying powers, and some of the springs are vividly coloured. On the road running N.E. to Rotorua (56 m.) are the resorts of Weirakiri (7 m.) and Ateamuri (31 m.). Lake Taupo is finely situated, hills rising over 2000 ft. immediately from the shores, while the mountains of Tongariro, Ngauruhoe, an active volcano, and Ruapehu, a snow-clad peak, back the view to the south and mark the limit of the great volcanic line which extends 100 m. north-westward.
to White Island in the Bay of Plenty. The upper Waikato enters the lake from the south near Tokaanu, where there is another collection of springs, &c. The river forms several fine falls and rapids below the lake.

TAURELLUS, NICOLAIUS (1547–1609), German philosopher and theologian, was born at Mompelgard. He read theology at Tübingen and medicine at Basel, where he lectured on physical science. He subsequently became professor of medicine at Aitdorf, to which centre he was drawn by the career of Peter. He attacked the dominant Aristotelianism of the time, and endeavoured to construct a philosophy which should harmonize faith and knowledge, and bridge over the chasm made by the first Renaissance writers who followed Pomponazzi. Scholasticism he condemned on account of its unquestioning submission to Aristotle. Taurellus maintained the necessity of going back to Christianity itself, as at once the superstructure and the justification of philosophy.

His chief works were Philosophiae Triumphius (1573); Synopsis Metaphysicæ Aristotelis (1596); De Rerum Aeternitate (1604); and a treatise written in criticism of Caesalpinus entitled Caeasaræ Alpes (1597). See Schmid-Schwarzenburg, Nicolaius Taurellus (1860 and 1864).

TAURI, the earliest known inhabitants of the mountainous south coast of the Crimea (Herodotus iv. 103). Nothing is certain as to their affinities. They probably represent an old population perhaps connected with some Caucasus stock; in spite of the resemblance of the name Taurisci they are not likely to be Celts. They were famous in the ancient world for their maiden goddess, identified by the Greeks with Artemis Tauropolos or Iphigienia, whom the goddess was said to have horded to her shrine at the moment when she was to have been sacrificed at Aulis. Orestes sought her sister, and almost fell a victim to the Tauric custom of sacrificing to the maiden shipwrecked strangers, a real custom which was the ground of the whole myth. His adventures were the subject of many by Euripides and Goethe. Towards the end of the 2nd century B.C. we find the Tauri dependent allies of the Scythian king Scillus, who from their harbour of Symbolon Portus or Paladium (Balaklava) harassed Chersonese (q.v.). Their later history is unknown.

TAURIDA, government of southern Russia, including the peninsula of Crimea and a tract of mainland situated between the lower Dnieper and the coasts of the Black Sea and the Sea of Azov. It is bounded by these two seas on the S., while it has on the N. the governments of Kherson and Ekaterinoslav. The area is 24,532 sq. m., of which 9704 sq. m. belong to the Crimea. The continental part consists of a gently undulating steppe (from sea-level up to 400 ft. in the north-east) of black earth, with only a few patches of saline clay on the shores of the Sivash or Potrid Sea, and sand along the lower Dnieper. The government is drained by the Dnieper, which flows along the frontier for 180 m., and by two minor streams, the Molochnaya and Berda. Many small lakes and ponds occur in the north, as well as on the Kinburn peninsula, at the mouth of the Dnieper, where salt is made. There are no forests. The climate is continental, and resembles that of central Crimea and Kherson. The population in 1866 was estimated at 1,634,700. The continental portion, although less mixed than that of the peninsula, consists of Great and Little Russians, who constitute 83 per cent. of the whole, Germans (54 per cent.), Bulgarians (2-8 per cent.), Jews (3-6 per cent.), and Armenians. The chief occupation of the people is agriculture, and every available patch of land has been brought under the plough. In 1900 no less than 43 per cent. of its area was under cereal crops alone. The principal crops are rye, wheat, oats, barley and potatoes. Tobacco is also grown, and over 32,000 acres are under vineyards, while gardens extend to some 15,500 acres in Crimea. Live-stock breeding is extensively engaged in. Salt is the only mineral raised, but the iron industry, and especially the manufacture of agricultural machinery (e.g. at Berdyansk), has greatly developed. The export trade is considerable, the chief ports being Sevastopol, Eupatoria, Theodosia, and Yalta on the Black Sea, and Azov and Berdyansk on the Sea of Azov. The fisheries along the coast are active. Manufactures are insignificant, but there is a brisk export trade in grain, salt, fish, wool and tallow. The government is divided into eight districts, the chief towns of which are Simferopol, capital of the government, Eupatoria and Theodosia, in Crimea, and Aleshki, Berdyansk, Melitopol, Perekop and Yalta on the continent.

TAURINI, an ancient Ligurian people, although the name may be of Celtic origin, who occupied the upper valley of the Padus (Po) in the centre of the modern Piedmont. In 218 B.C. they were attacked by Hannibal, with whose friends the Insurbes they had a long-standing feud, and their chief town (Taurasia) was captured after a three days' siege (Polybius iii. 60, 8). As a people they are rarely mentioned in history. It is not known when they definitely became subject to the Romans, nor when the colony of (Julia) Augusta Taurinorum (Torino, Turin) was founded in their territory (probably by Augustus after the battle of Actium). Both Livy (v. 34) and Strabo (iv. p. 209) speak of the Taurini as including one of the passes of the Alps, which points to a wider use of the name in earlier times.


TAUROBOLIUM, the sacrifice of a bull, usually in connection with the worship of the Great Mother of the Gods, though not limited to it. Of oriental origin, its first known performance in Italy occurred in a.d. 134, at Puteoli, in honour of Venus Cælestis. Prudentius describes it in Peristephanon (x, 1066 ff.): the priest of the Mother, clad in a toga worn cinctori Gabinio, with golden crown and fillets on his head, takes his place in a trench covered by a platform of planks pierced with fine holes, on which a bull, magnificent with flowers and gold, is slain. The blood rains through the platform on to the priest below, who receives it on his face, and even on his tongue and palate, and after the baptism presents himself before his fellow-worshippers purified and regenerated, and receives their salutations and reverence.

The taurobolium in the 2nd and 3rd centuries was usually performed as a measure for the welfare of the Emperor, Empire, or community, its date frequently being the 24th of March, the Dies Sanguinis of the festival of the Great Mother and Attis. In the late 3rd and the 4th centuries its usual motive was the purification or regeneration of an individual, who was spoken of as renatus in aeternum, born for eternity, in consequence of the ceremony (Corp. Insuc. Lat. vi. 510–512). When its efficacy was not eternal, its effect was considered to endure for twenty years. It was also performed as the fulfillment of a vow, or by command of the goddess herself, and the privilege was limited to no sex nor class. The place of its performance at Rome was near the site of St Peter’s, in the excavations of which several altars and inscriptions commemorating taurobolia were discovered.

The taurobolium was probably a sacred drama symbolizing the relations of the Mother and Attis (q.v.). The descent of the priest into the sacrificial foss symbolized the death of Attis, the withering of the vegetation of Mother Earth; his bath of blood and emergence the restoration of Attis, the rebirth of vegetation. The ceremony may be the spiritualized descent of the primitive oriental practice of drinking or being baptized in the blood of an animal, based upon a belief that the strength of brute creation could be acquired by contact with the sublunary being of the Deity. In spite of the phrase renatus in aeternum, there is no reason to suppose that the ceremony was in any way borrowed from Christianity.

See Esperandici, Inscripciones de Lectorum (1892), pp. 94 ff.; Zippel, Pestschrift zum Doctorjubilaeum, Ludwig Friedländer, 1895. See also Showerman, Mother of the Gods, the University of Wisconsin, No. 43, pp. 280–284 (Madison, 1901); Hopding, Attis, Seine Mythen und Sein Kult (Giessen, 1903), pp. 166 ff., 201; Curnow, Le Taurobole et le culte de Belenus, Revue d’histoire et de litérature religieuses, vii. No. 2, 1901. (G. SN.)
TAURUS—TAUVENIER

TAURUS ("the Bull"), in astronomy, the second sign of the zodiac (q.v.), denoted by the symbol Τ. It is also a constellation of very great antiquity, the Pleiades and Hyades, two star clusters, being possibly referred to in the Old Testament; Aldebaran, a star in this constellation, is mentioned by Hesiod and Homer. Ptolemy catalogued 44 stars, Tycho Brahe 43, Hevelius 51. The Greeks fabled this constellation to be the bull which bore Europa across the seas to Crete, and was afterwards raised to the heavens by Jupiter. A Tauri, or Aldebaran, is a brilliant star of a reddish colour and magnitude 1·2; this star is the principal object of the group named the Hyades, named after the seven daughters of Atlas and Aethra—Abaris, Coronis, Eudora, Pasithoe, Plexaris, Pytho and Tycho—fabled by the Greeks to have been transformed into stars by Jupiter for threatening the death of their brother Hyas. Another star group in this constellation is the Pleiades. The Algonquian name of this constellation is a "Oldgo" variable, varying in magnitude from 3·4 to 4·2. Nebula M.1 Tauri is a famous "crab" nebula, so named by Lord Rosse from its clawlike protuberances; it is the first of the series of nebula on the enumeration of Messier.

TAUSEN, HANS (1494—1561), the protagonist of the Danish Reformation, was born at Birkende in Funen in 1494. The quick-witted peasant lad ran away from the plough at an early age, finally settling down as a friar in the Johannite cloister of Antvorskov. In 1516 he was transferred to Viborg, which he left for Tauris in 1518. At Tauris he was teaching there for a time and also at Copenhagen, he was again sent abroad by his prior, visiting, among other places, the newly founded university of Leyden and making the acquaintance of the Dutch humanists. He was already a good linguist, understanding both Latin and Hebrew. Subsequently he translated the books of Moses from the original. In May 1523 Tausen went to Wittenberg, where he studied for a year and a half, when he was recalled to Antvorskov. In consequence of his professed attachment to the doctrines of Luther he was forced to leave his diaconate as a punishment; transferred, in the spring of 1525, to the Grey Friars' cloister at Viborg in Jutland, where he preached from his prison to the people assembled outside, till his prior, whom he won over to his views, permitted him to use the pulpit of the priory church. At Viborg the seed sown by Tausen fell upon good soil. Several young men in the town had studied at Wittenberg, and the burghers, in their Lutheran zeal, had already expelled their youthful bishop JörgenFriis. Tausen's preaching was so revolutionary that he no longer felt safe among the Franciscans, so he boldly transferred his monastic bond of place and under the protection of the burgomaster of Viborg. At first he preached in the parish church of St John, but this soon growing too small for him he addressed the people in the market-place from the church tower. When the Franciscans refused to allow him to preach in their large church, the mob broke in by force. A compromise was at last arranged, whereby the friars were to preach in the forenoon and Tausen in the afternoon. The bishop, very naturally averse to these high-handed proceedings, sent armed men to the church to arrest Tausen, but the burghers, who had brought their weapons with them, drove them "the bishop's swains away." In October 1526 King Frederick I., during his visit to Aalborg, took Hans Tausen under his protection, appointed him one of his chaplains, and charged him to continue for a time "to preach the holy Gospel" to the citizens of Viborg, who were to be responsible for his safety, thus identifying himself with the new doctrines in direct contravention of the plain letter of his coronath oath. Tausen found a diligent fellow-worker in Jörgen Viborg, better known as Sadolin, whose sister, Dorothea, he married, to the great scandal of the Catholics. He was indeed the first Danish priest who took unto himself a wife. He was also the first of the reformers who used Danish instead of Latin in the church services, the "Even song" he introduced at Viborg being of great beauty. Tausen was certainly the most practically gifted of all the new native teachers. But he was stronger as a preacher and an agitator than as a writer, the pamphlets which he now issued from the press of his colleague the ex-priest Hans Vingaard, who settled down at Viborg as a printer, being little more than adaptations of Luther's opuscula. He continued to preach in the Grey Friars' church, while Sadolin, whom he had "consecrated" a priest, officiated at the church of the Dominicans, who had already fled from the town. The stouter-hearted Franciscans only yielded to violence persistently applied by the soldiers whom their opponents quartered upon them. In 1526 Tausen's "mission" at Viborg came to an end. King Frederick now recommended him to Copenhagen to preach heresy at the church of St Nicholas, but here he found an able and intrepid opponent in Bishop Rönne. Serious disturbances thereupon ensued; and the Protestants, getting the worst of the argument, silenced their gainsayers by insulting the bishops and priests in the streets and profaning and devastating the Catholic churches. A Herredag, or Assembly of Nobles, was held at Copenhagen on the 2nd of July 1530, ostensibly to mediate between the two conflicting confessions, but the king, from policy, and the nobility, from covetousness of the estates of the prelates, made no attempt to prevent the excesses of the Protestant rabble, openly encouraged by Tausen. On the other hand, the preachers failed to obtain the repeal of the Odense recess of 1527 which had subjected them to the spiritual jurisdiction of the prelates. On the death of King Frederick, Tausen, at the instance of Rönne, was in 1533, after a trial of blasphemy and condemned to expelusion from the diocese of Sjælland, whereupon the mob rose in arms against the bishop, who would have been murdered but for the courageous intervention of Tausen, who conducted him home in safety. The noble-minded Rönne thereupon, from gratitude, permitted Tausen to preach in all his churches on condition that he moderated his tone. On the final triumph of the Reformation Tausen was appointed bishop of Ribe (1542), an office he held with great zeal and fidelity for twenty years.

See: Strib, Tausens Læn (Ribe, 1876); Danmarks Riges Historie, vol. 3 (Copenhagen, 1882). (R. N. B.)

TAUSIG, FRANK WILLIAM (1859—1910), American economist, was born at St Louis, Missouri, on the 28th of December 1859. He was educated in his native city and at Harvard University, where he became professor of political economy in 1892. He has made a particular study of finance, and has written Tariff History of the United States (1888); The Silver Situation in the United States (1892); Wages and Capital (1896). He was for some time editor of the American Quarterly Journal of Economics.

TAUSOEUES, JEMIMA, BARONESS VON (1807—1893), British novelist, was born at Sea View, Co. Donegal, on the 23rd of October 1807, her maiden name being Montgomery. In 1838 she married the Baron von Tausopoulos of Marquartstein (1803—1883), chamberlain to the king of Bavaria, and in Bavaria she passed most of the rest of her life. She was the author of several novels, written in English, describing South German life, manners and history. The Initials (1850), Quix (1857), and At Odds (1863) are the best known of these. She died on the 12th of November 1893.

TAVASTEHS, a province of Finland, bounded by the provinces of Nyland, Viborg, Vasa and St Michel. Pop. (1904) 317,326. The province is largely unproductive, much of the surface being composed of hills and lakes, but in favourable districts agriculture is successfully pursued, and there is a school of agriculture and an institute of forestry.

TAVERN, the old name for an inn, a public house where liquor is sold and food is supplied to travellers. It is, however, now usually applied to a small ale-house where liquor only is supplied. The word comes through Fr. from Lat. taberna, a booth, shop, inn. It is usually connected with the root seen in "tabernum," board, whence Eng. "table," and thus meant originally a hut or both made of planks or boards of wood.

TAUVENIER, JEAN BAPTISTE (1606—1689), French traveller and pioneering of trade with India, was born in 1605 at Paris, where his father Gabriel and uncle Melchior, Protestants from Antwerp, pursued the profession of geographers and engravers. The conversations he heard in his father's
house inspired Tavernier with an early desire to travel, and in his sixteenth year he had already visited England, the Low Countries and Germany, and seen something of war with the imperialist Colonel Hans Brenner, whom he met at Nuremberg. Four and a half years in the household of Brenner's uncle, the viceroy of Hungary (1624-29), and a brief connexion in 1629 with the duke of Rethel and his father the duke of Nevers, prince of Mantua, gave him the habit of courts, which was invaluable to him in later years; and at the defence of Mantua in 1629, and in Germany in the following year with Colonel Walter Butler (afterwards noted in the death of Wallenstein), he gained some military experience. When he left Butler to view the diet of Ratisbon in 1630, he had seen Italy, Switzerland, Germany, Poland and Hungary, as well as France, England and the Low Countries, and spoke the principal languages of these countries. He was now eager to visit the East; and at Ratisbon he found the opportunity to join two French fathers, M. de Chapes and M. de St Liebou, who had received a mission to the Levant. In their company he reached Constantinople early in 1631, where he spent eleven months, and then proceeded by Tokat, Erzerum and Erivan to Persia. His farthest point in his first journey was Ispahan; he returned by Bagdad, Aleppo, Alexandria, Malta and Italy, and was again in Paris in 1633. Of the next five years of his life nothing is known with certainty, but it was probably during this period that he became controller of the household of the duke of Orleans. In September 1638 he began a second journey (1638-43) by Aleppo to Persia, and thence to India as far as Agra and Golconda. His visit to the court of the Great Mogul and to the diamond mines was connected with the plans realized more fully in his later voyages, in which Tavernier travelled as a merchant of the highest rank, trading in costly jewels and other precious wares, and finding his chief customers among the greatest princes of the East. The second journey was followed by four others. In his third (1643-49) he went as far as Java and returned by the Cape; but his relations with the Dutch proved not wholly satisfactory, and a long lawsuit on his return yielded but imperfect redress. In his last three journeys (1651-55, 1657-62, 1664-68) he did not proceed beyond India. The details of these voyages are often obscure; but they completed an extraordinary knowledge of the routes of overland Eastern trade, and brought the now famous merchant into close contact with the greatest Oriental potentates. They also secured for him a large fortune and great reputation at home. He was presented to Louis XIV., "in whose service he had travelled sixty thousand leagues by land," received letters of nobility (on the 16th of February 1669), and in the following year purchased the barony of Aubonne, near Geneva. In 1662 he had married Madeleine Goise, daughter of a Parisian jeweller.

Thus settled in ease and affluence, Tavernier occupied himself, as it would seem at the desire of the king, in publishing the account of his journeys. He had neither the equipment nor the tastes of a scientific traveller, but in all that referred to commerce his knowledge was vast and could not fail to be of much public service. He set to work therefore with the aid of Samuel Chappuiez, a French Protestant littérateur, and produced a Nouvelle Relation de l'Intérieur du Sträly du Grand Seigneur (4to, Paris, 1675), based on two visits to Constantinople in his first and sixth journeys. This was followed by Le Six Voyages de J. B. Tavernier (2 vols. 4to, Paris, 1676) and by a supplementary Recueil de Plusieurs Récitons (4to, Paris, 1679), in which he was assisted by a certain La Chapelle. This last contains an account of Japan, gathered from merchants and others, and one of Tongking, derived from the observations of his brother Daniel, who had shared his second voyage and settled at Batavia; it contained also a violent attack on the agents of the Dutch East India Company, at whose homes Tavernier had suffered more than one wrong. This attack was elaborately answered in Dutch by H. van Quellernburgh (Vindicia Batavis, Amst., 1684), but made more noise because Arnaud drew from it some material unfavourable to Protestantism for his Apologie pour les Catholiques (1681), and so brought on the traveller a ferocious onslaught in Jurieu's Esprit de M. Arnauld (1684). Tavernier made no reply to Jurieu; he was in fact engaged in weightier matters, for in 1684 he travelled to Berlin at the invitation of the Great Elector, who commissioned him to organize an Eastern trading company—a project never realized. The closing years of Tavernier's life are obscure; the time was not favourable for a Protestant, and it has even been supposed that he passed some time in the Bastille. What is certain is that he left Paris for Switzerland in 1687, that in 1689 he passed through Copenhagen on his way to Russia through Moscovy, and that in the same year he died at Moscow. It appears that he had still business relations in the East, and that the neglect of these by his nephew, to whom they were intrusted, had determined the indefatigable old man to a fresh journey.

Tavernier's travels, though often reprinted and translated, have two defects: the author uses other men's material without distinguishing it from his own observations; and the narrative is much confused by his plan of desiring the chronological order and giving instead notes from various journeys about certain routes. The latter defect, it is true, while it embarrasses the biographer, is hardly a blemish in view of the object of the writer, who sought mainly to furnish a guide to other merchants. A careful attempt to disentangle the thread of a life still in many parts obscure has been made by Charles Joret, Jean Baptiste Tavernier d'apres des Documents Inédits et des Observations, 4to, Paris, 1886, where the literature of the subject is fully given.

See also an English translation of Tavernier's account of his travels so far as relating to India, by V. Balf, 2 vols. (1889).

TAVIRA, a seaport of southern Portugal, in the district of Faro (formerly the province of Algarve); at the mouth of the river Seca, 21 m. E.N.E. of Faro. Pop. (1900) 12,175. The harbour is protected by two forts, and the public buildings contain a Moorish citadel, a ruinous monastery, and a nunnery founded by King Emanuel (1495-1521). Tavira has sardine and tunny fisheries, and carries on a considerable coasting trade. Excellent fruit is grown in the neighbourhood.

TAVISTOCK, a market town in the Tavistock parliamentary division of Devonshire, England, in the valley of the Tavy, on the western border of Dartmoor; 161 m. N. of Plymouth, on the Great Western and the London and South Western railways. Pop. of urban district (1901), 4728. There are some remains (including a portion in the square, now used as a public library) of the magnificent abbey of St Mary and St Robert, founded in 1060, destroyed by the Danes in 997 it was restored, and among its famous abbots were Lyving, friend of Canute, and Aldred, who crowned Harold II. and William, and died archbishop of York. The abbey church was rebuilt in 1285, and the greater part of the abbey in 1457-58. The church; of St Eustachius dates from 1318, and possesses a lofty tower supported on four open arches. Within are monuments to the Glanville and Bourchier families, besides some good stained glass, one window being the work of William Morris. Kelly College, near the town, was founded by Admiral Benedictus Marwood Kelly, and opened in 1877 for the education of his descendants, and the orphan sons of naval officers. Mines of copper, manganese, lead, silver and tin are in the neighbourhood, and the town possesses a considerable trade in cattle and corn, and industries in brewing and iron-founding. The mining industry generally has declined, but there is a trade in arsenic, extracted from the copper ore.

The early history of Tavistock (Tavi stove) centres round the abbey of St Rumon. Both town and abbey were sacked by the Danes in 997, but were shortly afterwards rebuilt, and the latter at the time of the Conquest ranked as the wealthiest house in Devon, including the hundred and manor of Tavistock among its possessions. Tavistock was governed from before the Conquest by a portreeve, who in the 14th century was assisted by a select council of burgesses, styled in 1660 "The Masters of the Toune and Parish of Tavistock." It returned two members to parliament as a borough from 1295 until deprived of one member by the act of 1857, and finally disfranchised
by that of 1885, but no charter of corporation was granted until 1683, when Charles II. instituted a governing body of a mayor, twelve aldermen and twelve assistants; with a recorder, deputy recorder, common clerk and two sergeants-at-mace. A market on Friday and a three days' fair at the feast of St Rumon were granted by Henry I. in 1102, the monks of Tavistock; and in 1552 two fairs on April 23 and November 28 were granted by Edward VI. to the earl of Bedford, then lord of the manor. In the 17th century great quantities of cloth were sold at the Friday market, and four fairs were held at the feasts of St Michael, the Epiphany, St Mark, and the Decollation of St John the Baptist. The charter of Charles II. instituted a Tuesday market and fairs on the Thursday after Whitsunday and at the feast of St Swithin. In 1822 the old fairs were abolished in favour of six fairs on the second Wednesdays in May, July, September, October, November and December. The Friday market is still held. Tavistock was one of the four stannary towns appointed by charter of Edward I., at which tin was stamped and weighed, and monthly courts were held for the regulation of mining affairs. It was also the site of one of the earliest printing-presses, and copies of the stannary laws and of a translation of Boethius issued from the Tavistock press in the reign of Henry VIII. are preserved in Exeter College library. The decay of the woollen industry at Tavistock was attributed by the inhabitants in 1641 to the dread of the Turks at sea and of popish plots at home. The tin-mining industry has much declined. The Royalist troops were quartered here in 1643 after the defeat of the Parliamentary forces at Bradock Down.

See Victoria County History, Devonshire; A. J. Kempe, Notices of Tavistock and its Abbey (London, 1830); R. N. Worth, Calendar of Tavistock Parish Records (Plymouth, 1887).

TAVOY, a town and district in the Tenasserim division of Lower Burma. The town is on the left bank of the river of the same name, 30 m. from the sea. Pop. (1901) 22,371. It carries on a considerable coastwise trade with other ports of Burma, and with the Straits Settlements. The chief industry is silk-weaving, but there are also rice and timber mills. The district has an area of 5308 sq. m. It lies between Siam and the Bay of Bengal, enclosed by mountains on three sides, viz., the main chain of the Bilkutang on the east, rising in places to 5000 feet, which, with its densely wooded spurs, forms an almost impassable barrier between British and Siamese territory; the Nwahlabo in the centre, which takes its name from its loftiest peak (5000 ft.); and a third range, under the name of Thinmaw, between the Nwahlabo and the sea-coast. The chief rivers are the Tenasserim and Tavoy, which is formed by the junction of two streams which unite near Met-ta; for the greater part of its course it is dangerous to navigation. The Tavoy is navigable for vessels of any burden. It is interspersed with many islands, and with its numerous smaller tributaries affords easy and rapid communication. The climate is on the whole pleasant. The annual rainfall averages 228 inches. Pop. (1901) 109,979, showing an increase of 16 per cent. in the decade. The staple crop is rice. Forests cover an area of nearly 5000 sq. m., of which 960 sq. m. are "canalised." Tavoy, with the rest of Tenasserim, was handed over to the British at the end of the first Burmese war in 1824. A revolt broke out in 1829, headed by the former governor, who was at once quelled, and since the district has remained undisturbed.

TAWDRY, an adjective used to characterize cheap finery, and especially things which imitate in a cheap way that which is rich or costly, or adornments of which the freshness and elegance have worn off. The word is first used in combination in the phrase "tawdry lace," a shortened form or corruption of St Audrey's or St Awdrey's lace. St Audrey was St Etheldreda, who founded Ely cathedral, and it is generally accepted that tawdry-laces or tawdries were necklaces bought at St Audrey's Fair on the 17th of October. Nares (Glossary to the Works of English Authors, 1850) gives as an alternative the story that the saint died of a swelling in the throat, which she took as a judgment for having worn fine necklaces in her youth.

TAXATION (from "tax," derived, through the French, from Late Latin, to appraise, which again is connected with the same root as tangerie, to touch), that part of the revenue of a state which is obtained by compulsory dues and charges upon its subjects. The state may have revenue from property of its own. In past times one of the principal sources of the revenue of the sovereign was in fact property of some sort, of which the crown lands in Great Britain, still administered by the government, are a remnant. In other countries, even at the present time, there is a large public domain yielding revenue. Local authorities also largely own property from which a revenue is obtained. But as a rule, and in spite of what has often been the practice in the past, and of exceptions which may still exist in some countries, a government obtains the money required for its expenses by means of taxation. Some of the apparent exceptions, moreover, appear to be only exceptions in name. It is contended, for instance, that the revenue from land obtained by the government of India is in reality of the nature of a land rent—a species of property owned by the government. But the fact of a government levying so general a charge may be held ipso facto to convert the charge into a tax, having much the same economic effects and consequences as a tax. When, moreover, a state receives a revenue from property, some of the economic consequences may be the same as if it received the money by means of a tax. In both cases there is absorption and administration by the state of so much of the income of the community, and it may be a question whether the private ownership of the property would not be more expedient both for the state and its subjects than state ownership is, in spite of the apparent advantage to all concerned in the state getting so much of its income without the complication of a tax.

The Four Kinds of Taxes.—In the economic development of states taxes have come to be grouped in different ways, according to variations in the method of levying them or the means of enforcing compulsion or other differences. One of the most usual divisions is into direct and indirect taxes. Taxes are distinguished as direct, because they are charged directly upon the tax-payer from whose income they are supposed to be taken. Indirect taxes are those where it is recognized from the beginning that the individual who pays in the first instance usually passes on the charge to some one else, who may again pass it on until it finally reaches the subject who bears the brunt. A tax, a direct charge upon all incomes above a certain limit, is the principal type in the United Kingdom of a direct tax. In France there is a group of taxes known by that name—a land tax, a personal and furniture tax, a door and window tax, and a trade licence tax. In the United States there are mainly assessments of the capital value of property, always for state and local purposes only, and not for the central government. Among the indirect taxes the most important are excise and customs duties upon articles of general consumption, the principal articles almost everywhere being tobacco, beer and tobacco, sugar, tea, coffee and tea, and also among the articles commonly selected. In essential character there is no difference between excise and customs duties, except that excise duties are levied upon articles of home production, and customs upon articles imported from abroad, or brought into one part of a country or empire from another part; but excise duties on the whole are considered more likely to interfere with trade, in consequence of the necessity of supervising the production of the articles affected. Next in importance to excise and customs we have duties levied by means of stamps upon documents or by charges at the time of registering deeds to which registration is necessary for the purpose of being valid. The charge in one case upon the article at a certain stage of its production, and in the other upon a transaction, is supposed to be passed on by the first payer to others. With these have been usually classed in the United Kingdom...
certain licence taxes upon traders, although such licences in France are reckoned direct taxes.

This division into direct and indirect is, however, far from logical. To take first the direct taxes. The income tax itself is not, in all cases, really paid to the state directly by the person out of whose income it comes. It is paid, in the first instance, in the case of land or houses, by the occupier, and where the occupier is a tenant it is recovered by him from the owner. In the case of joint-stock companies the company pays the state, and deducts the amount from the individual owners of stocks and shares. Thus the distinction between direct and indirect is drawn in receiving the rent of crown lands, and with similar economic incidents and consequences. Thus the direct taxes so called may frequently be no more direct than any others.

As regards indirect taxes, again, there appear to be some cases at least where it is by no means certain that the charge is passed on; stamp duties, for instance, especially where moderate in amount, may have the effect of diminishing pro tanto the profits in business of the person paying them, or the income which he enjoys. Where they are heavy, as, for instance, with the French registration duties on the transfer of property, there appears to be little doubt that they constitute a deduction from the price which a seller receives, and thus they are direct enough. Sometimes also, when a charge upon a commodity is not such a figure as to be easily divisible among the ordinary units of retail consumption, so that it can be passed on to a consumer of the articles in the form of an increased price, it may remain fixed upon those who first pay it, at least for a time. This is supposed to have actually happened with the increase of the beer duty in the British budget of 1894 by 6d. per barrel—a sum which would not when divided by the pint amount to an increase in the cost of living as the tax fell.

When the malt tax, a tax upon milling grain, was imposed in Italy many years ago, it was found that no corresponding increase took place in the price of flour and bread. The trade fell into the hands of the millers on a large scale, who paid the tax out of their increased profits from larger business, while the smaller millers were crushed out; so that this was manifestly the case of a tax, so called indirect, where the whole burden really fell on those who paid the charge in the first instance, and who in theory were supposed to pass it on to others. Even in the case of indirect taxes there, are important exceptions to the rule that they are indirect.

The division of taxes into direct and indirect is thus based on no real intrinsic difference. It is a classification for convenience's sake, adopted upon a rough observation of conspicuous, or apparently conspicuous, differences in the mode of levying taxes, and nothing more. The division, nevertheless, cannot be passed over without mention, as it is not only a common one in economic writing, but it figures largely in budget statements, financial accounts, and finance ministers' speeches—especially in the United Kingdom and France. In the United Kingdom the distinction has been made familiar by free-trade discussions. Direct taxation in the shape of income tax was substituted for indirect taxation previously levied, in order to relieve trade from the shackles of duties and charges which had become all-embracing. In France the direct taxes above referred to are described officially as direct, having been originally, there is little doubt, the main sources of government income; and there is equally an official designation of certain heads of revenue as "contributions et taxes indirectes." Recently in budget debates in

England there has been much comparison of the amounts yielded at different times by direct and indirect taxes respectively.

Other general classifications of taxes have also been attempted, as, for instance, taxes upon real property, and taxes upon personal property, and so on. Classification is indeed only too easy. Applying a characteristic common to some taxes, we can make a group of them, and set them against a group of all the other taxes lumped together. Such classifications are, however, uninstructional, and it has been found practically necessary in financial writing to take the principal taxes by their general grouping as that of import or stamp duties, and then describe their nature, cost, and incidence. In this way each country has a grouping of its own, though there is a common likeness, and the experience and practice of one country assist the financial study of another. As Adam Smith remarks, there is nothing in which governments have been so ready to learn of one another as in the matter of new taxes.

Descriptions of Taxes.—Following the practice of authors on finance, we may give a short account of the principal taxes in the United Kingdom, with references in passing to points of interest in the taxation of the United States, and of other countries. See, however, also the article on ENGLISH FINANCE.

The income tax (q.v.) for many years has been the most prominent, and latterly it has been the most productive, single tax. Its technical name is the property and income tax, but it is essentially a charge upon all incomes or profits, whether arising from property, or from the remuneration of personal services, or from annuities, income being applied with the widest possible meaning. As originally instituted in April 1798, during the great war with France, under the name of a "triplicate assessment," it was rather a consolidation of various assessed taxes levied upon the luxuries of the rich and upon property, than a wholly new tax. In December of the same year this impost was repealed, and a true income tax of 10 per cent. established on all incomes over £60, with abatements between £50 and £200. It was intended as a temporary tax for war purposes only, and was repealed in 1802, but was reimposed when the war recommenced in 1803, with the limit of abatement reduced to £50. So odious was it that parliament in 1815, when the war came to an end, ordered the destruction of the documents relating to it. Its efficiency as an instrument of revenue or restraint, with the taxes or excise as to its revival in 1842, when Sir Robert Peel inaugurated his great free-trade reform and swept away duties on exports, duties on imported raw material, and other imposts hampering the trade of the country. The intention again was that the tax should be temporary, but although the free-trade work was practically completed in the early 'sixties, and Mr Gladstone went so far as to dissolve parliament in 1874 with a promise that he would abolish the tax if his party were returned to power, it has become a permanent impost. The reasons are that with the tax at a low rate it has been found much less intolerable than during the Napoleonic War, when it was at the rate of 10 per cent., while the pressure of the tax has also been greatly mitigated by placing very high the minimum income subject to it, and giving abatements upon the lower taxable incomes. These expedients have since been carried much farther. The tax, if kept at a low rate, undoubtedly fulfils a useful function as a revenue reserve for emergencies, on account of the ease with which it can be put up and down without disturbing trade. But in recent years, by rising to the rate of 1s. 2d. per £, it has been felt more heavily, and at this height is decidedly less elastic. As regards this tax at least there is no question of its "directness" in a sense, as it is so contrived that it can hardly be passed on by those who are struck at, though they are not always the same as those who pay in the first instance, as has already been pointed out. There have been great complaints also of injustice by the possessors of temporary and precarious incomes, who have to pay the same rate of tax as the owners of permanent incomes from property, although these complaints have been diminished to some small extent by the raising of
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the minimum limit of the income assessed and the increase of the principle of abatements.

The varieties of income charged being very great, and special claims for consideration having been set up at different times, the result has been the formation of an income tax code, defining the methods and rules for assessing the different classes of profits and income, and prescribing the way in which abatements and exemptions are to be obtained. A leading peculiarity is that special inquiry into the aggregate of individual incomes. Although it is called a direct tax, the method of levy, as far as property is concerned, is upon the profits at their source, and not as they are distributed among the receivers. The question of the amount of individual incomes only comes before the authorities when claims for exemption and abatement are made. The character of the tax is accordingly much less odious than it would be if an account of individual incomes were invariably demanded, as was the case in the United States during the Civil War, when an income tax existed for a short time.

Other taxes grouped with the income tax by the authorities are house duty and land tax, but they are unimportant by comparison. The house duty replaced a window tax and other charges which were formerly not unimportant, especially in the interval between 1815 and 1843, when there was no income tax. It is a charge upon the occupiers of houses, mainly dwelling-houses, according to the amount of rent, the rate upon dwelling-houses ranging from 3d. to 9d. in the £, and the yield being about £150,000 per annum. The charge is probably much the same as that of the income tax itself, though there are curious questions as to the ultimate incidence as between owners and occupiers of houses. The land tax is quite unimportant, being an ancient tax upon an old assessment which has long become obsolete, and it interests economists most of all by the illustration it furnishes of what may be called a rent-charge tax—a tax, that is, which has been so long in existence and so fixed in its basis that it becomes in reality a charge upon the property, and not a direct burden upon the person who pays it, as the income tax is upon the person who pays it or for whom it is paid. In 1897 the basis of the tax was varied, but not in any way to affect the principle just stated.

The next great group of taxes is that of the excise (q.v.) and customs duties upon commodities. Excise duties are charges upon commodities produced at home on their way to the consumer, and customs duties in the United Kingdom are charges upon commodities brought into the country from abroad; and they are of essentially the same nature. Not only so, but excise duties and customs duties are in some cases suffering greatly to each other, like articles being produced and home and imported from abroad, so that for the sake of the revenue they have both to be taxed alike. Of this in the British system spirits are the best instance.

Export duties, it may be observed, are not important in systems of taxation generally, as there are few articles where the charge will not really fall on the wages of labour and profits of capital within the country imposing them; but opium grown in India is a well-known exception, and in the West Indies export duties on principal articles of production, in spite of their incidence, have been found a convenient source of revenue.

The list of commodities selected for taxation in the English fiscal system, under Free Trade, is very small. Few countries have so short a list of import duties, but this is in consequence of their design to give protection, which raises totally different questions from those of revenue.

The next large group of taxes is that of the stamp duties (q.v.). The principal items are those derived from a stamp of 1d. upon each cheque or receipt for money paid, and from a variety of charges on deeds and other instruments, and principally on the price paid for the transfer of real property and of stocks and shares, and on mortgages. Included are various charges on foreign bonds to bearer, to compensate for the advantage they have in escaping the transfer duty on deeds, through their passing on sale or mortgage from hand to hand. The essence of the compulsion in the case of stamp duties is the invalidity of the documents in courts of law unless the stamp is affixed, besides liability to penalties for not affixing the proper stamps. As things go in matters of taxation, English stamp duties are low. In France, besides the stamp duties, there are charges on the transfer of real property amounting to about 6 per cent. on the official registration of the transfer which is necessary to make it effective.

We come next, in dealing with taxation, to a group of charges about which the question has been raised as to whether they are, properly speaking, taxes or not. These are the post office charges, and the charges for telegraph service, including telephones. In the classification of the revenue in English budgets and in official returns these charges are deliberately separated from the above sources of the revenue described as taxes, and charge, with "revenues derived from other sources." The correctness of this procedure is questionable. According to old usage, the post office was made a state monopoly for the express purpose of levying taxation by means of it. In France the postage on letters is still called the taxe des lettres. There is no doubt also, that when postage on letters is charged at the rate of 1d. each, where the cost of collection and delivery, as in the metropolis, is perhaps not more than a tenth of a penny, it is difficult to distinguish the levy from that of any other tax. The excuse, as a rule, may hold good, that the postal charge is only a reasonable one for service rendered, so that the net derived is probably much the same as that of the tax itself, though there be curious questions as to the ultimate incidence as between owners and occupiers of houses.

Another source of revenue in British imperial finance is that from fees in courts of justice, patent stamps and the like, which is usually classified, like the income of the post office, as revenue derived from other sources than taxes. The amount is not large, though unfortunately the charge is not accurately known, to the fees being treated in many cases as extra receipts, and deducted from the expenditure of the departments by which they are received, so that this part of the national expenditure is not shown in the accounts at all. The proceeding appears to be quite incorrect, whatever excuse there may be for treating revenue like that of the post office as non-tax revenue. Fees levied on proceedings in courts of justice are not only taxes, but taxes of the worst sort. They received the special condemnation of Jeremy Bentham. It is a blot on British finance, therefore, that this part of the taxation is treated as if it were not taxation at all, and largely concealed from view in the way described.

Lastly, all, we have to notice among the imperial taxes the estate (q.v.) or death duties, as they are called—the charges made by government on the transfer of property from the dead to the living. These have been considerably increased in amount. Various interesting questions arise regarding them. Logically they are apparently taxes upon the dead, as they limit the area of bequest, but they are felt by the living who receive the estate as if the burden of taxation fell on them. Practically, when a stranger receives the residue of a business man, the proper way of viewing the tax would appear to be that it is a share of property claimed by the state against a
stranger who has no right in the matter except that which the state gives him, so that it is hardly a tax at all, as the word is usually understood; but when the estate is received by the near relatives of the deceased who were subsisting upon it even before his death, it is undoubtedly felt as a tax by them, and operates as a tax. It is even at times a very burdensome tax, falling upon a family when its sources of income are otherwise diminished, while it has the demerit of striking a small number annually instead of being diffused equally. Duties also raise the question as to how they are to be taxed upon capital. They are, in fact, the same even at the lowest rates of 1 to 4 per cent. upon the capital charged, and they have to be paid at such times as to cause their being paid out of capital and not out of income, so that their tendency is to diminish the capital available for productive enterprises.

Local Taxation.—Besides the above revenue from taxation for imperial purposes, large amounts are raised for local purposes. The local authorities derive a large income from private property, and from monopolies such as water, gas, electric light, telephones and tramway service, which they carry on, and on which the only real property, which is mainly real and cannot be moved away, can be assessed and made to pay. The owners of real property, however, continually urge that they are unfairly treated, and that other property should be rated. Next there has been misconception, arising from the same cause, in the constant attempt to charge the occupier of lands and houses with rates, although the real effect of the rates must be, as a rule, to diminish the value of the property affected like an old-established land tax, so that rates, properly speaking, do not fall upon either owner or occupier. It would be hard, however, to persuade the mass of occupiers in England that they do not pay the rates, so that the expedient of dividing the rates between owner and occupier, though it cannot affect their real incidence to a substantial extent, constantly finds favour. The confusion has been further increased of late years by attempts, as far as towns are concerned, to find a new subject of taxation in what are called rate values, as if rates themselves were not in reality an appropriation by the state of a portion of the whole value of the property, subject to which all the other interests exist. It would be impossible here even to state all the questions that have arisen about rates; but the essential confusion caused by the neglect of practical men to study the actual history of taxation, as it may be called, must be obvious to every student. The frank recognition that local income taxes are impossible, and that taxation on property for local purposes can only be applied to real property, where it becomes, usually or frequently, in the nature of a rent-charge, would have saved the legislature and the public an infinity of laborious discussion. Other taxes for local purposes comprise dues and tolls, such as harbour dues, where the money is required for such a definite purpose as a harbour, maintained at the expense of the traffic accommodated. Here again the question arises as to whether the tax is a mere compulsory charge or payment for a service rendered. Among these tolls may perhaps be included some charges in the nature of octroi dues, imposed on commodities entering a town, but not to a great extent. Such dues, in the nature of customs, are very common in continental cities, and yield large revenue to the local authorities, although they have been very generally, if not quite universally, abolished in the United Kingdom. They have been regarded with much dislike by most economists, and some dues of the kind which existed in London, viz., dues on coal and wine imported, and metage dues on grain, were much imposed until their final abolition in recent years. When of moderate account, however, dues of this sort appear no more objectionable than harbour dues already mentioned, or any other moderate charges on transactions. If of large amount and very numerous, they hamper trade, as all taxation tends to do, but that is no reason for condemning them specially when the choice lies between them and other forms of taxation.

In addition, we have to notice certain taxes which up to 1910-11 were levied by the British government and distributed to the local authorities, just as in France the government levies certain direct taxes, or centimes additionnels, added to its own direct taxes for the benefit of the local authorities. These taxes were additional beer and spirit dues (customs and excise), excise licences, and share of probate and estate duty. The remarks already made on the corresponding taxes levied for imperial purposes of course apply to these. Exceptionally, it may be added, as regards the licence taxes, which occupy quite an inferior place in the British system of taxation for imperial purposes, that the question whether some of them are not really direct in their incidence on the first person charged may also be raised, although they are classed with indirect taxes. Many of the licences are those of brewers, distillers and publicans, and others in trade, and are paid out of the general profits of the business, so that they can hardly be passed on to the consumers, while other licences are for shooting, for employing carriages and men-servants, and for similar objects, where the charge on the payer is direct. This may be the place to mention that in other countries, as in France, the licence duties on traders are considerably more general than in the United Kingdom, and are levied on an elaborate scale, according to the size of population of the town where the business is carried on, and the rent paid for the premises. They take the place, to some extent, of the income tax, and are usually classed with the direct taxes.

The peculiarity of taxes which are levied by the imperial authority and distributed among the local authorities for disbursement deserves notice. There must be a general cause for such an arrangement when we find it to have been in existence in France and other countries, and to have been introduced into the United Kingdom. And this cause no doubt is the need of the local authorities, and the difficulty of letting them have taxes of their own to levy which do not interfere with the imperial monopoly. The arrangement is obviously objectionable on the score of its conducing to local extravagance, as local authorities are not likely to be so economical with money that comes to them from the outside, as it were, as they would be with money directly taken from their own pockets. Local authorities receive other subventions and aids from the central government besides the proceeds of these taxes, so that their appropriation for local needs is related to a large question which belongs, however, to the general subject of local government, and is much too large a subject to be here. Incidence of Taxation.—In describing the principal taxes which are employed in the United Kingdom to provide for the national expenditure, observations have necessarily been made upon the incidence, probable or assumed, upon the taxpayer, and on the question how far they may fall equally on the whole community without any special incidence being traceable. The incidence of taxation is, however, a special subject for discussion, and is connected with various large
issues, such as that of Free Trade, which are of deep interest to economic students.

The starting-point of discussions as to incidence of taxation is a classical passage in Adam Smith's Wealth of Nations (book v, chap. ii.), where he lays down the following maxims with regard to taxes in general: 1. the subject of which has to be brought to bear on the support of the government, as nearly as possible, in proportion to their respective abilities; that is, in proportion to the revenue which they respectively enjoy under the protection of the state. 2. the tax which each individual is bound to pay ought to be certain and not arbitrary. 3. Every tax ought to be levied at the time or in the manner in which it is most likely to be convenient for the contributor to pay it. [Adam Smith specially praises indirect taxes on commodities under this head, because the consumer "pays them by little and little as he buys the goods," and "it must be his own fault if he ever suffers any considerable inconveniency from such taxes."]

4. Every tax ought to be so contrived as both to take out and keep out of the pockets of the people as little as possible over and above what it brings into the public treasury of the state. [This last passage is specially directed against taxes which are expensive to collect, or discourage trade, or offer temptation to smuggling, or subject people to frequent visits of the tax-gatherers.] These maxims have commanded universal assent, as they are obviously the common sense of the subject. Nevertheless, however, that while general maxims are easy, the application presents difficulties, and since Adam Smith wrote, and especially in modern times, new questions of some interest have been raised. Adam Smith does not go minutely into the incidence of taxation. Taxes in his view must come out of rent, or profit, or the wages of labour; and he observes that every tax which falls finally upon one only of the sorts of revenue "is necessarily unequal in so far as it does not affect the other two," and in examining different taxes he disregards as inadequate this sort of a priori observation "to that inequality which is occasioned by a particular tax falling unequally upon that particular sort of private revenue which is affected by it." Recent discussion, however, has gone rather to the point which Adam Smith neglected, that of inequality generally, not merely as between different sorts of income, but as between individuals and classes.

The whole burden of taxation, it is maintained, should fall equally upon classes and individuals as far as possible, and, if necessary, taxes falling equally upon special sources of private revenue should be balanced against each other in order to obtain the desired result. Along with this view none of the state ought to the question whether the burden of taxation should not be progressive—the proportion of the sum taken by the state from the tax-payers increasing with the wealth of the individual, because ability to pay taxes is assumed to be not in proportion to, but to increase with the size of, the income.

What opinion should be held regarding this modern view as to equality in taxation, which differs so widely from anything countenanced by Adam Smith, though his language is echoed in it? The answer must be that, however sound, the view is impracticable and indeed inclines me to the belief that the heavy proportion of the taxes in almost every system of taxation, and at any rate in the British system, where the exact incidence is in no way traceable, or where there is no sort of general agreement as to the incidence. The whole of the British revenue from post office and telegraph service, and the whole of the stamp revenue, are derived from charges whose exact incidence cannot be traced. We have seen, indeed, that doubt is even felt as to whether post office and telegraph charges can be treated as taxes at all. Again, the death duties are in a distinct category; these duties fall each year not on a particular class of the community, or a particular kind of property, but on a few individuals only, who are in some cases treated severely, while others may have no cause of complaint. In the course of fifty years, it may be said, the balance will be rectified, and the whole class to which the individuals belong, and the property they own, will be visited in turn, so that this taxation should be credited to them in an account of the incidence of taxes generally; but fifty years is altogether too long a period for such adjustments to be made. Thus a very large proportion of the total revenue of many, and although the rate of duty is the same, the definition of income seems imperfect, so that many pay on a much larger assessment of income than seems fair in comparison with other incomes of nominally the same amount, but really of much greater value when all deductions from the gross sum are fairly reckoned. If all who pay income tax are lumped together and contrasted with those who do not pay, then there is a false division to begin with, and there is so far no means of establishing equality or inequality. As regards indirect taxes, there is so little difficulty in ascertaining the relative consumption of different classes, for the simple reason that in the same class so called the habits of consumption differ widely. It is only by a wide extension of the term "working man," for instance, that a class which includes a steady mechanic earning 30s. to £2 a week, who is frequently a total abaster, and a labourer of inferior capacity and character earning 15s. to 20s. a week, and who is not a total abaster, can be spoken of as one, and credit given to the one class for so much taxation on spirits, beer, tobacco, wine, tea and sugar. There are at least geographical differences of kind; on the other hand, the consumption by the income tax paying classes of customs and excise articles must vary indefinitely amongst themselves, according to personal habits, size of families, and even their geographical distribution. A further difficulty is furnished by a question as to whether the employer of domestic servants who gives them their board does or does not bear the burden of the duties on the articles which they consume, and which he buys for their use. Theoretically the burden falls on them as consumers. They would have more real wages, it is said, if the price of the articles they consume was not raised by them; but practically most employers are convinced that they pay the taxes for their servants. To establish, therefore, any fair account of the incidence of indirect taxes on different classes of the community, real classes being distinguished, and not mere rough grouping into so-called classes of units who are altogether heterogeneous, is probably beyond the skill of man.

All this is evident on a view of imperial taxation alone. In studying equality, moreover, local taxation must be brought into view, with even more impracticable differences of opinion which arise in local geographical differences of kind. Even when hunting is the only tax, the moment rates are brought into question it is seen at once how impossible it would be to establish equality among tax-payers, when owners on one side and occupiers on the other claim that they each bear the burden of the same taxes, and economists favour the opinion that much of the burden is in the nature of a rent-charg on the property, and in any case is equally diffused over the whole community.

Adam Smith was thus not altogether badly advised in not carrying his investigations into the equality of taxation farther than he did. There was another reason for his so doing in the heavy-handedness of the burden of taxation at the time he wrote; governments exacting as much as they could, and being only desirous of finding the easiest means of doing so. It is the very lightness of taxation in recent years which has suggested the possibility of comparing the relative burdens of different
classes, which would have seemed quite hopeless with a high taxation and an immense variety of high taxes. The conclusion that with good taxes long established the burden of taxation tends to become equal over the whole community was certainly not ill founded in the circumstances of former times, and may be accepted as true even in the present day.

As to progressive taxation based on the assumption that equality requires a larger proportionate charge upon a big income than on one of a smaller amount, the practical application of the principle, if true, would be impossible. A great deal more would need to be known than is now known about the effect of taxes on different classes, and the aggregate amount of different incomes, before such a task could be undertaken. If there is a greater proportionate charge already on the larger incomes, nothing more need be done, and we cannot know that there is not.

As to the justice of such a progressive tax, there is a common opinion in its favour among economists, at least to the extent of exempting a certain minimum of subsistence from taxation; but the present writer, after accepting this view in early life on the authority of Mill, must now express the greatest doubt. The ideal is equality, and no measure of a minimum of subsistence can really be devised.

Of course there may be single taxes which are progressive in form, such as the licence tax in France, or the income tax in Great Britain, where progress is established by abatements, or the death duties, where progress by scale is very common. But such progression may arise in a different way and on different principles from those proposed in defence of a general system of progressive taxation. It may be expedient for balancing taxation and roughly redressing palpable inequalities, and may be adopted for that purpose and no other.

Statistical inquiries as to the incidence of taxation of the particular taxes, though ideal or even approximate equality of a palpable arithmetical kind is practically unattainable by governments, are not altogether to be put aside. The information thus obtainable may be useful as far as it goes, indicating the directions in which the burden of taxation may press, and forming a guide of some utility when changes of taxation are contemplated. Calculations, for instance, as to what people at the lower levels of the income tax must pay because they happen to be struck by every sort of tax as no other class is, and calculations as to the freedom from taxation of large numbers of consumers whose incomes are not sufficient to living enable them to escape the tax-gatherer as the class to which they belong cannot generally do, may help a finance minister in the selection of taxes to be repealed or reduced or to be newly imposed. With every effort after equality he must fail to satisfy all, but friction may be diminished and the work of carrying on government quietly and steadily facilitated.

Taxes and Free Trade.—Taxation ought not to interfere with trade if possible, and the object of Adam Smith’s maxim, as we have seen, was largely to erect sign-posts warning finance ministers against the kind of taxes likely to taxation trade.

There has been much discussion, however, on free trade since Adam Smith’s time, and the far-reaching nature of his warnings is not yet even generally understood. There will probably be general agreement as to the wisdom of avoiding taxes which are uncertain and arbitrary, or which involve frequent visits of the tax-gatherer; but so far from there being a general assent in all countries to his maxims as to the expediency of avoiding taxation, which takes more from the tax-payer than what comes into the hands of the government, this is the very characteristic of duties deliberately imposed by most governments for the purpose of interfering with trade, and frequently called for even in the United Kingdom with a similar object.

In a question of taxation, however, for the purpose of meeting the expenses of the government, all such duties must be ruled out. Taxes, as instruments for advancing the prosperity of a country, are things unknown to the study of “taxation” in the proper sense of the word. The only proper object of taxation is to meet the expenses of the state, and when taxes are used primarily or mainly for some other object they can only be justified by political and economic reasons of a different order from anything that has been under discussion.

On this ground, in an account of taxation proper, one might avoid discussing altogether the question of irregular or illegitimate taxation. But the subject is of too much popular interest, perhaps, to be passed over altogether. Generally, then, it may be affirmed that taxation in its essential nature cannot be thought of as a good instrument for promoting trade and the advancement of a country. So far as it operates at all, it operates by diverting trade from the channels in which it would naturally flow into other channels, and this diversion reduces the industry, so far as it goes, must involve loss. People are induced to do things they would otherwise leave alone, or to leave alone what they would otherwise do, because money is given to them out of the pockets of the tax-payers to make it worth their while to do so; but there is palpably loss and not profit in the proceeding. It is urged that in time industries are set up that would not otherwise have existed, and population thereby attracted, this being especially the argument for protective duties in new countries; but even so, there is loss to set against the final gain, if any, and we invoke if the cost account in which a balance of loss and gain is attempted. The presumption is that on balance there is loss. In new countries especially the diversion of industry from its natural development cannot but be mischievous, wrong manufactures and industries being set up at the expense of the whole community, instead of those manufactures and industries which would be most profitable.

There is more to be said for the political argument which induced Adam Smith to favour navigation laws, giving a preference to national shipping in national waters, and for a similar political argument in favour of duties on agricultural produce imported into the country, on the ground, as regards navigation, that the prosperity of the shipping industry in particular was essential to the safety of the country, and on the ground, as regards duties on agricultural produce, that the maintenance of a larger rural population and of a larger agricultural production than would exist under natural conditions of perfect free trade was essential to the welfare of the state and even to its very existence in the possible event of a temporary defeat at sea and a partial blockade of the coasts. This is not the place to discuss such political problems, but there is no question of free trade, history and practice, to the community of any such taxation is frankly acknowledged.

Sir John A. Macdonald, the great protectionist prime minister of Canada, in a conversation with the present writer in 1882, avowed without hesitation that protectionist taxation in Canada was indefensible on economic grounds, and he defended it exclusively for political reasons. Politically one might differ from him, but economists as such must either be silent when political reasons are alleged for taxes that are against fundamental maxims, or must be content to point out the cost of the taxes in order that the communities concerned may decide whether an object in view is obtainable by means of the taxation, and is worth the price.

A great deal has been said as to taxes termed “counter-vailing duties,” which are called for in order to defend free trade itself against the protectionist bounties of foreign governments. Such duties are obviously taxes outside the limits to be considered in a question of taxation proper. They are to be imposed for other purposes than revenue. As to the claim for them that they will restore free trade conditions by nullifying the foreign bounties which have caused a disturbance of trade, this is really in the nature of a political reason. A country which is so devoted to free trade that it not only practises free trade itself but endeavours to convert others by nullifying their protectionist measures as far as it can, even with immediate loss to itself, departs from the guidance of self-interest so far; but its political action may be justifiable in the long run by other considerations. It seems right to point out, however, that countervailing duties, which are really differential duties of a special kind, are not the good expedient they are supposed to be for nullifying foreign bounties; that
experience of differential duties in former times is altogether against them; and that they cannot be enforced without certificates of origin and other causes of harassment and confusion in the conduct of trade.

The extent of the interference with trade, in regard to particular taxes, is also a matter of importance. A particular tax is not necessarily to be condemned because it takes a little more out of the pockets of the people than what the government receives. Such a defect is a ground for consideration in weighing a particular tax against others, but it is only one inconvenience among many incidental to all taxes.

Some English applications of free trade theory in recent times in the matter of import duties have been pedantic—the abolition of the shilling corn duty in 1860 by Robert Lowe (Lord Sherbrooke) being typical of this pedantry, though it is not the only instance. No doubt, in theory, this duty, being levied on the import only and not on the home production of corn, took from the tax-payer a shilling on every quarter of grain produced at home which did not go into the exchequer. Per contra the tax was wholly unfelt, a shilling a quarter only affecting an average family of four persons to the extent of three shillings per annum, or about three farthings a week, while it was paid little by little, as Adam Smith explains with regard to indirect taxes in general. The amount yielded, moreover, was considerable, being equal to a penny on the income tax, which it is desirable to maintain as a reserve of taxation. When we balance advantages and disadvantages, therefore, the repeal of the corn duty and similar measures would appear to have been sacrifices of revenue without adequate reason.

Rates of Taxation.—Apart from the merits or demerits of particular taxes or groups of taxes, and the questions as to inequality, injury to trade, and the like already discussed, the aggregate of taxation, or rather revenue, of a state may be considered in the most general way, having regard to the proportion of the total state revenue accounted for by each individual, and the return made by the state therefor. Here there are the greatest variations. At one time, for instance, during the great wars at the beginning of the 19th century, it was calculated that the British government expenditure, and the corresponding revenue, mostly raised by taxation, were each equal to about one-third of the aggregate of individual incomes—that is, as £60,000,000 to about £270,000,000. Proportions even higher have not been unknown in history, and it is probable that in Russia, India, Egypt, and in other countries at this moment, the proportion may amount to one-fourth or one-fifth. On the other hand, some years ago in the United Kingdom, before the high expenditure on army and navy began, and before the South African war of 1890–1892, it was probable that with an outlay of less than £1,000,000 by the central government, the proportion of this outlay to the aggregate income of the people was not higher than one-fourteenth. At the beginning of 1902, when the South African war was closing, the normal peace expenditure, even reckoned at £1,60,000,000, did not exceed one-tenth, while even peace and war expenditure together in 1901, taking them as close on £200,000,000, did not exceed one-eighth. These varying proportions, however, mean different things economically, and it is of obvious interest that, besides questions as to particular taxes, the broad effect of the whole burden of taxation should also be discussed.

The important points in this connexion appear to be: (1) Very large appropriations can be made by the state from the revenue of its subjects without permanent injury. The common country suffers, but the land and fixed capital remain, and when the high Government expenditure ceases individuals at once have the benefit, subject to possible disturbance at the moment of transition, when many persons employed by the state return to private employment. (2) A state which in ordinary times appropriates one-tenth or some less proportion of aggregate individual incomes is much stronger relatively than a state absorbing one-fourth, one-third, or even a higher proportion. It has much larger resources, which would be available if time were given to develop them. (3) When the proportion becomes one-tenth or less it is doubtful whether the state can do best for its subjects by making the proportion still lower, that is, by abandoning one tax after another, or even a greater or smaller advantage would not be gained by using the revenue for wise purposes under the direction of the state, such as great works of sanitation, or water supply, or public defence. In other words, when taxes are very moderate and the revenue appropriated by the state is a small part only of the aggregate of individual incomes, it seems possible that individuals in a rich country may waste individually resources which the state could apply to very profitable purposes. The state, for instance, could perhaps more usefully engage in some great works, such as establishing reservoirs of water for the use of towns. The great plan of drainage under one of the channels between Ireland and Great Britain, or a sea-cause across Scotland between the Clyde and the Forth, or purchasing land from Irish landlords and transferring it to tenants, than allow money to fructify or not fructify, as the case may be, in the pockets of individuals. Probably there are no works more beneficial to a community in the long run than those like a tunnel between Ireland and Great Britain, which open an entirely new means of communication of strategic as well as commercial value, but are not likely to pay the individual entrepreneur within it.

Authorities.—See also, for taxation and taxes in different countries, the separate articles on the finance under the heading of each country; and the articles on Free Trade, Protection and Tariffs. The following short list of authors may be useful to the student: Adam Smith, a wealth of nations; Ricardo's Principles of Taxation; Mill, Principles of Political Economy; Bastable, Public Finance; E. A. Seligman, Shifting and Incidence of Taxation (2nd ed., 1899); Garnier, Traité de Finances; Cohn, System der National-Oekonomie; Wagner, Finanzwissenschaft; Roscher, System der Finanzwissenschaft. (R. Gs.)

TAXIDERMY, the art of preserving the integument, together with the scales, feathers or fur, of animals. Little is known of the beginnings of the practice of the "stuffing" or "setting up" of animals for ornament or for scientific purposes; and it is highly probable, from what we gather from old works of travel or natural history, that the art is not more than some three hundred years old. It was practised in England towards the end of the 17th century, as is proved by the Sloane collection, which in 1725 formed the nucleus of the collection of natural history now preserved in the Sloane room at the University of Kensington. It was not until the middle of the last century that any one devoted to the principles of the then little understood art was published in France, R. A. F. Réaumur's treatise (1749) being probably the first. This was followed at intervals by others in France and Germany, until the beginning of the 19th century, when the English began to move in the matter, and several works were published, notably those by E. Donovan, W. Swainson, Capt. Thomas Brown and others. These works, however, are long since inadequate; and at the Great Exhibition of 1851, the Germans and French taught British taxidermists the rudiments of scientific treatment of natural objects. The demands of sportsmen for the due preservation of their trophies, and the requirements of the great museums in every civilized country, have rapidly transformed a crude handicraft into an elaborate art, and the finest modern results, as produced by a private firm like Rowland Ward in England, or the expert staff of the American Museum of Natural History in New York, leave almost nothing to be desired. The rapidly recurring editions of Rowland Ward's handsome Guide to the art of collecting and preserving various species of birds, by John Rowley's little manual Supplies a guide to the beginner, and the expert specializes in the particular branch of the art which he prefers.

2 Taxidermist's Manual (Glasgow, 1833).
3 A Sportsman's Practical Collecting, Preserving and Artistic Setting up of Trophies and Specimens (London, many editions).
4 The Art of Taxidermy (New York, 1898).
more detail as to what may be done in the workshop; Montague Browne's elaborate treatise remains a standard work, whilst William T. Hornaday has supplied a very full account of the excellent American methods which he has done so much to develop.

The first principle governing the art is that, after the specimen has been procured, in as fresh and clean a state as may be, it should have the skin stripped from the body in such a manner as not to disturb the scales if a fish or a reptile, the feathers of a bird, the hair of a mammal. To do this correctly requires a small stock of tools, as well as a great amount of patience and perseverance. The appliances comprise several sharp knives (some pointed and some oilstone), a pair of scissors, a pair of pilers, a pair of nippers or "cutting-pliers," some tow, a wadding, needles and thread, also a "stuffing-iron," some crooked awls, a pair of fine long flat-nosed pilers, and a camel-hair brush. "The preservative compound is often the original (Bécouër's) arsenical soap," made by cutting up and boiling 2 lb. of white soap, to which 12 oz. of salt of tartar and 4 oz. of a mixture, when intimately glued, should be well worked into this mixture, when nearly cold, 2 lb. of powdered arsenic and 5 oz. of camphor (the latter previously triturated in a mortar with spirits of wine) are added. The mixture is put away in small jars or pots for use. Like all arsenical preparations, this is exceedingly dangerous in the hands of unskilled persons, often causing shortness of breath, sores, brittleness of the nails and other symptoms; and, as arsenic is really no protection against the attacks of insects, an efficient substitute has been invented by Browne, composed of 1 lb. of white curd soap and 3 lb. of whiting, triturated together, to which is added, whilst hot, 2 oz. of chloride of lime and, when cold, 1 oz. of tincture of musk. This mixture is perfectly safe to use when cold (although when hot the fumes should not be inhaled, owing to the chlorine given off), and is spoken of as doing its work efficiently. Solutions of corrosive sublimate, often recommended, are, even if efficient, dangerous in the extreme. Powders consisting of tannin, pepper, camphor, and burnt alum are sometimes used for "making skins," but they dry them too rapidly for the purposes of "mounting." Mammals are best preserved by a mixture of 1 lb of burnt alum to 4 lb. of salt-petre; this, when intimately glued, should be well worked into the skin. Fishes and reptiles, when not cast and modelled, are best preserved in rectified spirits of wine; but this, when economy is desired, can be replaced by "Müller's solution" (bichromate of potash 2 oz., sulphate of soda 1 oz., distilled water 3 pints) or by a nearly saturated solution of chloric of zinc. The cleaning of feathers and furs is performed by rubbing them lightly with wadding soaked in benzoline, afterwards dusting on plaster of Paris, which is beaten out, when dry, with a bunch of feathers.

The preparation and mounting of bird specimens, the objects most usually selected by the amateur, are performed in the following manner. The specimen to be operated upon should have its nostrils and throat closed by plugs of cotton-wool or tow; both wing-bones should be intimately glued to the body, and the head laid upon a table on its back; and, as birds—especially white-breasted ones—should seldom, if ever, be opened on the breast, an incision should be made in the skin under the wing on the side most damaged, from which the thigh protrudes. When push-pinning gently this is cut through at its junction with the body, when the knife is gently used to separate the skin from this, the wing-bone is seen on the open side. This is then cut through by scissors, and by careful manipulation the skin is further freed from the back and breast until the neck can be cut off. The other side now remains to be dealt with; from this the wing is cut by travelling downwards, the remaining leg is cut away, and very careful skinning over the stomach and upon the lower back brings the operator to the tail, which is cut off, leaving a small portion of the bone (the coccyx) in the skin. The body now falls off, and nothing remains in the breast but the neck and head. To skin these out completely without unduly stretching the integument, is a task trying to the patience, but it can be accomplished by gradually working the skin away from the back of the head forward, taking care to avoid cutting the eyes or the eyelids, but by cautious management, to cut the membranous skin over those parts, so that the eyes are easily extracted from the orbits without bursting. The skin should be carefully manipulated, since every movement round the neck, when with neck attached, should be cut off, the brains extracted, all the flesh cleared from the skull and from the bones of the wings, legs and tail; the skin is then turned over to the right side, and turned into its proper position. When "skins" only are to be made for the cabinet, it is sufficient to fill the head and neck with choped tow, the body with a false one made of tow, tightly packed to give the skeleton a natural position. When the skin is to be fitted over the body of the stomach, and to place a band of paper tightly pinned around the body over the breast and wings, and allow it to remain in a warm position, free from dust, for several days or weeks, according to the size of the specimen, the body must be pinned on the head, sex, locality and date, and put away with insect powder around it.

When, however, the specimen is to be mounted, the operation is considerably more difficult. First, a skull is made, with a false bone of tightly wrapped tow is made upon a wire pointed at its upper end. This is inserted through the incision under the wing, the pointed end going up the neck and through the skull to the outside. When the imitation body rests within the skin, pointed wires are thrust through the soles of the feet, up the skin of the back of the legs, and are finally clenched in the bounding edges of the skin of the under surface, and also clenched through into the body. A stand or perch is provided, and the bird, being fixed upon this, is, after the eyes have been inserted, arranged in the most natural attitude of the specimen. When thus mounted, the imitation body is cut off, and the skin and feathers are dusted and dressed, if necessary, when the specimen is to be kept in a cold place indefinitely.

Mammals are cut along the stomach from nearly the middle to the breast, and are skinned by working out the hind legs first, cutting them off under the skin at the junction of the femur with the trunk, and carefully removing them off the lower back and front until the tail is reached, the flesh and bones of which are pulled out of the skin, leaving the operator free to follow on up the back until the last under portion is reached. This is then dressed as like manner. The neck and head are skinned out down to the inner edges of the lips and nose, great care being exercised not to cut the outer portions of the ears, the eyelids, the nose or the lips. The ears are then cleaned off, and the brain and eyes extracted. The skull should adhere to the skin by the inner edges of the lips. All the flesh should be trimmed from the bones of the legs. The head, being shaped, where the flesh was removed, by tow and clay, is returned into the skin. A long wire of sufficient strength is tightly bound with tow, making a long, narrow body, through which wires are thrust by the skin of the soles of the feet. The wires and bones being wrapped with tow and clay into the skin, the points of the wires are pushed through the tow body and clenched. They and the body are then bent into the desired position, and modelled up by the addition of more tow and clay, until the contours of the natural body are imitated, when the stomach is sewn up. A board is provided upon which to fix the specimen, artificial eyes are inserted, the lips, nose and eyelids fixed by means of pins or "needle-points," and the specimen is then placed in a warm atmosphere.

Reptiles, when small, have their skin removed by cutting away the attachment of the skin to the cervical vertebrae, and by turning the "pectoral" (the mesial) into the "pectoral" (the lateral) position. When large, they are cut along their median line, and treated in the same manner as mammals.

Fishes, after being covered on their best side with paper or magazine, are cut along the lateral line from neck to tail, the gills to the gills, and are skinned out by removing "cutlets," as large as is possible without cutting the skin, which, indeed, should be kept damp during work. After being cured with a preservative, they are fixed with sawdust or dry plaster of Paris, sewn up, turned over on a board, the fins pinned out, and the mouth adjusted, and, when perfectly dry, the plaster may be shaken out.

The new school of taxidermists, with new methods, whose aim is to combine "knowledge of anatomy and modelling with taxidermic technique, has now come to the front, all processes of "stuffing" have been discarded in favour of modelling. Within the limits of an article like the present it is impossible to do more than indicate the methods in general. In the case of mammals, after the skin has been completely removed, even to the toes, a copy is made of the body, posed as in life, and from this an accurate representation of the skin is made. The model is then covered with skin, which is dipped, and moulded to follow every depression and prominence, the manikin, before having the skin put on it, frequently being covered completely with a thin layer of clay; the study is then suffered to dry; and, models having been made, in the case of large animals, of the 

1 Artistic and Scientific Taxidermy and Modelling (London, 1896).  
mucous membrane of the jaws, palate, tongue and lips, these are truly reproduced in a plastic material. The ordinary glass eyes are discarded, and hollow globes, specially made, are hand-painted from nature, and are fixed in the head so as to convey the exact expression which the pose of the body demands. Birds, if of any size, can be modelled in like manner, and fishes are treated by a somewhat identical process, being finally coloured as a "still life" painting.

To give a life-like representation, attention is also paid to artistic "mounting." By this is meant the surrounding of specimens with appropriate accessories, and it is well exemplified by the work shown in the natural history museum at South Kensington, where, for example, birds are arranged as in a state.

The great American museums have extended a similar method to the mounting of even large mammals, whilst they have made bird groups naturally still more life-like by panoramic backgrounds and top and side lighting of the cases. (M. B.)

TAY, the longest river in Scotland. From its source in Ben Lui (7300 ft.), a mountain on the borders of Perthshire and Argyllshire, it pursues a mainly north-easterly direction to Logierait, where it curls to the south by east as far as Dunkeld; there its course turns to the south-east to the mouth of the Isla, where it bends towards the south by west to the vicinity of Scone. From this point it makes a sharp descent to the south by east beyond the county town, when, at the point where the river turns south-east to near Nethy Bridge, Broughty Ferry and Ardeer, it again faces the north-east as far as Breughty Ferry, whence it flows straight eastwards into the North Sea, off Breadalbane in Forfarshire, after a total run of 117 miles. During the first 11 miles it is known as the Fillan and discharges into Loch Dochart. From the lake it emerges as the Dochart (13 m.), which enters Loch Tay at Killin. Flowing through the loch for 143 m., it issues at Kenmore under its proper name of Tay. From hence to the sea its course measures 781 m., from which we may deduct 25 m. as the length of the Firth of Tay (which begins at Cairn pier Ferry), leaving 353 m. as the length of the stream between Kenmore and the mouth of the Earn. Its principal affluents on the right are the Braan, Almond and Earn, and on the left the Lyon, Tummel and Isla. Along with its tributaries, therefore, it drains all Perthshire and portions of Forfarshire and Argyllshire, having a catchment basin of 2400 sq. m. In many parts the current is impetuous, and in flood has occasionally wrought much havoc, certain of the inundations being historically important. Its mean discharge of water every minute is estimated to amount to 273,000 cubic ft., a larger output than that of any other stream in the United Kingdom, and would make Dundee at all stages of the tide, and the estuary is navigable to Newburgh by vessels of 500 tons, and as far as Perth by ships of 200 tons. The navigation, however, is seriously obstructed by shifting sandbanks. The estuary varies in width from 1/2 m. at Cairn pier Ferry to fully 3 m. at its mouth. The principal points on the river are Crianlarich on the Fillan (with stations on the West Highland and Callander to Oban railways), Luib and Killin on the Dochart, Kenmore, Aberfeldy, Dunkeld, Birnam, Stanley, Scone, Perth and, on the north shore of the river, below the mouth of the Almond, Kenmore, and on the south shore, Newburgh, Newport and Tayport. It is bridged at Kenmore, Aberfeldy, Logierait, Dunkeld, Caputh and Perth (3). The first railway viaduct across the firth at Dundee was nearly two miles long and had been in use for some eighteen months from the date of its opening in 1877. During the night of the 28th of December 1879, however, while a great gale was at the height of its fury, the passing of a train over the central section gave purchase to the tempest and that portion of the structure was blown down along with the train and the unfortunate travellers. Some 75 to 90 persons are supposed to have perished. The second bridges of somewhat lower height, 2 m. and 73 yds. in length, was erected 60 ft. higher up stream and opened in 1887. The Tay is famous for salmon, the annual catch in the river and estuary being the most valuable in Scotland. There is a hatchery at Hormonfield, close to Luncarty station, 4 m. N. of Perth, for the artificial breeding of salmon, the fish being liberated from the ponds about the age of three years. In respect of riparian scenery the Tay as a whole is the most beautiful river in Scotland, the stretch between Logierait and Cargill, particularly the reaches above and below Dunkeld, being universally admired.

TAY, Loch, the largest lake in Perthshire, Scotland. It is situated about the middle of the county and has a flattened ogee form, with a general trend from N.E. to S.W. It is 134 m. long from Killin at the head to Kenmore at the foot, from 1/2 m. to fully 1 m. wide. The maximum depth is 508 ft., the mean depth 200 ft. The lake lies 355 ft. above the sea, covers an area of 6530 acres, or over 10 sq. m., and has a drainage basin of 232 sq. m., including the overflow from Lochs Dochart and Tushaill. It receives at Killin the rivulet Lochy and 1/2 m. rises near the left bank. There are piers at Killin, Ardeonaig, Lawers, Fernan and Kenmore, at which the steamers call during the tourist season; ferries at Ardeonaig and Lawers; and a coaching road on the left shore and a somewhat longer and more hilly road on the right. At the foot of the lake is an island containing the ruins of the priory which was founded in 1121 by Alexander I. in memory of his wife Sibylia, daughter of Henry I. She was buried here. Loch Tay enjoys great repute for its salmon-fishing.

As for the towns, a town of the province of Tayabas, Luzon, Philippine Islands, 8 m. N. of Lucena, the capital. Pop. of the municipality (1903) 147,740. Tayabas is picturesquely situated on the slopes of the extinct volcano Banájao, and commands a magnificent view of the surrounding country, which is extremely fertile, and is planted in rice and coco-nuts. Its climate, although cool, is very unhealthy, malignant malarial fevers causing a high death-rate. It has a church and convent of large size and massive construction. During the revolt of 1896 a Spanish garrison occupying these buildings withstood a siege of fifty-eight days. Thereafter the garrison was forced to surrender by lack of food. Tagalog and Bicol are the languages spoken. Until 1901 Tayabas was the capital of the province.

TAYGETUS (Tαγέτος or Tαγύτος, mod. St Elias or Pente-daktylon), the highest mountain ridge in the Peloponnese, separating Laconia from Messenia. Height 7000 ft. The highest point is H. Elias; here horses are said to have been sacrificed to Helios.

TAYLOR, ANN (1782-1880), afterwards Mrs. Gilbert, and TAYLOR, JANE (1783-1824), English writers for children, were daughters of Isaac Taylor (1750-1826), were born in London on the 30th of January 1782 and the 23rd of September 1783 respectively. In 1786 the Taylors went to live at Lavenham in Suffolk, and ten years later removed to Colchester. Jane was a lively and entertaining child, and composed plays and poems at a very early age. Their father and mother held advanced views on education, and under their guidance the girls were instructed not only in their father's art of engraving, but in the principles of fortification. Their poems were written in short intervals in the round of each day's occupations. Ann was the older, and wrote for herself to the point of Duenna. She then offered a riddle to a puzzle in the Minor's Pocket Book for 1799, and Jane made her first appearance in print in the same periodical with "The Beggar Boy." The publishers then wrote to Isaac Taylor asking for more verses for children from his family, and the result was Original Poems for Infant Minds (2 vols., 1804-5), by "several young persons," of whom Ann and Jane were the largest contributors. The book had an immediate and lasting success. It went through numerous editions, and was translated into German, Dutch and Russian. The elder Jane Taylor wrote directly for children, and viewed events and morals from the nursery standpoint. They had many imitators, but few serious rivals in their own kind, except perhaps Mrs Elizabeth Turner. They followed up this success with Rhymes for the Nursery (1806), Hymns for Infant Minds (1808, and ed. 1810), a less-known collection, Signor Topsy.
TURRY'S Wonderful Magic Lantern; or, The World Turned Upside Down (1810), and Original Hymns for Sunday School (1812). In 1813 Ann married a Congregational minister, the Rev. Josiah Gilbert, and Jane went to live at Ilfracombe with her brother Isaac. In 1816 Jane returned to Ongar, where the family had been settled for some years, and died there on the 13th of April 1824. Mrs Gilbert died at Nottingham on the 20th of December 1866. Both sisters wrote after their separation, but none of their later works had the same marked interest and shallowed much more than her sister, notably in the Contributions of Q. O. (2 vols., 1824), and in Display, A Tale for Young People (1873); but, though she was generally supposed to be the chief writer of the two, some of the most famous pieces in their joint works, such as "I thank the goodness and the grace," "Meddlesome Matty," "The Notorious Glutton," &c., are by Ann.

The best edition of the Poetical Works of the sisters is that of 1877. There is an excellent edition (1905) of the Original Poems and Others, by Ann and Jane Taylor and Adelaide O'Keeffe, edited by E. V. Lucas, with illustrations by F. D. Bedford.

Abundant information about Ann and Jane Taylor is to be found in: Autobiography and Other Memorials of Mrs Gilbert (2 vols., 1879), edited by her son Josiah Gilbert; Isaac Taylor, Memoirs . . . of Jane Taylor (2 vols., 1879), and the collection by the same editor entitled The Family Pen: Memorials . . . of the Taylor Family of Ongar, vol. ii. (1867).

TAYLOR, BAYARD (1825-1878), American author, was born at Kennett Square in Chester county, Pennsylvania, on the 11th of January 1825. The son of a well-to-do farmer, he received his early instruction in an academy at West Chester, and later at Unionville. At the age of seventeen, he began to practice law in West Chester. A little volume, published at Philadelphia in 1844 under the title Ximenia, or the Battle of the Sierra Morena, and other Poems, brought its author a little cash; and indirectly it did him better service as the means of his introduction to The New York Tribune. With the money thus obtained, and with an advance made to him on account of some journalistic work to be done in Europe, "J. B. Taylor" (as he had up to this time signed himself, though he bore no other Christian name than Bayard) set sail for the East. The young poet spent a happy time in roaming through certain districts of England, France, Germany and Italy; that he was a born traveller is evident from the fact that this pedestrian tour of almost two years cost him only £100. The graphic accounts which he sent from Europe to The New York Tribune, The Saturday Evening Post, and The United States Gazette were so highly appreciated that on Taylor's return to America he was advised to throw his articles into book form. In 1846, accordingly, appeared his Views Afoot, or Europe seen with Knapsack and Staff (2 vols., New York). This pleasant book had considerable popularity, and its author now found himself a recognized man of letters; moreover, Horace Greeley, then editor of the Tribune, placed Taylor on the Tribune staff (1846) thus securing him a certain if a moderate income. His next journey, made when the gold-fever was at its height, was to California, as correspondent for the Tribune; from this expedition he returned by way of Mexico, and, seeing his opportunity, published (2 vols., New York, 1850) a highly successful book of travels, entitled El Dorado; or, Adventures in the Path of Empire. Ten thousand copies were said to have been sold in America, and thirty thousand in Great Britain, within a fortnight from the date of issue. Bayard Taylor always considered himself nearer than his elder sister to the line of the "old-time" literature of his country; and that in 1851 he found himself on the banks of the Nile. He ascended as far as 12° 30' N., and stored his memory with countless sights and delights, to many of which he afterwards gave expression in metrical form. From England, towards the end of 1852, he sailed for Calcutta, proceeding thence to China, where he joined the expedition of Commodore Perry to Japan. The results of these journeys (besides his poetical memorials) were A Journey to Central Africa; or, Life and Landscapes from Egypt to the Negro Kingdoms of the White Nile (New York, 1854); The Lands of the Saracen; or, Pictures of Palestine, Asia Minor, Sicily and Spain (1854); and A Visit to India, China and Japan in the Year 1853 (1855). On his return (December 20, 1853) from these various journeys he entered, with marked success, upon the career of a public lecturer, delivering addresses in every town of importance from Maine to Wisconsin. About two years' experience of this lucrative profession, he again started on his travels, on this occasion for northern Europe, his special object being the study of Swedish life, language and literature. The most noteworthy result was his "Swedish Letters" to the Tribune were also republished, under the title Northern Travel: Summer and Winter Pictures (London, 1857). His first wife, May Agnew, died (1856) within a year of her marriage, and in October 1857 he married Maria Hansen, the daughter of Peter Hansen, the German astronomer. The ensuing winter was spent in Greece. In 1859 Taylor once more traversed the whole extent of the western American gold region, the primary cause of the journey lying in an invitation to lecture at San Francisco. About three years later he entered the diplomatic service as secretary of legation at St Petersburg, and the following year (1863) became chargé d'affaires at the Russian capital. In 1864 he returned to the United States and resumed his active literary labours, and it was at this period that Hannah Thurston (New York, 1863), the first of his four novels, was published. This book had a moderate success, but neither in it nor in its successors did Bayard Taylor betray any special talent as a novelist. In 1874 he went to Iceland, to report for the Tribune the one thousandth anniversary of the first settlement there. In 1876 he was accredited United States minister at Berlin. Notwithstanding the restless passion for travel which had always possessed him, Bayard Taylor was (when not actually en route) sedentary in his habits, especially in the later years of his life. His death occurred on the 19th of December, only a few months after his arrival in Berlin.

Taylor's most ambitious productions in poetry—his Masque of the Gods (Boston, 1872), Prince Deukaiinos; a lyrical drama (Boston, 1878), The Picture of St John (Boston, 1866), Lars; a Pastoral of Norway (Boston, 1873), and The Prophet; a tragedy (Boston, 1874)—are marred by a ceaseless effort to overstrain his power. But he will be remembered by his poetic and excellent translation of Fausi (2 vols., Boston, 1870-71) in the original metres. Taylor fell, in all truth, "the torment and the ecstasy of verse"; but, as a critical friend has written of him, "his nature was so ardent, so full-blooded, that slight and common sensations intoxicated him, and he estimated their value, and his power to transmit it to others, beyond the true value of the sensation and the power. He began to compose, a distinct lyrical faculty: so keen indeed was his ear that he became too insistently haunted by the music of ordinary words; but still it remained to him a constant and firm note of his own. His best short poems are "The Metempsychosis of the Pine" and the well-known Bedouin love-song. In his critical essays Bayard Taylor had himself in no inconsiderable degree been the writer of the first, and been indelibly associated with "that poetic insight which is the vital spirit of criticism." The most valuable of these prose dissertations are the Studies in German Literature (New York, 1879). Collected editions of his Poetical Works and his Dramatic Works were published at Boston, 1888; his Life and Letters (Boston, 2 vols., 1884) were edited by his wife and Horace E. Scudder.

See also Albert H. Smyth, Bayard Taylor (Boston, 1896), in the "American Men of Letters" series; and W. D. Howells's Literary Friends and Acquaintances (1900).

TAYLOR, BROOK (1865-1931), English mathematician, was the son of John Taylor, of Bifrons House, Kent, by Olivia, daughter of Sir Nicholas Tempest, Bart., of Dutham, and was born at Edmonton in London on 26th August 1865. He was educated at his father's College, Cambridge, as a fellow-commoner in 1701, and took degrees of LL.B. and LL.D. respectively in 1700 and 1714. Having studied mathematics under John Machin and John Keill, he obtained in 1708 a remarkable solution of the problem of the "centre of oscillation," which, however, remaining unpublished until May 1714 (Phil. Trans., vol. xxvii. p. 11), his claim to priority was unjustly disputed by John Bernoulli. Taylor's Methodus Incrementorum Directa et Inversa (London, 1715) added a new branch to the higher mathematics, now designated the "calculation of finite differences." Among other ingenious applications, he used it to determine
TAYLOR, Sir Henry

the form of movement of a vibrating string, by him first successfully reduced to mechanical principles. The same work contained the celebrated formula known as "Taylor's theorem" (see INFINITESIMAL CALCULUS), the importance of which remained unrecognized until 1772, when J. L. Lagrange realized its powers and termed it "le principal fondement du calcul différentiel."

In his essay on Linear Perspective (London, 1715) Taylor set forth the true principles of the art in an original and more general form than any of his predecessors; but the work suffered from the brevity and obscurity which affected most of his writings, and needed the elucidation bestowed on it in the treatises of Joshua Kirby (1754) and Daniel Fournier (1761).

Taylor was elected a fellow of the Royal Society early in 1712, sat in the same year on the committee for adjudicating the claims of Sir Isaac Newton and Gottfried Wilhelm Leibnitz, and acted as secretary to the society from the 13th of January 1714 to the 21st of October 1718. From 1715 his studies took a philosophical and religious bent. He corresponded, in that year, with the Comte de Montmort on the subject of Nicolas Malebranche's tenets; and unfinished treatises, "On the Jewish Sacrifices" and "On the Lawfulness of Eating Blood," written on his return from Aix-la-Chapelle in 1719, were afterwards found among his papers. His marriage in 1721 with Miss Brydges of Wallington, Surrey, led to an estrangement from his father, a person of somewhat morose temper, which terminated in 1723 after the death of the lady in giving birth to a son. The ensuing two years were spent by him with his family at Birfons, and in 1725 he married, with the paternal approbation, Sabetta, daughter of Mr. Sawbridge of Olanthig, Kent, who, by a strange fatality, died also in childbed in 1730; in this case, however, the infant, a daughter, survived. Taylor's fragile health gave way; he fell into a decline, died on the 29th of December 1731, at Somerset House, and was buried at St. Ann's, Soho. By his father's death in 1720 he had inherited the Birfons estate. As a mathematician, he was the only Englishman after Sir Isaac Newton and Roger Cotes capable of holding his own with the Bernoullis; but a great part of the effect of his demonstrations was lost through his failure to express his ideas fully and clearly.

A posthumous work entitled Contemplatio Philosophica was printed for private circulation in 1753 by his grandson, Sir William Young, Bart., prefixed by a life of the author, and with an appendix containing extracts from his letters. Several short papers by him were published in Phil. Trans., vols. xxvii. to xxxii., including accounts of some interesting experiments in magnetism and capillary attraction. He issued in 1719 an improved version of his work on perspective with the title of Principles of Linear Perspective, revised by Colson in 1749, and printed again, with portrait and life of the author, in 1811. A French translation appeared in 1753 at Lyons. Taylor's paper (Methodus Incrementorum, p. 168) the first satisfactory investigation of astronomical refraction.


TAYLOR, Sir Henry (1800–1886). English poet and political official, was born on the 18th of October 1800, at Bishop-Middleham, Durham, where his ancestors had been small landowners for some generations. His mother died while he was yet an infant, and he was chiefly educated by his father, a man of studious tastes, who, finding him less quick than his two elder brothers, allowed him to enter the navy as a midshipman. Finding the life uncongenial, he only remained eight months at sea, and after obtaining his discharge was appointed to a clerkship in the storekeeper's office. He had scarcely entered upon his duties when he was attacked by typhus fever, which laid low both his brothers, then living with him in London. In three or four years more his office was abolished while he was on duty in the West Indies. On his return he found his father happily married to a lady whose interest and sympathy proved of priceless value to him. Through her he became acquainted with her cousin, Isabella Ferwick, the neighbour and intimate friend of Wordsworth, who introduced him to Wordsworth and Southey. Under these influences he lost his early admiration for Byron, whose school, whatever its merits, he at least was in no way calculated to adorn, and his intellectual powers developed rapidly. In October 1822 he published an article on Moore's Irish Melodies in the Quarterly Review. In another year he went to London to seek his fortune as a man of letters, and meet with rapid success, though not precisely in this capacity. He became editor of the London Magazine, to which he had already contributed, and in January 1824 obtained, through the influence of Sir Henry Holland, a good appointment in the Colonial Office. He was immediately entrusted with the preparation of confidential state papers, and his opinion soon exercised an important influence on the decisions of the secretary of state. He visited Wordsworth and Southey, travelled on the Continent with the latter, and, at a certain time, mainly through his friend and official colleague, the Hon. Hyde Villiers, became intimate with a very different set, the younger followers of Bentham, without, however, adopting their opinions—"young men," he afterwards reminded Stuart Mill, "who every one said would be ruined by their independence, but who ended by obtaining all their hearts' desires, except one who fell by the way." The reference is to Hyde Villiers, who died prematurely. Taylor actively promoted the emancipation of the slaves in 1833, and became an intimate ally of Sir James Stephen, then counsel to the Colonial Office, afterwards under-secretary, by whom his Act of Emancipation was sombrely framed. His duties at the Colonial Office were soon afterwards lightened by the appointment of James Spedding, with whom he began a friendship that lasted till the end of his life.

His first drama, Isaac Comenius, Elizabethan in tone, and giving a lively picture of the Byzantine court and people, was published anonymously in 1828. Though highly praised by Southey, it made little impression on the public. Philip van Artevelde, an elaborate poetic drama, the subject of which had been recommended to him by Southey, was begun in 1828, published in 1839, and, aided by a large subscription from Lockhart's pen in the Quarterly, achieved extraordinary success. Its great superiority to Taylor's other works may be explained by its being to a great extent the vehicle of his own ideas and feelings. Artevelde's early love experiences reproduce and transfigure his own. Edwin the Fair (1842) was less warmly received; but his character of Dunstan, the ecclesiastical statesman, is a fine psychological study, and the play is full of historical interest. Meanwhile he had married (1839) Theodosia Spring-Rice, the daughter of his former chief Lord Montagle, whom he met at St. James's, and, with Sir James Stephen, had taken a leading part in the abolition of negro slaves. His friend John Stuart India, painted in 1832.

The State Poems, a volume of essays suggested by his official position, had been published in 1836, and about the same time he had written in the Quarterly the friendly notices of Wordsworth and Southey which did much to dispel the conventional prejudices of the day, and which were published in 1849 under the somewhat misleading title of Notes from Books. In 1847 he was offered the under-secretaryship of state for the colonies, which he declined. Notes from Life and The Eve of Conquest appeared in this year; and an experiment in romantic comedy, The Virgin Ideal, with admirable comment from Wordsworth, was published in 1849. A Sicilian Summer, was published in 1850. "The pleasantest play I had written," says the author; "and I never could tell why people would not be pleased with it." His last dramatic work was St. Clement's Eve, published in 1862. In 1869 he was made K.C.M.G. He retired from the Colonial Office in 1872, though continuing to be consulted by government. His last days were spent at Bournemouth in the enjoyment of universal respect; and the public, to whom he had hitherto been an almost impersonal existence, became familiarized with his picturesqueness of appearance in old age, as represented in the photographs of his friend Julius de la Motte Cameron. He died on the 27th of March 1886. His Autobiography, published a year before his death, while sinning a
little by the egotism pardonable in a poet and the garrulity
natural to a veteran, is in the main a pleasing and faithful
picture of an aspiring youth, an active maturity, and a happy
and honoured old age.

Taylor's Artevelde cannot fail to impress those who read it
as the work of a poet of considerable distinction; but, perhaps
for the very reason that he was so prominent as a state official,
he has not been accepted by the world as more than a very
accomplished man of letters. His lyrical work is in general
laboriously artificial, but he produced two well-known songs—
"Quoth the crow: neither maiden nor wife" and "If I had the
wings of a dove."

Taylor's Autobiography (2 vols. 1885) should be supplemented by his
Correspondence (1888), edited by Edward Dowden. His Works
were collected in five volumes in 1877-78.

TAYLOR, ISAAC (1785-1865), English author, son of Isaac
Taylor (1759-1829), engraver and author, was born at Laven-
ham, Suffolk, on the 17th of August 1878. He was trained by
his father to be an engraver, but early adopted literature as a
profession. From 1834, the year of his marriage, he lived a
busy but uneventful life at Stanford Rivers, near Ongar, Essex,
where he died on the 28th of June 1865. His attention was
drawn to the study of the fathers of the church through
reading the works of Sulpicius Severus, which he had picked up
at a bookstall. He published a History of the Transmission
of Ancient Books to Modern Times (1827), a study in biblical
criticism, and some other works, but he attracted little notice
until, in 1829, he published anonymously a book bearing upon
the religious and political problems of the day, entitled The
Natural History of Enthusiasm, which speedily ran through
eight or nine editions. Fanaticism (1833), Spiritual Despotism
(1835), Saturday Evening (1832), and The Physical Theory of
Ancient Life (1836), all commanded a large circulation. In
his Ancient Christianity (1839-46), a series of dissertations in
reply to the "Tracts for the Times," Taylor maintained that
the Christian church of the 4th century should not be regarded
as embodying the doctrine and practice of the apostles because
it was then already corrupted by contact with pagan superstition.
The book met with great opposition, but Taylor did not follow up the
controversy.

Among his other works may be mentioned biographies of Ignatius
Loyola (1845) and John Wesley (1851); a volume entitled The
Discoveries of the Arab Geographers (1851); and a course of lectures on The Spirit
of Hebrew Poetry (1861).

TAYLOR, ISAAC (1829-1901), English philologist, eldest son of the
preceding, was born at Stanford Rivers, 2nd May 1829. He was educated at Trinity College, Cambridge, and took the
mathematical tripos in 1853. His interests, however, were
linguistic rather than mathematical, and his earliest publication
was a translation from the German of W. A. Becker's Charicles.
Though of Nonconformist stock, Isaac Taylor joined the Church
of England, and in 1857 was ordained to a country curacy. In
1860 he published The Liturgy of the Dissenters, an appeal for
the revision of the Book of Common Prayer "on Protestant
lines," "as expedient for the material interests of the Church,
and as an act of plain justice to the Dissenters." His studies
in local etymology bore fruit in Words and Places in Etymological
Illustration of History, Ethnology and Geography (1864). Be-
tween 1865 and 1869, when he was in charge of a Bethnal
Green parish, his philological studies were laid aside, and he
published only The Burden of the Poor and The Family Pen, a
record of the literary work of his own family, the Taylors of
Ongar. In 1869 he became incumbent of a church at Twicken-
ham, and used his comparative leisure to produce his Etruscan
Researches (1874), in which he contended for the Ugrian
origin of the Etruscan language. In 1875 he was presented
to the rectory of Settrington, Yorkshire, and began his systematic
researches into the origin of the alphabet. His Greeks and Goths;
a Study on the Runes (1879), in which he suggested that the
runes were of Greek origin, led to a good deal of controversy.
His most important work is The Alphabet, an Account of the
Origin and Development of Letters (1883; new and revised
dition 1890). Taylor points out that alphabetical changes are the
result of evolution taking place in accordance with fixed
laws. "Epigraphy and palaeography may claim, no less than
philology or biology, to be ranked among the inductive
sciences." He was largely indebted to the Egyptian researches of
Rougé, which it has since become necessary to reconsider in
the light of discoveries in Crete. In 1885 Taylor became canon
of York, and two years later dean. His paper on the Origin of
the Aryans, read at the British Association in 1887, was after-
wards expanded into a book. In the following winter he visited
Egypt, and his letters from there, collected under the title
Egyptian Notes, aroused considerable controversy from the extremely favourable view he took of the Mahommedan religion. For the last few years of his life
Dean Taylor suffered from ill health, and was laid aside from
active work for some time before his death in October 1901.

TAYLOR, GEORGE (1613-1667), English divine and author, was
baptized at Cambridge on the 15th of August 1613. His
father, Nathaniel, though a barber, was a man of some educa-
tion, for Jeremy was "solely grounded in grammar and mathe-
matics." The tradition that he was descended from the Settrington Taylor, who lived in Yorkshire, is now no more.

Taylor was a pupil of Thomas Lovering, at the newly founded Perse grammar
school. Lovering is first mentioned as master in 1619, so that
Taylor probably spent seven years at the school before he was
entered at Gonville and Caius College as a sizar in 1626,1 eighteen
months after Milton had entered Christ's. And while George
Herbert was public orator and Edmund Waller and Thomas
Fulle were undergraduates of the university. He was elected
a Perse scholar in 1628, and fellow of his college in 1633, but
the best evidence of his diligence as a student is the enormous
learning of which he showed so easy a command in after years.
In 1633, although still below the canonical age, he took holy
orders, and, accepting the invitation of Thomas Risden, a
former fellow-student, to supply his place for a short time as
lecturer in St Paul's, he at once attracted attention by his eloquence and by his handsome face. Archbishop Laud sent
for Taylor to preach before him at Lambeth, and took the
professor under his own chaplain, who was no more than
his fellowship at Cambridge before 1636, but he spent, appa-
rently, much of his time in London, for Laud desired that his
"mighty parts should be afforded better opportunities of study
and improvement than a course of constant preaching would
allow of." In November 1635 he had been nominated by
Laud to a fellowship at All Souls, Oxford, where, says Wood
(Athen. Oxon., Ed. Bliss, ill. 781), love and admiration still
waited on him. He seems, however, to have spent little time
there. He became chaplain to his patron the archbishop, and
chaplain to visitors from Charles I. At Oxford William Chilling-
worth was then busy with his great work, The Religion of Pro-
testants, and it is possible that by intercourse with him Taylor's
mind may have been turned towards the liberal movement of
his age. After two years in Oxford, he was presented, in March
1638, by Juxon, bishop of London, to the rectory of Uppingham,
in Rutlandshire. In the next year he married Phoebe Langs-
dale, by whom he had six children, the eldest of whom died
at Uppingham in 1642. In the autumn of the same year he
was appointed to preach in St Mary's on the anniversary
of the Gunpowder Plot, and apparently used the occasion to
clear himself of a suspicion, which, however, haunted him through
life, of a secret leaning to the Romish communion. This
suspicion seems to have arisen chiefly from his intimacy with
Christopher Davenport, better known as Francis a Sancta
Clara, a learned Franciscan friar who became chaplain to Queen

1An obviously erroneous entry in the Admission Book states that he had been at school under Mr. Lovering for ten years, and
was in his fifteenth year. Admissions to Gonville and Caius College
(ed. J. Venn, 1887).
Henrietta; but it may have been strengthened by his known connexion with Laud, as well as by his ascetic habits. More serious consequences followed his attachment to the Royalist cause. The author of *The Sacred Order and Offices of Episcopacy or Episcopal Assay against the Arrians and Aethapli New and Old* (1642), could scarcely hope to retain his parish, which was not, however, sequenated until 1646. Taylor probably accompanied the king to Oxford. In 1643 he was presented to the rectory of Overstone, Northamptonshire, by Charles I. There he would be in close connexion with his friend and patron Spencer Compton, 2nd Earl of Northampton.

During the next fifteen years Taylor's movements are not easily traced. He seems to have been in London during the last weeks of Charles I., from whom he is said to have received his watch and some jewels which had ornamented the ebony case in which he kept his Bible. He was then taken prisoner with other Royalists while besieging Cadigan castle on the 4th of February 1645. In 1646 he is found in partnership with two other deprived clergymen, keeping a school at Newton Hall, in the parish of Llanvihangel-Aberbtythych, Carmarthenshire. Here he became private chaplain to Richard Vaughan, 2nd Earl of Carbery (1600–1680), whose hospitable mansion, Golden Grove, is immortalized in the title of Taylor's still popular manual of devotion, and whose first wife was a constant friend of Taylor. The second Lady Carbery was the original of the "Lady" in Milton's *Comus*. Mrs Taylor had died early in 1651. His second wife, Joanna Bridges, said to have very doubtful authority to have been a natural daughter of Charles I. She owned a good estate, though probably impoverished by Parliamentary exactions, at Mandinam, in Carmarthenshire.

From time to time Jeremy Taylor appears in London in the company of his friend Evelyn, in whose diary and correspondence his name repeatedly occurs. He was three times imprisoned: in 1654–5 for an injudicious preface to his *Golden Grove*; again in Chepstow castle, from May to October 1655, on what charge does not appear; and a third time in the Tower in 1657–8, on account of the indiscretion of his publisher, Richard Royston, who had adorned his "Collection of Offices" with a print representing Christ in the attitude of prayer.

Much of his best work was produced at Golden Grove. In 1646 appeared his famous plea for toleration, *Thologia E'lektivai*, *A Discourse of the Liberty of Prophecying*. In 1649 he published the complete edition of his *Apology for authorized and set forms of Liturgy against the Pretence of the Spirit*, as well as *Great Exemplars of the Holy Art of Prayer* (1650), a book which was inspired, its author tells us, by his earlier intercourse with the Earl of Northampton. Then followed in rapid succession the *Twenty-seven Sermons* (1651), "for the summer half-year," and the *Twenty-five* (1653), "for the winter half-year," *The Rule and Exercises of Holy Living* (1650), *The Rule and Exercises of Holy Dying* (1651), a controversial treatise on *The Real Presence* (1654), the *Golden Grove*; or *A Manuale of daily prayers and laneties* (1655), and the *Unum Necessarium* (1655), which by its Pelagianism gave great offence. *The Discourse of the Name and Things of God* is a manual of Christian practice, which has retained its place with devout readers. The scope of the work is described on the title-page. It deals with "the means and instruments of obtaining every virtue, and the remedies against every vice, and considerations serving to the resisting all temptations, together with prayers containing the whole Duty of a Christian." *Holy Dying* was perhaps even more popular. A very charming piece of work of a lighter kind was inspired by a question from his friend, Mrs Katherine Phillips (the "matchless Orinda"), asking "How far is a dear and perfect friendship authorized by the principles of Christianity?" In answer to this he dedicated to the "most ingenious and excellent Mrs Katherine Phillips" his *Discourse of the Nature, Offices and Measures of Friendship* (1657). *His Doctor Dubitantium, or the Rule of Conscience . . .* (1660) was intended to be the standard manual of casuistry and ethics for the Christian people.

He probably left Wales in 1657, and his immediate connexion with Golden Grove seems to have ceased two years earlier. In 1658, he was offered a lectureship in Lisburn, Ireland, by Edward Conway, second Viscount Conway. At first he declined a post in which the duty was to be shared with a Presbyterian, or, as he expressed it, "where a Presbyterian and myself shall be like Castor and Pollux, the one up and the other down," and to which also a very meagre salary was attached. He was, however, induced to take it, and found in his patron's mansion at Portmore, on Lough Neagh, a congenial retreat.

At the Restoration, instead of being recalled to England, he probably expected to be given certain privileges, he was appointed to the see of Down and Connor, to which was shortly added the small adjacent diocese of Dromore. He was also made a member of the Irish privy council and vice-chancellor of the university of Dublin. None of these honours were sincere. Of the university he writes, "I found all things in a perfect disorder . . . a heap of men and boys, but no body of a college, no one member, either fellow or scholar, having any legal title to his place, but thrust in by tyranny or chance." Accordingly he set himself vigorously to the task of framing and enforcing regulations for the admission and conduct of students and for the discipline of the university, and also of establishing lectureships. His episcopal labours were still more arduous. There were, at the date of the Restoration, about seventy Presbyterian ministers in the north of Ireland, and most of these were from the west of Scotland, and were imbued with the dislike of Episcopacy which distinguished the Covenanting party. No wonder that Taylor, writing to the duke of Ormonde shortly after his consecration, should have said, "I perceive myself thrown into a place of torment." His letters perhaps somewhat exaggerate the danger in which he lived, but there is no doubt that his authority was resisted and his overtures rejected. His writings also were ransacked for matter of accusation against him, "a committee of Scotch spiders being appointed to see if they can gather or make poison out of them." Here, then, was Taylor's opportunity for exemplifying the wise toleration he had in other days inculcated, but the new bishop had nothing to offer the Presbyterian clergy but the bare alternative—submission to episcopal ordination and jurisdiction or deprivation. Consequently, in his first visitation, he declared thirty-six churches vacant; and of these forcible possession was taken by the clergy. At the same time many of the gentry were won by his unbridled charity and devotedness as well as by his eloquence. With the Roman Catholic element of the population he was less successful. Ignorant of the English language, and firmly attached to their ancestral forms of worship, they were yet compelled to attend a service they considered profane, conducted in a language they could not understand. As Heber says, "No part of the administration of Ireland by the English crown has been more extraordinary and more unfortunate than the system pursued for the introduction of the Reformed religion. At the Instance of the Irish bishops Taylor took his book *Discourse of the Name and Things of God* (in two parts, 1664 and 1667), but, as he himself seemed partly conscious, he might have more effectually gained his end by adopting the methods of Ussher and Bedell, and inducing his clergy to acquire the Irish tongue. The troubles of his episcopate no doubt shortened his life. Nor were domestic sorrows wanting in these later years. In 1661 he married, at Lisburn, Edward, the only surviving son of his second marriage. His eldest son, an officer in the army, was killed in a duel; and his second son, Charles, intended for the church, left Trinity College and became companion and secretary to the duke of Buckingham, at whose house he died. The day after his son's funeral Taylor caught fever from a patient whom he visited, and, after a ten days' illness, he died at Lisburn on the 13th of August 1667, in the fifty-fifth year of his age. He was buried at Lisburn in a monument richly ornamented, with the following inscription:

1 See an angry letter by Brian Duppa, bishop of Salisbury, on the subject (Eden i. xliii.).
his life and the seventh of his episcopate, and was buried in the cathedral of Dromore. Taylor's fame has been maintained by the popularity of his sermons and devotional writings rather than by his influence as a theologian or his importance as an ecclesiastic. His mind was neither scientific nor speculative, and he was attracted rather to questions of casuistry than to the problems of pure theology. His wide reading and capacious memory enabled him to quote extensively from his religious reading, and supplied him with material for building up a completely designed and enduring edifice of systematized truth. Indeed, he had very limited faith in the human mind as an instrument of truth. "Theology," he says, "is rather a divine life than a divine knowledge." His great plea for toleration is based on the impossibility of exciting theology into a demonst proper home. It is one possible all should be of one mind. And what is impossible to be done is not necessary it should be done." Differences of opinion there must be; but "heresy is not an error of the understanding but an error of the will." He would submit all minor questions to the reason of the individual member, but he set certain limits to toleration, excluding "whatever is against the foundation of faith, or contrary to good life and the laws of obedience, or destructive to human society, and the public and just interests of bodies politic." Peace, he thought, might be made "if men would not call all opinions heresy." The nature of fundamental articles. Of the propositions of sectarian theologians he said that confidence was the first, and the second, and the third part. Of a genuine poetic temperament, fervid and mobile in feeling, and of a prolific fancy, he had also the sense and wit that come of varied contact with men. All his gifts were made available for influencing other men by his easy command of a style rarely matched in dignity and colour. With all the majesty and stately elaboration and musical rhythm of Milton's finest prose, Taylor's style is relieved and brightened by an astonishing variety of felicitous illustrations, ranging from the most dignified and elaborated his sermons especially abound in quotations and allusions, which have the air of spontaneously suggesting themselves, but which must sometimes have baffled his hearers. This seeming pedantry is, however, atoned for by the clear practical aim of his sermons, the noble ideal he keeps before his hearers, and the skill with which he handles spiritual experience and urges incentives to virtue.

The whole works of... Jeremy Taylor with a life of the author and a critical examination of his writings was published by Bishop Robert Anderson, who revised the text. Page Eden (1847-54). His most popular works, The Liberty of Prophesying, Holy Living, and Holy Dying have been often reprinted. The Poems and Verse-translations of Jeremy Taylor were edited by Dr. A. B. Grosart in vols. of the Miscellaneous of the Fuller Worthies Library (1870). The first biographer of Jeremy Taylor was his friend and successor, George Rust, who preached a funeral sermon (in 1662) which remains a valuable document. His life has been written by John Wheeldon (1703), H. K. Bonney (1815), T. S. Hughes (1831), R. H. Willmott (1847), George L. Duyckinck (New York, 1860). The chief authority is still Eden's revision of Bishop Heber's memoir, which includes much valuable correspondence. See also E. W. Gosse's Jeremy Taylor (1904) in the English Men of Letters series. A bibliography of works dealing with the subject is included in the article by the Rev. Alexander Grosart in the Victoria National Biography. S. T. Coleridge was a diligent student and a warm admirer of Jeremy Taylor, whom he regarded as one of the great masters of English style. A series of comments by Coleridge are collected in his Literary Remains (1858, vol. iii. pp. 263-390).

TAYLOR, JOHN (1580-1653), English pamphleteer, commonly called the “Water-Poet,” was born at Gloucester on the 24th of August 1580. His father was a small officer to John, who served (1596) in Essex's fleet, and was present at Flodden in 1519 and at the siege of Cadiz. On his return to England he became a Thames waterman, and was at one time collector of the perquisites exacted by the lieutenant of the Tower. He was an expert in the art of self-advertisement, and achieved notoriety by a series of eccentric journeys. With a companion as feather-brained as himself he journeyed from London to Queenborough in a paper boat, with two stockfish tied to canes for oars. The Pennyles Pilgrimage, or the Moneyless Perambulation of John Taylor ... how he traveled on foot from London to Edinborough in Scotland ... 1618, contains the account of a journey perhaps suggested by Ben Jonson's celebrated undertaking, though Taylor emphatically denies any intention of burlesque. He went as far as Aberdeen. At Leith he met Jonson, who good-naturedly gave him twenty-two shillings to drink his health in England. Other travels undertaken for a wager were a journey to Prague, where he is said to have been entertained (1620) by the queen of Bohemia, and those described respectively in A very merry, wherry ferry voyage, or Yorke for my money, and A New Discovery by sea with a Wherry from London to Salisbury (1623). At the outbreak of the civil war Taylor began to keep a public-house at Oxford, but when his friends the Royalists were obliged to surrender the city he returned to London, where he set up a similar business at the sign of “The Crown” in Phoenix Alley, Long Acre. At the time of the king's execution he changed his sign to the Mourning Crown, but the authorities objected, and he substituted his own portrait. He was buried in the churchyard of St Martin's-in-the-Fields on the 3rd of December 1653.

Taylor gave himself the title of “the king's water-poet and the most famous water-man.” He was not a poet, though he could string rhymes together on occasion. His style lay in a coarse, rough and ready wit, a talent for narrative, and a considerable command of repartee, which made him a dangerous enemy. Thomas Coryate, the author of the Crudities, was one of his favourite butts, and he roused Taylor's special anger because he persuaded the authorities to have burnt one of Taylor's pamphlets directed against him. This was Laugh and be Fat (1617?), a parody of the Odeonchan Banquet.

Sixty-three of Taylor's works appeared in one volume in 1630. This was reprinted by the Spenser Society in 1868-9, being followed by other tracts not included in the collection (1870-8). Some of his more amusing productions were edited (1872) by Charles Hindle in The Works of John Taylor. They provide some very entertaining reading, but in spite of the legend on one of his title-pages, “Lastly that (which is Rare in a Traveller) all is true,” it is permissible to exercise some mental reservations in accepting Mr. Hindle's conclusions. The other tracts of Taylor's in his Miscellaneous of the Fuller Worthies Library (1870).

TAYLOR, JOHN (1704-1766), English classical scholar, was born at Shrewsbury on the 22nd of June 1704. His father was a barber, and, by the generosity of one of his customers, the son, having received his early education at the grammar school of his native town, was sent to St John's College, Cambridge. In 1732 he was appointed librarian, in 1734 registrar of the university. Somewhat late in life he took orders, became rector of Lawford in Essex in 1751, and canon of St Paul's in 1757. He died in London on the 4th of April 1766. Taylor is best known for his editions of some of the Greek orators, chiefly valuable for the notes on Attic law, e.g. Lysias (1730); Demosthenes Contra Leptinum (1741) and Contra Midimius (1743, with Lycurgus Contra Leocratem), intended as specimens of a proposed edition, in five volumes, of the orations of Demosthenes, Aeschines, Dinarchus and Demades, of which only vols. ii. and iii. were published. Taylor also published (under the title of Marmor Sandyscum) a commentary on the inscription on an ancient marble brought from Greece by Lord Sandwich, containing particulars of the receipts and expenditure of the Athenian magistrates appointed to celebrate the festival of Apollo at Delos in 574 B.C. His Elements of Civil Law (1755) also deserves notice. It was deeply attacked by Wharton in his Divine Legation, professedly owing to a difference of opinion in regard to the persecution of the early Christians, in reality because Taylor had spoken disparagingly of his scholarship.
TAYLOR, JOSEPH—TAYLOR, ROWLAND

TAYLOR, JOSEPH (c. 1586-c. 1653), English actor, is mentioned in the folio Shakespeare of 1623 as one of the twenty-six who took principal parts in all of these plays. There is a legend that he was trained by Shakespeare to play Hamlet, and that he succeeded Burbage in this and other parts. Certain it is that in many of Beaumont and Fletcher's plays he played a leading rôle, and he is one of the ten actors who signed the dedication of the first folio of these dramatists (1647).

TAYLOR, MICHAEL ANGELO (1757-1834), English politician, was a son of Sir Robert Taylor (1714-1748), the architect, and was educated at Corpus Christi College, Oxford, becoming a barrister at Lincoln's Inn in 1774. He entered the House of Commons as member for Poole in 1784, and, with the exception of a short period of imprisonment (1789) for incurring the displeasure of parliament until 1834, although not as the representative of the same constituency. In parliament Taylor showed himself anxious to curtail the delays in the Court of Chancery, and to improve the lighting and paving of the London streets; and he was largely instrumental in bringing about the abolition of the pillory. At first a supporter of the younger Pitt, he soon veered round to the side of Fox and the Whigs, favoured parliamentary reform, and was a personal friend of the regent, afterwards George IV. He was on the committee which managed the affairs of the East India Company. He was made a privy councillor in 1831; and died in London on the 16th of July 1834. Taylor is chiefly known in connexion with the Metropolitan Paving Act of 1817, which is still referred to as "Michael AngeloTaylor's Act." Often called "Chicken Taylor" because of his reference to himself as a "mere chicken in the law," he is described by Sir Spencer Walpole as "a pompous barrister, with a little body and a loud voice." Taylor's father, Sir Robert, was the founder of the Taylorian Institution at Oxford.

TAYLOR, NATHANIEL WILLIAM (1786-1859), American Congregational theologian, was born in New Milford, Connecticut, on the 23rd of June 1786, grandson of Nathaniel Taylor (1722-1800), pastor at New Milford. He graduated at Yale College in 1807, studied theology under Timothy Dwight, and in 1812 became pastor of the First Church of New Haven. From 1822 until his death in New Haven on the 10th of March 1859 he was Dwight professor of didactic theology at Yale. He was the last notable representative of the New England School, in which his predecessors were the younger Edwars, John Smalley (1734-1820) and Nathaniel Emmens. In the Yale College, with influence, he had been one of his predecessors, Bennet Tyler (1783-1858), founded in East Windsor a Theological Institute to offset Taylor's teaching at Yale.

Taylorism, sometimes called the "New Haven" theology, was an attempt to defend Calvinism from Armenian attacks, and the defence itself was an attack of Armenianism and Pelagianism by A. A. Hodge of Princeton and Leonard Woods of Andover. Taylor's theology was distinctively infra-lapsarian; it disagreed with Samuel Hopkins and Emmens in rejecting the theory of "divine efficiency and in arguing that man can choose the right "even if he won't"—distinguishing Edwards between natural ability and moral inability; it distinguished sensibility or susceptibility as something different from will or understanding, without moral qualities, to which the appeal for right choice may be made; and it made self-love (a term borrowed from Dugald Stewart, connecting the innocent love of happiness and distinct from selfishness) the particular feeling appealed to by the inductiveness of the law and grace.

He wrote Practical Sermons (1858; edited by Noah Porter); Lectures on the Moral Government of God (2 vols., 1859), and Essays and Lectures upon Select Topics in Revealed Theology (1859), all published posthumously.

TAYLOR, PHILIP MEADOWS (1808-1876), Anglo-Indian administrator and novelist, was born at Liverpool on the 25th of September 1808. At the age of fourteen he was sent to England to become a clerk to a Bombay merchant. On his arrival the house was in financial difficulties, and he was glad to accept in 1824 a commission in the service of his highness the nizam, to which service he remained devotedly attached throughout his long career. He was speedily transferred from military duty to a civil appointment, and in this capacity he acquired a knowledge of the languages and the people of Southern India which has seldom been equalled. He studied the laws, the geology, the antiquities of the country; he was alternately judge, engineer, artist, and man of letters, for on his return to India in 1849 on furlough he published the first of his Indian novels, Confessions of a Thug, in which he reproduced, with singular vivacity and truth, the scenes which he had heard described by the chief actors in them. This book was followed by a series of tales, Tipoo Sultan (1840), Tara (1843), Ralph Darnell (1845), Seeta (1872), and A Noble Queen (1878), all illustrating periods of Indian history and society, and giving a prominent place to the native character, for which the Indian institutions and traditions he had a great regard and respect. Returning to India he acted from 1849 to 1853 as Indian correspondent for the Times. He also wrote a Student's Manual of the History of India (1879). About 1859, Meadows Taylor was appointed by the nizam's government to administer, during a long minority, the principality of the young raja of Shorapore. He succeeded without any European assistance in raising this small territory to a high degree of prosperity, and such was his influence with the natives that on the occurrence of the mutiny in Bengal he held his ground without military support. Colonel Taylor, whose merits were now recognized and acknowledged by the British government of India—although he had not been in the service of the company—was subsequently appointed to the deputy commissionership of the Western ceded districts, where he succeeded in establishing a new assessment of revenues at once more equitable to the cultivators and more productive to the government. By indefatigable perseverance he had raised himself from the condition of a half-educated lad, without patronage, and without even the support of the Company, to the successful government of some of the most important provinces of India, 36,000 square miles in extent and with a population of more than five millions. On his retirement from service in 1860 he was made a C.S.I. and given a pension. Taylor died at Mentone on the 17th of May 1876. See Meadows Taylor's The Story of My Life (1877).

TAYLOR, ROWLAND (d. 1555), English Protestant martyr, was born at Rothbury, Northumberland; he took minor orders at Norwich in 1528 and graduated LL.B. at Cambridge in 1530 and LL.D. in 1534. Adopting reformed views he was made chaplain by Cranmer in 1540 and presented to the living of Hadleigh, Suffolk, in 1544. In Whitsun week, 1547, he preached a "notable sermon," at St Paul's Cross, and was given the third stall in Rochester cathedral. In 1549 he was placed on a commission to examine Anabaptists, and in 1551 he was appointed Vicar of Hadleigh and Bishop Ridley, select preacher at Canterbury, and a commissioner for the reform of the canon law; in 1552 Coverdale made him archdeacon of Exeter. Apparently he advocated the cause of Lady Jane Grey, for on the 25th of July 1553, only six days after Mary's proclamation as queen, he was committed to the custody of the sheriff of Essex. He was released not long afterwards, and with the support of his parishioners offered strenuous resistance to the restoration of the Mass. He was consequently imprisoned in the King's Bench prison on the 26th of March 1554. The sturdy protestation of Taylor, and his flock, who seem to have caused various commotions, marked him out for the special hatred of Mary's government; and he was one of the first to suffer when in January 1555 parliament had once more given the clerical courts liberty of jurisdiction. He was sentenced on the 22nd, excommunicated on the 29th, degraded by Bonner on the 4th of February, and burnt on the 9th at Aldham Common near Hadleigh. His blameless character had made a great impression on his age, and he was commemorated in many popular ballads. He was regarded as the ideal of a Protestant parish priest; he was married and had nine children. The alleged descent of Jeremy Taylor from him has not been proved. See Thomas Quinton Stow's Memoirs of Rowland Taylor (1833); Dict. of Nat. Biog. iv. 463-4, and authorities there cited. (A. F. P.)
TAYLOR, THOMAS (1758–1832), English writer, generally called "the Platonist," was born in London on the 15th of May 1758, and lived there till his death on the 1st of November 1832. He was sent to St Paul's school, but was soon removed to Sheerness, where he spent several years with a relative who was engaged in the dockyard. He then began to study for the dissenting ministry, but an ignorant marriage and pecuniary difficulties compelled him to abandon the idea. He became a schoolmaster, a clerk in Lubbock's banking-house, and from 1796–1806 was assistant secretary to the society for the encouragement of arts, manufactures and commerce, which post he resigned to devote himself to the study of philosophy. He had the good fortune to obtain the patronage of the duke of Norfolk and of a Mr Meredith, a retired tradesman of literary tastes, who assisted him to publish several of his works. These mainly consisted of translations of the whole or part of the writings of Aristotle, Plato, Plotinus, Proclus, Pausanias, Porphyry, Ocellus Lucanus, and the Orphic hymns. His efforts were unavailing—almost contemptuously—received, but, in spite of defects of scholarship and lack of critical faculty, due recognition must be awarded to the indomitable industry with which he early convulsed his mind. He refers to the "Western Plctho" in Isaac Disraeli's "Curiosities of Literature" and in his novel "Varrius," and as "England's gentle priest" in Mathias's "Pursuit of Literature."

TAYLOR, TOM (1817–1880), English dramatist and editor of Punch, was born at Bishop Wearmouth, near Sunderland, on the 19th of October 1817. After attending school there and studying for two sessions at Glasgow University, he in 1837 entered Trinity College, Cambridge, of which he became a fellow. Subsequently he held for two years the professorship of English literature at University College, London. He was known already for early dramatic pieces, and in 1840 he published "The Modern Plutarch" and "The World of the Ancients" in his novel "Varrius," and as "England's gentle priest" in Mathias's "Pursuit of Literature."

TAYLOR, WILLIAM (1765–1836), English man of letters, served in the Navy in that city on the 7th of November 1765. He belonged to the Unitarian community, and went to a school kept at Palgrave, Suffolk, by Rochemont Barbauld, husband of Anna Letitia Barbauld, where Frank Syens (1763–1817) was among his schoolmates. He travelled on the Continent for some years to perfect himself in foreign languages. William Taylor and his father were both in sympathy with the French Revolution, and belonged to a "revolution society" at Norwich. In 1791 the disturbed condition of affairs induced the elder Taylor to wind up his business and return to Norwich. He devoted himself to literature. He was an enthusiastic German poet, and did great service to English literature by translations of Bürger's Lenore (1790, printed 1796), of Lessing's Nathan the Wise (1790, printed 1805), of Goethe's Iphigenia in Tauris (1790, printed 1793), and of four of Wieland's Dialogues of the Gods (1795). He was a prolific writer of review articles, in which his knowledge of foreign literature served as a useful standard of criticism. Much of this material was made use of in his most important work, his "Historic Survey of German Poetry" (3 vols., 1829–30). He also edited the works of his friend Sayers in a memoir (1823). He died at Norwich on the 5th of March 1836.

TAYLOR, ZACHARY (1784–1850), twelfth president of the United States, was born in Orange county, Virginia, on the 24th of September 1784. During the following year his father, Colonel Richard Taylor, a veteran of the War of Independence, migrated to Kentucky, settling near Louisville, and thereafter played an important part in the wars and politics of his adopted state. The boyhood and youth of Zachary Taylor were thus passed in the midst of the stirring frontier scenes of early Kentucky, and from this experience he acquired the hardihood and resoluteness that characterized his later life, although he inevitably lacked the advantages of a thorough education. In May 1823 he was commissioned as first lieutenant in the 7th United States Infantry, and for the next few years was employed in routine duties. Early in 1812 he was made captain, and during the ensuing hostilities with Great Britain distinguished himself by his gallant defence against the Indians of Fort Harrison, a stockade in central Indiana. For this he was breveted major, and in May 1814 received a regular major's commission, but being reduced at the conclusion of the war to the rank of captain, temporarily left the service. In May 1816 he was reinstated as major, and in 1819 was promoted to be a lieutenant-colonel; and in the routine discharge of his duties he was stationed at various posts on the western frontier. In 1832, as colonel, he took part in the Black Hawk War, and was the officer to whom Black Hawk surrendered; later he occasionally acted as Indian agent along the upper Mississippi.

In 1836 Taylor was ordered from Wisconsin to take command against the Seminoles in Florida. On the 25th of December 1837, after a difficult campaign, he inflicted a severe defeat upon the Indians at the battle of Okeechobee, and for this was breveted brigadier-general. Then followed four years of haraasing service in the Florida Territory. In May 1842 he assumed command of the First Department of the army, with headquarters at Fort Jefferson, Louisiana.

While at New Orleans in 1843, Taylor received orders from President Polk to march his troops into Texas, as soon as that state should accept the terms of annexation proposed by the Joint Resolution of Congress of March 2, 1845. Later in June Polk, who assumed that the Rio Grande rather than the Nueces was the south-western boundary of Texas, ordered him to take up a position at the mouth of the Sabine, or at some other
point best suited for an advance to the former river. By the middle of August Taylor had selected a position at Corpus Christi, on the west bank of the Nueces and within the disputed territory, and here he remained until the following spring. Upon the definite refusal of the Mexican government under Paredes to resume with the United States the diplomatic relations broken off by the annexation of Texas, Taylor was ordered to advance to the Rio Grande for the purpose of anticipating any hostile incursion from Mexico. He himself favoured such a movement if the United States was to maintain its claim as regards the boundary. In obedience to his instructions he left Corpus Christi on the 12th of March 1846, fortified Point Isabel as a base of supplies, and took up his position on the disputed river, opposite the Mexican town of Matamoros. Here he began to construct Fort Texas, afterwards called Fort Brown, upon the present site of Brownsville. The commander of the Mexican Army of the North, Ampudia, immediately summoned him to retire behind the Nueces under the threat of interpreting his advance as an invasion of Mexican territory. Taylor not only disregarded this summons, but within the following week proceeded to blockade the Rio Grande. Hostilities were then unavoidable, and the first passage at arms occurred on the 24th of April 1846, when a large force of Mexicans on the east bank of the Rio Grande ambushed and captured a small party of American dragoons under Captain Seth B. Thornton (1814—1847). The news of this event led President Polk, on the 13th of May, to recommend a formal declaration of war on the ground that it existed "by the act of Mexico herself," for that power "has passed the boundary of the United States, has invaded our territory and shed American blood upon American soil." This statement was incorporated in the bill declaring war, and although severely criticized during the Senate debate, passed both houses of Congress by overwhelming majorities.

Meanwhile Taylor had strengthened his base of supplies at Point Isabel, where he was reinforced by militia from Texas and Louisiana, and during the return march from this post he was fiercely attacked at Palo Alto (about 8 m. N.E. of Brownsville, Texas) on May 8th, by the Mexicans under Arista. The latter was easily driven from the field, but on the following day threatened Taylor's advance in a much stronger position, Resaca de la Palma (about 4 m. N. of Brownsville). A brilliant charge by the dragoons under Captain May decided this contest, which Taylor followed up by a pursuit of the Mexican general to the Rio Grande. After relieving Fort Brown, which had been besieged since the 3rd of May, Taylor himself crossed the river, and on the 18th of May, Matamoros, from which Arista had already retreated to Monterrey.

As it was the intention of the administration to wage war for the purpose merely of bringing Mexico to negotiate, Taylor did not immediately advance southward from the Rio Grande. When, however, Mexico persisted in her refusal to treat, Polk decided to conquer her northern provinces. Taylor formed a new base of operations at Camargo, farther up the river, and from this point, in August began an advance towards Monterrey, the capital of Nuevo León. After hard fighting he occupied this city in the latter part of September. See Map Section II. The truce with which he followed up this success was unacceptable to the administration, and upon receiving notice to resume hostilities, he occupied Saltillo, the capital of Coahuila, and Victoria, the capital of Tamaulipas, thus completing the conquest of the north-eastern states of Mexico. By this time Taylor had been reinforced by some 3000 troops which had marched under Gen. John E. Wool from San Antonio directly towards Chihuahua, but which had been deflected at Monclova to be known as "army of occupation." During the war he was brevetted major-general (May 18, 1846), and Congress thrice passed votes of thanks and ordered the presentation of commemorative gold medals. President Polk distrusted Taylor because of his supposed Whig views, and now began to express his dissatisfaction with the general's failure to take full advantage of his victories and his hesitancy to suggest a plan for the future conduct of the war. Taylor was unwilling to lead his own army farther into the desert interior of Mexico and remained non-committal upon the projected attempt from Vera Cruz. When Polk finally determined upon the latter campaign, he selected Gen. Winfield Scott, although the latter was personally unacquainted to himself, as its leader, and despite Taylor's protests detached most of his experienced troops to join Scott's command. Meanwhile through the connivance of the American authorities, Santa Anna returned from his Cuban exile, and, as the newly elected Mexican president, disregarding his pledges to aid Polk in bringing about a satisfactory peace, prepared to wage a more effective war against the American invaders. Learning of the weakened condition of Taylor's force he made a sudden advance to the northward, with some 20,000 troops, and on the 22nd of February 1847 encountered Taylor with one-fourth that number at Buena Vista, a few miles beyond Saltillo. The all-day battle in the narrow mountain pass was the most stubbornly contested of the whole war, and the brilliant victory of Taylor over such odds made "Old Rough and Ready," as he was called by his troops, the hero of the hour. With this encounter the serious work of his "army of occupation" ended, although he was later joined by Gen. Alexander W. Doniphan's troops, who had marched from New Mexico rio Chihuahua. Taylor's brilliant victory, won when he was so greatly handicapped by Polk, emphasized the popular discontent which that president's policy had already generated and suggested that the Whig leaders were more disposed to listen. The general, however, had passed his mature years wholly in military service and had never voted, much less strongly allied himself, with any political party. Nevertheless when Taylor meetings became the fashion and newspapers began to advocate his nomination, party lines threatened to disappear despite the frantic efforts of the old-time chiefs of the two leading organizations to stem the tide against the popular favourite. The Democratic party with its more efficient machinery prevented a stampede of its rank and file, but the Whigs were less successful. Within a month after his victory over Santa Anna a Whig convention in Iowa nominated him for the presidency, and public meetings in Kentucky, Ohio, Virginia, Pennsylvania and elsewhere quickly took similar action, in many cases without regard to party lines. Taylor first adopted a course of discouraging these suggestions and emphasized his non-partisan attitude, but later gave way to the pressure, and issued a statement that proved satisfactory to the majority of the Whig politicians. Yet it required four ballots in the national convention to overcome the reluctance of Webster's, Clay's and Scott's followers and secure the party designation for Taylor. The success of these last leaders was more or less counterbalanced, however, by the split of the New York Democrats over the slavery question, which assured Taylor of the vote of that state. His residence in Louisiana, his ownership of a large plantation with its slaves, and his family connexion with Jefferson Davis (who had married his daughter), rendered him more acceptable to many of the Southern Democrats than their party candidate, Lewis Cass, an advocate of "squatter sovereignty" and the representative of the democracy of the free North-West. As a result Taylor carried eight states to the Whigs were less successful. Within a month the Whigs were less successful. Within a month after states the conditions were exactly reversed. He received a majority of electoral votes on each side of the Mason and Dixon line and was confirmed in his preconceived opinion that he was to be the president of the whole people. Both parties had attempted to avoid the burning slavery issue,—the Whigs by adopting no platform whatever and the Democrats by trusting to the well-known views of their candidate, but the political leaders in Congress could not escape the many definite questions presented by the possession of the territory newly acquired from Mexico. The Wilmot Proviso and the bill to organize the territory of Oregon had already aroused both sections and had given occasion for Webster and Calhoun to state their respective views upon the constitutional questions involved. The three weeks' contest over the election of a
speaker in the House of Representatives, in December 1849, emphasized the sectional passions already engendered. Under the circumstances the first message from President Taylor was awaited with great interest. While advising Congress to "abstain from the introduction of those exciting topics of sectional character which have hitherto produced painful apprehensions in the public mind," he favoured the admission of California as a free state, and counselled the legislators to avoid "disturbances of people of different sentiments in the slavery question. As he had already encouraged California to form the state government it desired, and later took a strong position against the efforts of Texas to possess itself of part of New Mexico, it was apparent that he was less inclined to favour the radical pro-slavery programme than his previous career had seemed to promise. This was still further emphasized by his marked friendship for William H. Seward and his contemptuous reference to the territorial portion of Clay's compromise measures as the Omnibus Bill." This situation militated greatly against that leader's cherished policy, and led him to a bitter criticism of the president on the floor of the Senate. Such was the situation when the president, early in July 1850, was stricken by the disease to which he succumbed on the 9th. His remains were temporarily interred at Washington, but afterwards removed to the family cemetery near Louisville.

The only son that survived him, Richard Taylor (1820-1879), popularly known as "General Dick," graduated at Yale in 1845, entered the Confederate army at the beginning of the Civil War, was commanding officer in Louisiana, and under Kirby Smith helped to subdue the wild and unruly portion of the Confederacy, after the fall of Vicksburg. He won the victory of Sabine Cross Roads over the Union expedition under Gen. N. P. Banks on the 8th of April 1864. He finally surrendered to Gen. E. R. S. Canby on the 4th of May 1865. He wrote Destruction and Reconstruction (1879).

H. Montgomery's Life (Auburn, 1893) and John Frost's Life (New York and Philadelphia, 1847) are almost wholly devoted to President Taylor's military career, and are excessively laudatory in character. A better biography is that (New York, 1892) by Maj.-Gen. O. O. Howard, in the "Great Commanders" series. There is much material about Taylor in the general histories of M. Master, Von Holst, and Rhodes.

TAYLOR, a town in Williamson county, Texas, U.S.A., about 33 m. N.E. of Austin. Pop. (1890) 2584; (1900) 4213 (1260 negroes); (1910) 5314. It is served by the International & Great Northern and the Missouri, Kansas & Texas railways. It is in a region especially devoted to the growing of cotton and grain and to poultry raising, and an annual county fair is held here. In the city are machine and car shops of the International & Great Northern railway, and cotton-compresses, and there are manufactures of cotton-seed oil, &c. Taylor, named in honour of Gen. Zachary Taylor, was founded in 1876, and was incorporated in 1882.

TAYPORT, a police burgh of Fife-shire, Scotland. Pop. (1901) 3325. It is situated on the Firth of Tay, here about 1 m. wide, opposite to Broughty Ferry, with which there is communication by means of a ferry, 53 m. N. of Leuchars Junction by the North British railway. Its older name alternative of Ferry Port on Craig has reference both to its uses and its site. Its industries include manufactures of linen and jute, spinning mills, engineering works, timber-yard and salmon fishery. In other respects it is a residential quarter for Dundee. A mile S.W. is the ancient site of the Burgh of Tayport, which belonged to Archb. Sharp (1613-1679), of whose mansion there are still some traces. Two miles and a half W. by S. is the police burgh of Newport (pop. 2860), with stations at Easter and Wester Newport, on the North British Railway Company's loop line from Leuchars Junction to Wornet. It lies on the Firth of Tay opposite to Dundee, with which there is communication by means of a ferry, as well as by rail via the Tay Bridge. Even to a greater extent than has Tayport, it has practically become a suburb of Dundee. Its small harbour was designed by Telford. Two and a quarter miles S.W. of Wornet, the nearest railway station, close to the southern terminus of the Tay Bridge, is the village of Balmerino (Gaelic, "Town on the seashore"). Its once considerable shipping trade has declined, but some fishery is still carried on. In 1227 Eremenzarde, widow of William the Lion, and her son Alexander II. founded a Cistercian Abbey here, but in 1604 the Abbey estates were converted into a temporal lordship in favour of James Elphinstone, created Lord Balmerino.

TAY, the Roman name of the city of Ctesiphon, which was given to the town of the province of Panassagian, Lycon, the site of the ancient town of Ctesiphon, situated near the river Tchernaiev, the capital. Pop. (1905) 19,400. The river furnishes water for irrigating the low fields in the vicinity. The town's inhabitants are farmers, and rice is the principal crop. Panassagian and Ilocano are the languages spoken.

TASSA (Ital., cf. Fr. lasse, Ger. Tasse, cup; all from Persian tas, goblet), a word generally adopted by archaeologists and connoisseurs for a type of drinking vessel. It is a shallow saucer-like dish either mounted on a stem and foot or on a foot alone.

TCHERNAIEV, MIKHAIL GREGORIOVICH (1828-1908), Russian general, the Russia of a noble family, was born 24th of October 1828. Educated at the Nicholas Staff College, he entered the army in 1847, and distinguished himself in the Crimean war and in the Caucasus. After serving as divisional chief of the staff in Poland, he went to Orenburg in 1858 as assistant to the commander of the line of the Syr-Darya, and the following year commanded an expedition to support the Kirghiz tribes on the borders of the Sea of Aral against the Khivans. He did duty on the staff of the army of the Caucasus for a time, and returned to Orenburg as chief of the staff. In 1864, having reached the rank of major-general, he made his famous march with 1000 men across the steppes of Turkestan to Chimbent in Khokand, to meet another Russian column from Semipalatinsk, in Siberia, in conjunction with which he successfully stormed Chimbent, and then unsuccessfully attacked Tashkent, 80 miles farther south. Wintering at Chimbent, he captured Tashkent the following year. This was contrary to his instructions, and although he was received in St Petersburg with enthusiasm, and presented with a sword of honour by the emperor, he was not again employed in the military service, and retired from it in July 1874. He bought, and edited with great success, the Russkii list in Slavonic interests, devoting himself to the Panslavic idea. In the summer of 1876 he was appointed commander-in-chief of the Servian army, but on entering Turkey was driven back by Osman Pasha, who followed him into Servia, defeating him at Zayechar and Yavor in July, and the campaign in Servia proved disastrous. He rashly proclaimed Milan king of Servia in September, and in October Aleksinats and Deligrad were in the hands of the Turks, and the road open to Belgrade. An armistice was concluded, and Tchernaiev resigned his command. In 1877 he visited Austria in connexion with his propaganda, but was expelled, and confined for a time in France. In 1879 he organized a Bulgarian rising, but was arrested at Adrianople and sent back to Russia. He succeeded Kaufmann (q.v.) as governor of Turkestan in 1882, but his aggressive policy led to his recall two years later, when he was appointed a member of the council of war at St Petersburg. In 1886 his opposition to the Central Asian Military railway caused him to lose his seat in the council. He died on the 16th of August 1898, at his country seat in the province of Mogilev.

The publications include: Voyage scientifique dans l'Altai oriental et les parties adjacentes de la frontière de Chine (with atlas, 1845); Atlas Miniere; description physique, statistique et archéologique de cette contrée (4 vols. with 3 atlases, 1853-60); Le Boisphore et Constantinople (1864, another ed. 1877); Considerations géologiques sur les îles Centrales (1870); and Espagne, Algérie et Tunisie (1886).
TEA (Chinese cha, Amoy dialect íè), the name given to the leaves of the tea bush (see below) prepared by decoction as a beverage. The term is by analogy also used for an infusion or decoction of other leaves, e.g., camomile tea; and similarly for the afternoon meal at which tea is served.

Historical.—The early history of tea as a beverage is mainly traditional. The lack of accurate knowledge regarding the past of the Chinese Empire may possibly some day be supplied, as European scholars become more able to explore the unvisited stores in the great Chinese libraries, or as Chinese students rank-sack the records of their country for the facts of earlier periods. It may then be learnt who made the first cup of tea, who planted the earliest bushes, and how the primitive methods of manufacture were evolved. In the absence of first-hand knowledge on the subject is mingled with much that is obviously mythical and with gleanings from the casual references of travellers and authors.

According to Chinese legend, the virtues of tea were discovered by the Emperor Chinnung, 2737 B.C., to whom all agricultural and medicinal knowledge is traced. It is doubtfully referred to in the book of ancient poems edited by Confucius, all of which are previous in date to 550 B.C. A tradition exists in China that a knowledge of tea travelled eastward to and in China, having been introduced 543 A.D. by Bodhidharma, an ascetic who came from India a few years. The name of the plant is little known, but that legend is also mixed with supernatural details. But it is quite certain, from the historical narrative of Lo Yu, who lived in the Tang dynasty (618-906 A.D.), that tea was already used as a beverage in the 6th century, and that during the 8th century its use had become so common that a tax was levied on its consumption in the 14th year of Tih Tsung (793). The use of tea in China in the middle of the 9th century is known from Arab sources (Reinaud, Relation des Voyages, 1845, p. 40). From China a knowledge of tea was carried into Japan, and thence to the rest of the eastern world. Tea was first introduced into Japan by Nakahara Taniemon, in the 10th century, and was planted in the southern island of Kusshiu, whence the cultivation spread northwards till it reached the high limit of 30° N.

It is somewhat curious that although many of the products of China were known and used in Europe at much earlier times, no reference to tea has yet been traced in European literature prior to 1588. No mention of it is made by Marco Polo, and no knowledge of the substance appears to have reached Europe till after the establishment of intercourse between Portugal and China in 1517. The Portuguese, however, did very little, but that legend is also mixed with supernatural details. But it is quite certain, from the historical narrative of Lo Yu, who lived in the Tang dynasty (618-906 A.D.), that tea was already used as a beverage in the 6th century, and that during the 8th century its use had become so common that a tax was levied on its consumption in the 14th year of Tih Tsung (793). The use of tea in China in the middle of the 9th century is known from Arab sources (Reinaud, Relation des Voyages, 1845, p. 40). From China a knowledge of tea was carried into Japan, and thence to the rest of the eastern world. Tea was first introduced into Japan by Nakahara Taniemon, in the 10th century, and was planted in the southern island of Kusshiu, whence the cultivation spread northwards till it reached the high limit of 30° N.

It was not till the middle of the century that the English began to use tea, and they also received their supplies from Java till in 1668 they were driven out of the island by the Dutch. At first the price of tea in England ranged from 50 to 100 per lb. In the Mercator Politicus, No. 435, of September 1658, the following advertisement occurs:—"That excellent and by all Physic-men approved China Drink called by the Chineans Tcha, by other nations Tea, is sold at the Taltans Head, a coffe-house in Sweetings Rents, by the Royal Exchange, London." Thomas Garway, the first English tea dealer, and founder of the well-known coffee-house, "Garraways," in a curious broadsheet, An Exact Description of the Growth, Quality and Virtues of the Leaf Tea, issued in 1659 or 1660, writes, "In respect of its scarceness and dearness, it hath been only used as a regalia in high treatments and entertainments, and presents made thereof to princes and grandees." In that year he purchased a quantity of the rare and much-prized commodity, and offered it to the public, in the leaf, at fixed prices varying from 40s. the lb, according to quality, and also in the infusion, "made according to the directions of the most knowing merchants and travellers into those eastern countries." In 1660 an Act of the first parliament of the Restoration imposed a tax on "every gallon of chocolate, sherbet and tea, made and sold, to be paid by the maker thereof, eightpence." (12 Car. II. c. 23.)

Pepys's often-quoted mention of the fact that on the 25th September 1666, "I did send for a cup of tea, a China drink, of which I never had drunk before," proves the novelty of tea in England. In 1667 the Honourable East India Company presented the king with 2 lb and 2 oz. of "thee," which cost 40s. per lb, and two years afterwards with another parcel containing 22½ lb, for which the directors paid 50s. per lb. Both parcels appear to have been purchased on the Continent. Not until 1677 is the Company recorded to have taken any steps for the importation of tea. The order then given to their agents was for "tea of the best kind to the amount of 100 dollars." But their instructions were considerably exceeded, for the quantity imported in 1678 was 4715 lb, a quantity which seems to have glutted the market for a time. The Company also imported tea from India, and in February 1684, the directors wrote thus to Madras:—"In regard thee is grown to a commodity here, and we have occasion to make presents therein to our great friends at court, we would have you to send us yearly five or six canisters of the very best and freshest thee." Until the Revolution no duty was laid on tea other than that levied on the infusion as sold in the coffee-houses. By 1 William and Mary, c. 6, a duty of 5s. per lb and 5 per cent. on the value was imposed. For several years the quantities imported were very small, and consisted exclusively of "Best Sencha," which was a sort of the finest sort. The introduction of tea to England was at Amoy, the teas previously obtained by the Company's factors having been purchased in Madras and Surat, wither it was brought by Chinese junks after the expulsion of the British from Java. During the closing years of the century the amount brought over seems to have been, on the average, about 20,000 lb a year. The instructions of 1700 directed the supercargoes to send home 300 tubs of the finer green teas and 80 tubs of bohea. In 1703 orders were given for "75,000 lb Singlo (green), 15,000 lb imperial, and 20,000 lb best to goos", at the average price of tea at this period was 16s. per lb.

As the 18th century progressed the demand for tea in England rapidly increased, and by the close of the century the rate of consumption exceeded an average of 2 lb per person per annum, a rate in excess of that of to-day of all people except those of Mongol and Anglo-Saxon origin. The business being a monopoly of the East India Company, and a very profitable one, the company at an early stage of its development endeavoured to ascertain whether tea could not be grown within its own dominions. Difficulties with China doubtless showed the advisability of having an independent source of supply. In 1718 Sir Joseph Banks, at the request of the directors, drew up a memoir on the cultivation of economic plants in Bengal, in which he gave special prominence to tea, pointing out the regions most favourable for its cultivation. About the year 1820 Mr David Scott, the first commissioner of Assam, sent to Calcutta from Kuch Behar and Rangpur—the very districts indicated by Sir Joseph Banks as favourable for tea-growing—certain leaves, with a statement that they were said to belong to the wild tea-plant. The leaves were submitted to Dr Wallis, government botanist at Calcutta, who pronounced them to belong to a species of Camellia, and no result followed on Mr Scott's communication. The leaves ultimately came into the herbarium of the Linnean Society of London, and have authoritatively been pronounced to belong to the indigenous Assam tea-plant. Dr Wallis's attribution of this and other specimens subsequently sent in to the genus Camellia, although scientifically defensible, unfortunately
diverted attention from the significance of the discovery. It was not till 1834 that, overcome by the insistence of Captain Francis Jenkins, who maintained and proved that, called by the name Camellia or not, the leaves belonged to a tea-plant, Dr Wallich admitted "the fact of the genuine tea-plant being a native of our territories in Upper Assam as incontrovertibly proved." In the meantime a committee had been formed by Lord William Bentinck, the governor-general, for the introduction of tea culture into India, and an official had already been sent to the tea districts of China to procure seed and skilled Chinese workmen to conduct operations in the Himalayan regions. The discovery and reports of Captain Jenkins led to the investigation of the capacities of Assam as a tea-growing country, and in 1834 an Act was passed by the East India Company resolved to institute an experimental establishment in Assam for cultivating and manufacturing tea, leaving the industry to be developed by private enterprise should its practicality be demonstrated.

In 1834 the monopoly of the East India Company was abolished and an era of rapid progress in the new industry began. In 1836 there was sent to London 1 lb of tea made from indigenous leaves; in 1837 2 lb of Assam tea were sent; in 1838 the quantity sent was 12 small boxes, and 95 boxes reached London in 1839. In 1840, 1841, and 1842, tea was offered at public auction in Calcutta early the following year, 35 packages, chiefly green-teas, stated to have been manufactured by a chief of the Singpho tribe aided by the government establishment. In the same auction catalogue were included 95 packages, "the produce of the Government Tea Plantation in Assam," many of which bore the Chubwa mark, one well known to this day. This auction is most interesting as being the first of British-grown tea, and it included about 6000 lb. It is of interest also for the reference to the Singpho tribe, who are even now in small numbers in the same district, where the tea produced in a primitive manner tea plucked from the indigenous trees growing in their jungles.

In January 1840 the Assam Company was formed to take over the early tea gardens of the East India Company, and this, the premier company, is still in existence, having produced up to 1907 no less than 117,000,000 lb of tea and paid in dividends £1,650,000 or 730 per cent. on capital. It is no longer the first company in extent of yield, as the Consolidated Tea and Lands Company produced in 1907 about 15,000,000 lb of tea, besides other products. The introduction of Chinese seeds and Chinese methods was a mistake, and there seems little reason to doubt that, in clearing jungle for tea planting, fine indigenous tea was frequently destroyed unwittingly in order to plant the inferior China variety. The period of unlearning the Chinese methods, and replacing the Chinese plants, had to be lived through. Vicissitudes of over-production and inflation came to interfere with an even course of success, but the industry developed and has increased enormously. From its point of origin in Assam, it has gradually spread to other districts with varying commercial success. The aggregate total of capital of the tea-producing companies in India and Ceylon now amounts to about £23,500,000.

The Dutch were rather earlier than the English in attempting to establish tea growing in their eastern possessions. A beginning was made in Java in 1826, but probably because of the even more marked influence of Chinese methods and Chinese plant, the progress was slow and the results indifferent. Of late years, however, by the introduction of fine Assam seed and the adoption of methods similar to those in use in India, a marked improvement has taken place, and there seems little reason to doubt that, with the very rich soil and abundant cheap labour that the island of Java possesses, the relative progress there may be greater in future than in any other producing land.

Somewhere about 1860 the practical commercial growing of tea was introduced into the island of Formosa. The methods of cultivation and manufacture followed there differ in many ways from those of the other large producing countries, but the industry has been fairly successful throughout its history. Attempts were repeatedly made to introduce tea culture in Ceylon, under both Dutch and British authority. No permanent success was attained till after 1836, when the disastrous effects of the coffee-leaf disease forced planters to give serious attention to tea. Since that period the tea industry has developed with marvellous rapidity, and now takes first rank in the commerce of the island.

Several plantations have been successfully put out both by the Russian government and private enterprise in the Caucasus, but it is doubtful whether they could exist long but for the high rate of duty on tea entering Russia from foreign countries. Natal has now about 3000 acres under tea giving a fairly large yield, and plantations are being established higher up on the slopes of the Drakensberg. The Cape Province is about 600 miles from the tea-growing region in Natal, and it is doubtless the desire to produce a tea of the quality most highly esteemed outside of Southern Africa, where it benefits to the extent of 4d. per pound of protection in the tariff. A small plantation exists in South Carolina under circumstances not conducive to financial success on a large scale of production. Attempts at tea growing have been made in the West Indies, Brazil, Australia, Nyassaland, Mauritius, the Straits Settlements, Johore, Fiji and at San Miguel in the Azores without marked success. In addition to favourable conditions of soil and climate, abundant cheap labour is an absolute necessity if satisfactory commercial results are to be obtained.

Botany.—The tea bush or tree is a member of the natural order Theaceae and is closely allied to the well-known ornamental shrub the camellia. As cultivated in China it is an evergreen shrub growing to a height of from 3 to 5 ft. The stem is bushy, with numerous and very leafy branches; the leaves are alternate, leathery in texture, elliptical, obtusely serrated, strongly veined and placed on short channelled footstems. The flowers are white, axillary and slightly fragrant,—often two or three together on separate pedicels. The calyx is small, smooth and divided into five oblong sepals. The corolla has from five to nine petals, cohering at the base. The stamens are short, numerous and inserted at the base of the corolla; the anthers are large and yellow, and the long style ends in three branches. The fruit is a woody capsule of three cells, each containing one large nearly spherical seed, which consists mainly of two large hemispherical cotyledons.

As is commonly the case with plants which have been long under cultivation, there has been some doubt as to specific distinctions among the varieties of tea. The plant was originally described by Linnaeus as one species, Thea sinensis. Later Bentinck established two species, viz. Thea Bohea and Thea viridis, and it was erroneously assumed that the former was the source of black teas, while Thea viridis was held to yield the green varieties. In 1843, however, Mr Robert Fortune found that, although the two varieties of the plant existed in different parts of China, black and green tea were produced from the leaves of the same plant by varying the manufacturing processes.

SIR GEORGE WATT (Journal of the Royal Agricultural Society, vol. xxxii.) describes with ample illustrations the recognized varieties, placing all of them under Camellia Thea, with the following subdivision:

A. Variety Viridis—races

1. Assam Indigenus.
2. Lushai.
4. Manipur.
5. Burma and Shan.

B. " Bohea.
C. " Stricta.
D. " Laxifoliax.

Of the foregoing, the teas of commerce are derived almost entirely from the varieties Viridis and Bohea. The Assam Indigenus, in its two sub-races of Singlo and Bazalona, and the Manipur, originally found wild in the jungles of the native state of that name, have, with various intercrossings and crossings, been used to cover the greatest areas of all the more modern planting in India, Ceylon and Java. The great size
of leaf when fully developed (4 to 9 ins. in length and 2 to 3½ in breadth) has made them in demand because of the heavy yields. From the variety Bohea, or from hybrids of descent from it, came the China teas of former days and the earlier plantings in India grown from imported China stock. The leaves of this variety are generally, roughly speaking, about half the size of those of the Assam Indigenous and Manipur sorts. The bush is in every way smaller than the Assam types. The latter is a tree attaining in its natural conditions, or where allowed to grow unpruned in a seed garden, a height of from 30 to 40 ft. and prospering in the midst of dense moist jungle and in shady sheltered situations.

The Bohea variety is hardy, and capable of thriving under many different conditions of climate and situation, while the indigenous plant is tender and difficult of cultivation, requiring for its success a close, hot, moist and equable climate. In minute structure it presents highly characteristic appearances.

The under side of the young leaf is densely covered with fine one-celled thick-walled hairs, about 1 mm. in length and 0.15 mm. in thickness. These hairs entirely disappear with increasing age. The structure of the epidermis of the under side of the leaf, with its contorted cells, is represented (×160) in fig. 3.

A further characteristic feature of the cellular structure of the tea-leaf is the abundance, especially in grown leaves, of large, branching, thick-walled, smooth cells (idioblasts), which, although they occur in other leaves, are not found in such as are likely to be confounded with or substituted for tea. The minute structure of the leaf in section is illustrated in fig. 4.

Constant controversy has existed as to what is the actual original home of the tea-plant, and probably no one has given to the subject more careful study than Professor Andreas Krassnow, of Kharkoff University. By order of the Russian government, he visited each of the great tea-growing countries, and the results of his observations were published in a book entitled *On the Tea-producing Districts of Asia*. He holds the opinion that the tea-plant is indigenous, not to Assam only, but to the whole monsoon region of eastern Asia, where he found it growing wild as far north as the islands of southern Japan. He considers that the tea-plant had, from the remotest times, two distinct varieties, the Assam and Chinese, as he thinks that the period of known cultivation has been too short to produce the differences that exist between them.

Chemistry.—What may be termed the chemistry of production, viz., that relating to soils, manures, manufacturing processes, &c., has of recent years received great attention from the scientific experts appointed in India and Ceylon to assist and guide the tea planters. The chemistry of the completed teas of commerce does not appear to have been subjected to adequate scientific study. There cannot be said to be any standard or recognized analysis. Many such have been made, and they may be found in chemical text-books of high authority, but they are defective because of the lack of commercial knowledge in association with the chemical skill. More attention seems to have been given to the matter in the United States of America and in Germany and Russia than in England, but the infinite variety of samples known to the commercial expert, and the impossibility of standardizing those in such a manner as to make readily recognizable what the chemist has treated, renders most of the recorded analyses of uncertain value.

There seems to be no relationship between the commercial value and the analysis, the arbitrary personal methods of the expert tea-taster being controlled by factors that chemistry does not appear to deal with. One reason may be that analyses are generally made of tea liquors produced by distilled water, which is the very worst possible from the point of view of the commercial expert or in domestic usage.

The principal chemical constituents of tea of practical interest are: caffeine, tannin and essential oil, on which depend respectively the physiological effects, the strength and the flavour. The commercial value appears to depend on the essential oil and aroma, not on the amount of caffeine, tannin or extract.

The following is suggested as a typical analysis of an average sample of black tea:—

<table>
<thead>
<tr>
<th>Content</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuminous</td>
<td>24</td>
</tr>
<tr>
<td>Gummy matters</td>
<td>4</td>
</tr>
<tr>
<td>Cellulose</td>
<td>4</td>
</tr>
<tr>
<td>Chlorophyll and wax</td>
<td>5</td>
</tr>
<tr>
<td>Caffeine</td>
<td>2</td>
</tr>
<tr>
<td>Tannin</td>
<td>3</td>
</tr>
<tr>
<td>Essential oil</td>
<td>10</td>
</tr>
<tr>
<td>Resin</td>
<td>2</td>
</tr>
<tr>
<td>Mineral matter (ash)</td>
<td>1</td>
</tr>
<tr>
<td>Moisture</td>
<td>2</td>
</tr>
<tr>
<td>Extractive matter</td>
<td>20-25</td>
</tr>
<tr>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

Also a trace (1 to 2 per cent.) of boheic acid, a vegetable acid peculiar to tea. The amount of tannin found in green teas appears to be
about half as much again as in black, and the former always yield less moisture, doubtless because of the harder fibre produced by the methods of manufacture followed by the different commercial uses. A large percentage of moisture found in any sample would indicate improper condition. At the stage of final firing, tea is supposed to be dry, not completely as is possible, and it is then sealed up to exclude air entirely. However, most liable to absorb moisture upon subsequent exposure. Caffeine (formerly known as theine) is the alkaloid of tea, and is identical with that of coffee, guarana, mate, and other closely related plants of the theobromaceous family. A large quantity of cocoa, and also to uric acid. In large quantities it is a poison, but in smaller quantities it acts as a stimulant. It exists in greater percentage in Indian and Ceylon teas than in those from Java, and is lowest in China and Japanese. Taxation is a hindrance and astringent substance, and in large quantities impairs digestion. Prolonged infusion increases the amount extracted. The essential oil of tea is of a characterless colour; it is lighter than water and possesses the distinctive odor of tea. Extracts made from it yield to 40 per cent. and is of guide to quality. Ash averages 5-7 per cent., about half of which is soluble in water. About 8 per cent. of it is proof of adulteration.

Commercial.—There is probably no article of large consumption the commerce in which has been so revolutionized during a single generation. In 1877, except to the initiated, tea meant China tea. India and Java were producing a little, but practically none only in Great Britain and Holland. Formosa and Japan were beginning to attract attention in America, but China supplied the world, and already supplied the market in the London market. Days of sailing ships from China had not entirely passed, and the steamers of the period were built for rapidity of transit to London. The Australasian colonies got their supplies direct, and part of the Russian tea was bought for the Russian public. By 1897, however, the greatly increased production in India and Ceylon, with the willingness of many nations to drink this tea, in preference to those of China, had left her to Russia as a customer of a customer. Nearly half her exportation of tea to the Russian markets is the return via Ceylon to India, showing that country too turned in the direction of using the stronger varieties. China and Japan have hitherto been regarded as the chief producers of tea, and the reputed large domestic consumption of those Mongolian peoples has led to assumptions of vast internal productions. There exist absolutely no data, and it is doubtful whether such a country can ever be gathered, for forming trustworthy estimates. In both of those countries tea is grown principally in a retail manner, and much of it simply for family consumption. The country cultivator has, as a rule, only a small area—perhaps a corner of his farm or garden—planted with tea, the produce of which is roughly sun-dried and cured in a primitive manner. Any surplus not needed for the family is sold in its sun-dried state to the collector, who takes it to the Hong, where it is fired, blended and packed for exportation. Excluding therefore from the description, the quantities produced for internal consumption in China and Japan (that from the former alone has been estimated at a total of 24,000,000 lb. in 1877), the following are the acreages for the years 1908:

<table>
<thead>
<tr>
<th>Country</th>
<th>Acreage under tea</th>
<th>Production</th>
<th>Quantities exported only</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>600,000</td>
<td>188,371,000</td>
<td>19,000,000</td>
</tr>
<tr>
<td>Japan</td>
<td>121,000</td>
<td>39,778,000</td>
<td></td>
</tr>
<tr>
<td>Formosa</td>
<td>74,000</td>
<td>26,000,000</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>581,000</td>
<td>420,411</td>
<td></td>
</tr>
<tr>
<td>Burma</td>
<td>4,480</td>
<td>3,249,000</td>
<td></td>
</tr>
<tr>
<td>Ceylon</td>
<td>390,000</td>
<td>170,527</td>
<td></td>
</tr>
<tr>
<td>Java</td>
<td>45,000</td>
<td>28,215,000</td>
<td></td>
</tr>
<tr>
<td>Natal</td>
<td>5,000</td>
<td>1,279,000</td>
<td></td>
</tr>
</tbody>
</table>

The quantities exported only are 276,601,000

The quantity from China includes about 16,000,000 lb. imported from India, Ceylon and Java, and worked up with China tea into bricks and tablets.

The modern developments of production and consumption have rendered the subject of China tea one of subordinate interest, except to students of commercial evolution. In several of the earlier editions of this work it was necessary to enlarge the headings, with many interesting pictorial illustrations of the processes of production. The conservative tendencies of Japan are most suitable to develop the old methods of extensive cultivation based on scientific manipulation of the crops by machinery in place of hand labour. Conclusively, their export trade has been for many years a diminishing thing in the eyes of the experienced grower. In China above, only 81,000,000 lb. were the ordinary black tea known to the English consumer (collectively described in the United States of America and Canada as English Breakfast Tea '). Out of that total, Great Britain consumed only about 5,000,000 lb., against a consumption of 126,000,000 lb. of China tea in the United States of America. This was chiefly to the United States of America, to Central Asia, and North Africa. The remainder, 88,000,000 lb. is brick and tablet tea sent entirely to Asiatic and European Russia, and to Java, Ceylon and the other islands in the territories of the Chinese empire. The use of brick tea is somewhat uncommon in western Europe. It does not arise from the necessity of reducing bulk to a minimum for conveyance by canals and rivers, but rather from the desire to separate the preparation of the tea in its requisite form has, however, largely left Chinese hands. The Russians have themselves established several important factories at Hankow, which is the chief seat of this industry, and to which plants are imported from China; large quantities are exported from India, Ceylon and Java. There are freely used in the preparation of small tablets, compressed to such a condition of hardness as to be portable, and are passed round as currency in certain districts of Russia. Of a somewhat different nature is the brick tea prepared chiefly at Ya-chou in the province of Ssu-chuan for overland transit to Tibet, to investigate the commerce in which Mr James Hutchison, M.A., was sent in 1906 as a special commissioner for the Indian Tea Cess Committee. This tea is mostly prepared from exceedingly rough leaf, including even bush prunings, which would only be plucked and used in the interior. The brick process was initiated, but worked out, in Ceylon. It is "panned," rolled, fermented and divided into various classes or qualities. It is then steamed and placed in a moulding frame, and forced to the required shape of brick wanted. The bricks are wrapped in paper bearing handwriting and the writing in Tibetan. For transit they are packed twelve together in hides sewn up while moist, which contract to a strong tight bundle and thus prevent the setting of the tea. The back of the coals for great distances across very high passes into Tibet, and the trade is estimated at an average of 19,000,000 lb. per year. About 9,000,000 is a subsidy from the emperor of China to the Tibetan monasteries.

The Japanese production is almost entirely green tea for North American use. It is prepared in two distinctive classes named by the first process to which they are submitted, viz., basket-fired, i.e. dried over a hot stove in a basket, and pan-fired, i.e. in machine-made pans. The industry is a declining one, because of change in the American taste, and the area under cultivation has diminished by nearly 20 per cent. in the ten years since 1896. The mulberry leaf for the most profitable silk trade has taken its place. The export production of Formosa is limited to a particular class of tea termed Formosa Oolong, practically all produced in the island of Taiwan. It is scarcely known in England save by experts. The Tea Cess Committees of India and Ceylon have been two powerful agencies for the improvement of the products. As the planting, productive and manufacturing processes of India may be taken to be generally representative of the trade.

The methods described hereafter are those generally followed in India and Ceylon in the manner of the most modern application.
but variations must take place according to district and elevation.

Propagation is from seed only. The seed is rather larger than that of the black mustard, and is perfectly spherical in shape. When ripe (about the month of November) the seeds are placed a few inches apart in carefully prepared nursery beds, which are then kept covered. During the first week or ten days after sowing, the third and fourth flushes are carefully removed. The seedlings should then be 6 in. to 8 in. high and ready to plant out in the fields. These are prepared by cutting down and building up the bushes, and afterwards hoed so as to form parallel rows running both ways. The intervals of planting vary, but 4 ft. by 4 ft. is a very common distance. In 15 ins. to 18 ins. deep, are dug for each plant, and refilled loosely—then the plants are carefully placed so as to admit of the shading being

interplanting of nitrogen-producing growths has been done with a view to enriching the soil, most notably clover.

Planted out.

In the early days an attempt was made to copy the Chinese methods, and the various processes were manual. Now, from the plucking stage onwards, almost everything is done by machinery. Seventy per cent. of the bushes are plucked every 7 to 10 days, and, as a rule, in India the opening bud and two leaves below it are plucked. To take more than this would be considered necessary. Besides, in the immature, the longest rarely being more than an inch in length. The lower leaves on the young shoots are too old and hard to manufacture into tea. The plucking is done by women and girls, who use a curved pruning knife, the blades of which the tea is touched by hand. The plucking season continues in some districts of India till December. As they are plucked, the leaves are spread out in baskets, and twice daily the pluckings are heaped up in sieves, which results in the leaves becoming firm and at the same time overcome any excess of moisture. The leaves are then dried in the sun, or are dried in sheds or in the shade. When the leaves are dry, they are either packed in bundles or separated, and sent, per train or steamer, to the factories. The leaves are then laid out in the manufacture, or a sort of drying

Various species of Ceylon and Assam, are raised in the northern plains of India. It was estimated that the whole crop of tea in 1900 was 250,000,000 lb., of which 230,000,000 lb. were manufactured, the balance being consumed in India.

The manufacture of tea consists of two operations—drying and fermenting. The leaves, having been plucked, undergo two processes—drying and fermentation. The leaf is first dried by the sun, or in ovens, and is then ready for rolling. On a successful outing the amount of the tea or enzyme is dependent. The object of rolling is to crush the leaves and to break their cells so as to liberate the juices. The leaves are passed repeatedly through a machine driven by steam or other power giving a rotary motion, the operation occupying about 40 to 60 minutes. The next process is familiarly termed fermentation, but is really an oxidation of the leaves. Should the leaf be subjected to heat and steam, or other process, before fermentation, it is said to have been withered, and some other processes applied, but in India very little green tea is manufactured. Many people still cherish the antiquated belief that the black and dark are formed and enhanced in the manufacture of the tea-plant, which is quite a mistake, the difference being merely one of preparation. After being rolled, the leaves are spread out in layers of 1 to 2 ins. thick in a cool house, and left under undergoing a second action, during which the leaves are checked after from 2 to 3 hours, according to climatic conditions. A further brief rolling to close up the open leaves is followed by the first firing, which is effected by subjecting the leaves to the gradual action of hot air up to a temperature of 250° F. Various processes of the same kind are in use, but the most popular is to place the leaves on the wires of a machine in a high temperature for about 9 hours, which will mature the leaf. When this point of the manufacture the leaf has been in the stalk, the leaves and bud being unseparated. They are now broken apart and sorted by mechanical sifters into the various grades or qualities, which are described as Orange Pekoe, Broken Pekoe, Tchins and Souchong, each of which names represents approximately the leaf-bud and the three lower leaves. In addition to these four classes, out of each are sifted all the broken elements of leaf broken in the process of manufacture, which are termed Broken Orange Pekoe, &c. These broken grades are frequently objected to by the consumer, under the impression that they are inferior in quality, but in the opinion of many experts—indeed the more broken grades are esteemed by those who enjoy the tea upon infusion. Upon completion of the sifting, the tea is again fired, and while warm it is packed tightly into lead-lined chests, and the leaf covers completely soldered over it, so that it may be kept practically air-tight.

The machinery in use is very varied in character, and it has been evolved principally by practical planters of a mechanical turn. It is not necessary to keep an engineer, but it is usual to have a sort of foreman who will direct the running of the plant, and who can be trained without any particular qualifications. The machinery is generally simple in character, and it is not unusual for a large estate, or a group of estates, to have one member of the European staff who is a qualified engineer. The motive power is generally a steam engine, but the greater economy and facility of oil engines have led to their fairly widespread adoption. Where water power is available, turbines of a variety of types are in use. The machine to be driven are air fans, rollers, roll-breakers, sifters, cutters and packers, and there are besides numerous types of driers or destackers. The names associated with the most successful and widely used machines are those of the Messrs. Jackson (makers, Marshalls of Gainsborough) and Davy (makers, Thos. & Davy, of Newhall). The production of the empty boxes for packing, called chests or half-chests, is in itself a large industry. The heavy old-fashioned country-made packages are rapidly being replaced by light-tared boxes made from several thicknesses of paper. The tea is then pressed tightly together, most of which come from Russia.

A production temporarily in excess of the world's demand of several years ago, led to the offering of bonuses for the production of tea in India. In 1908 the Ceylon government offered £3 per cwt. for the weight of the best quality of tea.
the ferment or enzyme, and renders it possible to conserve the tea in what is really nearer its natural form than the black tea that is so well known to the consumer.

Tea Consumption.—The following table gives particulars relative to the principal consuming countries, from which it will be seen that Great Britain and its English-speaking dependencies are the great consumers:

**Tea Consumption of Chief Consuming Countries in 1906.**

<table>
<thead>
<tr>
<th>Country</th>
<th>Total per annum (lb)</th>
<th>Rate per person of population</th>
<th>Rate of Duty per lb.</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Unknown</td>
<td>6-17</td>
<td>6d.</td>
</tr>
<tr>
<td>Russia</td>
<td>135,400,000</td>
<td>0-94</td>
<td>5d.</td>
</tr>
<tr>
<td>United States of America</td>
<td>84,842,000</td>
<td>8-90</td>
<td>Certain kinds free for Asiatic Russia or over Asiatic frontier, others 2d. to 1s. 11d. Free.</td>
</tr>
<tr>
<td>Dominion of Canada</td>
<td>23,969,000</td>
<td>3-44</td>
<td></td>
</tr>
<tr>
<td>Commonwealth of Australia</td>
<td>27,959,000</td>
<td>6-88</td>
<td></td>
</tr>
<tr>
<td>Dominion of New Zealand</td>
<td>6,141,000</td>
<td>6-5</td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>6,354,000</td>
<td>11</td>
<td>(If British grown)</td>
</tr>
<tr>
<td>France</td>
<td>2,428,000</td>
<td>0-06</td>
<td>9d. (surtax 2d. if not direct import).</td>
</tr>
<tr>
<td>Holland</td>
<td>7,874,000</td>
<td>1-45</td>
<td>2d.</td>
</tr>
<tr>
<td>South Africa</td>
<td>7,572,000</td>
<td>4-04</td>
<td>4d. (Natal tea free).</td>
</tr>
<tr>
<td>Argentine Republic</td>
<td>2,870,000</td>
<td>4-90</td>
<td>4d.</td>
</tr>
<tr>
<td>Tibet</td>
<td>19,000,000</td>
<td>1-13</td>
<td>High, but uncertain.</td>
</tr>
<tr>
<td>India (estimated)</td>
<td>7,240,000</td>
<td>?</td>
<td>Free.</td>
</tr>
<tr>
<td>Burma (average about)</td>
<td>10,000,000</td>
<td>?</td>
<td>4d. to 7d.</td>
</tr>
<tr>
<td>Persia (average about)</td>
<td>6,000,000</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>526,152,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The countries of smaller consumption absorbed about 25,000,000 lb, but there is a considerable excess in the returns of production over those of consumption. This arises partly from the latter relating in certain instances to an earlier period, and partly from the fact that much of the yield of 1906 was float or underspatched at the close of that year.

The following table gives the approximate rates of duty per English lb during 1907 in places not referred to above:—

- Austria and 4d. imported by Belgium . Free.
- Hungary . sea, by land 11d.
- Bahamas . 6d.
- Barbados . 3d. and 20% ad val.

British Guiana . 8d.
Bulgaria . 4d. plus 4d. excise and octroi 1d.
Chile . 9d.
Cyprus . 4d.
Denmark . 4d.
Ecuador . 2d.
Egypt . 8% ad val.
Fiji . 6d.
Gibraltar . Free.
Greece . 1d.
Grenada . 6d.
Honduras . 2d.
Italy . 1d.
Jamaica . 1s.
Lagos . 1d.
Malta . Free.
Mauritius . 3d.
Mexico . 6d.
Morocco . 10% ad val.
Newfoundland 33% ad val.
Nigeria . 10d.
Norway . 1s.
Peru . 65% ad val. and 10%.
Portugal . 2s. 6d.
Rumania . 3d. and 4d. excise.
Sierra Leone . 10% ad val.
Spain . 6d. (if transshipped in a European port 1s. 7d. cwt. ad val.
St. Helena . Free.
Strait Settlements . Free.
Sweden . 3d.
Switzerland . In receptacles weighing less than 5 kilos. 1d. over 1-10d.
Tobago and Trinidad . 6d.
Turkey . 11%.
Uganda . 10%.
Uruguay . 5d.
Venezuela . 6d.

The rate per head of population within the United Kingdom has not increased much during recent years, and in the Australasian colonies it has apparently fallen greatly as compared with recorded averages of 12 lb per head in Victoria and 9 lb in New South Wales in 1884. The modern statistics of the commonwealth may have accurately kept, and there may be less waste in use, but it is not supposed that there is any diminution in the free use of the beverage which has always characterized the anti-podean colonist. One important factor in keeping down the amount per person is the substitution in use, which for a generation has been in progress, of the stronger teas of India and Ceylon for the old-fashioned weaker produce of China. The progressive increase in the consumption of tea in Great Britain and Ireland during 50 years from 1836 to 1886 is shown in the table below. The dotted line represents the average monthly consumption in each year; the fluctuations in price of good sound China congou are traced by the black line; and the years in which reduced customs duty came into operation are indicated along the base. From 1860 onwards, the amount of Indian tea entered for home consumption is shown in monthly average by a black column. This column brings out the remarkable fact that the Indian tea alone consumed in 1886 equaled the consumption of all kinds in 1860, and was double the quantity of all kinds in 1836. The table, however, shows merely the general development of con-

**FIG. 5.**

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The table below shows the gradual and almost total displacement of China tea by that grown in the English dependencies. In both, the price fluctuations and fiscal changes are shown that their effect upon consumption may be judged. The prices below are the annual averages for all Indian teas sold in the London public auction market during the years stated. Lowness of price has not been the only factor in increasing the rate of consumption. The lean years and the fat years of the general labour market always tell, and the low range
prices for sugar during recent times has undoubtedly assisted in increasing the amount available for expenditure on tea. In Russia tea costs more to the consumer than in any country where modern transit by railway and steamer exists. The reason is the enormous proportion of the retail selling price which is exacted by the government by way of duty. But in return the government, with a paternal care for its people, makes absolutely certain that the tea reaches their hands as pure and unadulterated as when it first entered the country. Russian tea has always had a high reputation — largely sentimental, however. The quantity taken by the country is very large, but when spread over the enormous population the rate of consumption per person is not great. The extreme poverty of the great body of the people and the high price doubtless explain this. The method of use differs much from that followed in England. The samovar, or urn for boiling the water, is always in much evidence. Tea that makes a dark, strong liquor is preferred — not that such tea is more possible; quantity of tea-colored water may be drained from the teapot by refilling it over and over again from the samovar. The tea is generally drunk from glasses and while very hot, with a liberal addition of sugar and a flavouring of lemon. The method of use is probably a more healthy one than that followed in many parts of the United Kingdom, where strong infusions of powerful teas are indulged in too frequently.

The United States of America and the great colonial dependencies follow generally the English way of using the beverage. France, considering that it is England’s nearest neighbour, has a remarkably small tea consumption: 0.06 lb per person per annum, or about 1/34th only of the English rate. The increase in consumption there has been so small that it probably arises mainly from the increasing number of English and English-colonial visitors that spend portions of each year in the country.

Germany, and the Germanic peoples, take slightly more per person, but the statistics are rather indefinite. Holland, in Europe, comes next to England, and uses principally the product of her dependencies Java. The other nations of Europe are very small consumers. Some of the peoples of eastern Europe take their tea with an admixture of rum. In Morocco and generally throughout North Africa there is a considerable demand for green tea, which is drunk hot out of glasses, the liquor being almost saturated with sugar and strongly flavoured with mint.

In China and Japan tea is generally drunk without any other qualifying or flavouring addition. Exceedingly delicate teas can therefore be used unimpaired. In Japan the ceremony of serving tea is one of the better classes, been raised to a high art, which the girls have to study at school for protracted periods.

In Mongolia and other parts of Central Asia tea is made into a kind of soup, somewhat on the lines of the following written regarding tea in "Thibet by Dr. Oldham." Writing of the Tibetan he states: "As a beverage he drinks, all day long, cupsful of hot buttered tea, which is really a soup or broth made by boiling tea-leaves with rancid butter and rolls of rice (Chuk), and adding a little salt, and straining—a decoction which was invariably nasty to our taste, though no doubt it is wholesome; for it is not merely a stimulating hot drink in the cold, but overcomes the danger of sickness from drinking too much water in a country where the least water supply is dangerous polluted."

**Geography of Tea.**—The successful commercial production of tea on a large scale is confined to a strictly limited area enclosed by about 40° of latitude (5° S. to 35° N.) and about 73° of longitude (109° E. to 100° E.), and adding a little salt, and straining—a decoction which was invariably nasty to our taste, though no doubt it is wholesome; for it is not merely a stimulating hot drink in the cold, but overcomes the danger of sickness from drinking too much water in a country where the least water supply is dangerous polluted.

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Tea Adulteration.—In the earlier days of the tea trade, adulteration, especially prior to importation, was frequent, because the prices obtainable made it remunerative. Now, intentional adulteration is far less general, although the places of production the price obtainable is so low that any possible adulterant would be too costly to collect. Most countries have a close check upon this at the time of importation, and the checking is especially strict in British India, to analysis all samples of a doubtful character. Impure teas are not permitted to pass into consumption, but the quantity condemned after analysis as unfit for use in the year 1906 was 41 packages, out of a total of $175,000,000 lb.

Effect on Health.—The effect of the use of tea upon health has been much discussed. In the days when China green teas were much used, tea-grocers told the public that tea was a serious, because of the objectionable facing materials so often used. In the modern days of machine-made black tea, produced under British supervision, both the tea-taster and the ordinary consumer has to be on his guard against the product which has been carefully cooked and used in moderation, should be harmless to all normal human beings. There has been constant controversy as to whether China tea is better than that of other growths, but the verdict first of all of Great Britain, and subsequently of all the other large consuming countries, has relegated the produce of the Celestial Empire to a very subordinate position. A limited section of connoisseurs, on brick tea, Formosa tea, and other sorts, some of which are prepared for the Teacess Committees of India and Ceylon; *Journals of the Royal Asiatic Society, Journal of the Society of Arts, Geographic Journal of India and Ceylon, China in London,* and the like, with practical planting details, see *Tea: its Cultivation and Manufacture,* by David Crole (1897), with a full bibliography; also Rutherford's *Planter's Handbook.* For scientific aspects see *Chemistry and Agriculture of Tea,* by M. Kelway Bamber (1893). (J. M.G.)

**TEA-CADDY,** a box, jar, canister or other receptacle for tea. The word is believed to be derived from *catty,* the Chinese pound, equal to about a pound and a third avoirdupois.

The earliest examples that came to Europe were of Chinese porcelain, and approximated in shape to the ginger-jar. They had lids or stoppers likewise of china, and were often frequently blue and white. The English kilns at first imitated them, but speedily devised forms and ornament of their own, and there was hardly a ceramic factory in the country which did not compete for the supply of the new fashion. But tea-caddies were not for long confined to procelain or faience. They were presently made in a great variety of materials, and in an equal variety of shapes. Wood, pewter, tortoise-shell, brass, copper and even silver were employed, but in the end the material most frequently used was wood, and there still survive vast numbers of them, made in Japan for the European market. The woods used are wood and other choice timbers, often mounted in brass and delicately inlaid, with knobs of ivory, ebony or silver. Although many examples were made in Holland, principally of the earthenware of Delft, the finer varieties enamelled, enriched with ciphers, and emblazoned with heraldry, the tea-caddy was a typically English product. As the use of the jar waned and that of the box increased, the provision for different receptacles for green and black tea was abandoned, and the wooden caddy, with a lid and a lock, was made with two and often three divisions, the centre portion being reserved for sugar. Chippen-dale's caddies in Louis Quinze fashion were delightful, with their claw and ball feet and exquisite finish. On the whole the mahogany or rosewood caddy of the latter part of the 18th and the early years of the 19th century was, from the artistic point of view, the most elegant and satisfying. The wood was rich and well-marked, the inlay simple and delicate, the form graceful and unobtrusive. Even when it took the shape of a miniature sarcophagus, imitated from the massive wine- box of the Empire period, with little claw feet and brass rings, it was a decidedly pleasing object. The larger specimens were known as tea-chests. As tea grew cheaper it became less important that it should be kept constantly under the mistress's eye, and the tea-caddy gradually fell into desuetude. It has, however, never gone entirely out of use, though handsome examples are now most commonly regarded as ornaments or preserved in collections.

**TEACH** [Thatch or Thatch]. EDWARD (d. 1718), English pirate, popularly known as Blackbeard, is believed to have been born at Great Harwood in Yorkshire. He is said to have gone out to the West Indies during the war of the Spanish Succession of 1701-13, then spent some years in privateering, and after the declaration of peace (1713) to have turned pirate, but he is not actually heard of in this capacity till the end of 1716. The following year he captured a large French merchantman, rechristened her "Queen Anne's Revenge," and converted her into a warship of forty guns. His robberies and outrages in the Spanish main, the West Indies, and on the coasts of Carolina and Virginia, quickly earned him an infamous notoriety. He made his winter quarters in a convenient inlet in North Carolina, the governor of which colony was not above sharing in the profits of his crimes, but the governor of Virginia at last dispatched two sloops, manned from the British warships on the station, to cut him out. On the 22nd of November 1718 Lieutenant Maynard, commanding the attacking forces, boarded Teach's sloop, after a sharp fight, and himself shot the pirate dead. Teach seems to have been an ignorant ruffian. His personal appearance was remarkable. His nickname was due to his habit of tying up the ends of his long and bushy black beard with ribbon and curling them back over his ears. Johnson in *General History of the Pyrates* has his name as Teach, but according to the official records it was really Thatch or Teach.

**TEAK,** the most valuable of all known timbers. For use in tropical countries it has no equal, and for certain purposes it is preferable to other woods in temperate climates also. Its price is higher than that of any other timber, except mahogany. Great efforts have been made to find substitutes, but no timber has been brought to market in sufficient quantities combining the many valuable qualities which teak possesses.

The first good figure and description of the tree was given by Rheed, the best modern picture being that given by Brandis. The younger Linnaeus called it *Teckoa grandis.* It is a large deciduous tree, of the natural order Verbenaceae, with a tall, straight but often buttressed stem, a spreading crown, and the branchlets four-sided with large quadrangular pith. It is a native of the Indian peninsula, Burma and Siam, and is also found in the Philippine Islands, in Java and elsewhere in the Malay Archipelago. In India proper its northern limit is 24° 40' on the west side of the Aravalli Hills, and in the centre, near Jhansi, in 25° 30' N. lat. In Burma it extends to 20° 50' N. lat. From the wood of the teak, known in the English language as *Sarawak* teak, a large proportion of the teak produced in British India is exported to the United States of America. The wood is known as *Sarawak* teak, and the town of Sarawak on the Persian Gulf was entirely built of it. Saj is the name in Arabic and Persian; and in Hindi, Mahtrati and the other modern languages derived from Sanskrit the tree is called by that name. The tree itself is occasionally planted in Portugal, adopting this, called it *teke, teca,* whence the English name.

The rate in the London market since 1860 has fluctuated between 7½ and 8½ per load of 50 cab. ft.

1 The Sanskrit name of teak is *saka,* and it is certain that in India teak has been known and used largely for considerably more than 2000 years. A large number of the oldest and most important buildings in India are constructed of teak, and the town of Saraf on the Persian Gulf was entirely built of it. Saj is the name in Arabic and Persian; and in Hindi, Mahtrati and the other modern languages derived from Sanskrit the tree is called by that name. The tree itself is occasionally planted in Portugal, adopting this, called it *teke, teca,* whence the English name.

2 Forest Flora of North-West and Central India, Ill. t. 44.
TEAK

TEAK to near Myitkyina, in lat. 25° 30'. In Bengal or Assam it is not indigenous, but plantations have been formed in Assam as far as the 27th parallel. In the Punjab it is grown in gardens to the 32nd.

Teak requires a dry tropical climate, and the most important forests are found in those districts of India where, during the summer months, heavy rains are brought by the south-west monsoon, the winter months being nearly rainless. In the interior of the Indian peninsula, where the mean annual rain fall is less than 30 in., teak is more scarce, and it thrives best with a mean annual fall of more than 50 in. The mean annual temperature which suits it best lies between 75° and 81° Fahr. Near the coast the tree is absent, and inland the most valuable forests are on low hills up to 3000 ft. It grows on a great variety of soils, but there is one indispensable condition—perfect drainage or a dry subsoil. On level ground, with deep alluvial soil, teak does not always form regularly shaped stems, probably because the subsoil drainage is imperfect.

During the dry season the tree is leafless; in hot localities they do not fall in January, but in moist places the tree remains green till March. At the end of the dry season, when the first monsoon rains fall, the fresh foliage comes out. The leaves, which stand opposite, or only whorled in very young specimens, are from 1 to 2 ft. in length and from 6 to 12 in. in breadth. On coppice shoots the leaves are much larger, and not rarely from 2 to 3 ft. long. In shape they somewhat resemble those of the tobacco plant, but their substance is hard and the surface rough. The small white flowers are very numerous, on large erect cross-branched panicles, which terminate the branches. They appear during the rains, generally in July and August, and the seed ripens in the succeeding January and February. On the east side of the Indian peninsula, the teak flowers during the rains in October and November. In Java the plantations are leafless in September, while during March and April, after the rains have commenced, they are clothed with foliage and the flowers open. During the rainy season the tree is readily recognized at a considerable distance by the whitish flower panicles, which overtop the green foliage, and during the dry season the feathery seed-bearing panicles distinguish it from its associates.

The small oily seeds are enclosed in a hard, brown, cross-branched nut, which is surrounded by a thick covering, consisting of a dense felt of matted hairs. The fruit thus formed is further enclosed in the enlarged membranous calyx, in appearance like an irregularly plaited or crumpled bladder. The tree seeds freely every year, but its spread by means of self-sown seed is impeded by the forest fires of the dry season, which in India generally occur in March and April, after the seeds have ripened and have partly fallen. Of the seeds which escape, numbers are washed down the hills by the first heavy rains of the monsoon, while these collect in the valleys, and it is here that groups of seedlings and young trees are frequently found. A portion of the seed remains on the tree; this falls gradually after the rains have commenced, and thus escapes the fires of the hot season. The germination of the seed is slow and uncertain; a large amount of moisture is needed to saturate the sappy covering; many seeds do not germinate until the second or third year, and many do not germinate at all. Where the teak tree is associated with dense clumps of bamboo, natural reproduction is almost absent, except when the bamboo flowers and dies, and even then, if the dry bamboo and the resultant bamboo seedlings are not burnt, such young teak as may germinate are likely to be smothered at once.

The bark of the stem is about half an inch thick, grey or brownish grey, the sapwood white; the heartwood of the green tree has a pleasant and strong aromatic fragrance and a beautiful golden-yellow colour, which on seasoning soon darkens into brown, mottled with darker streaks. The timber retains its aromatic fragrance to a great age. On a transverse section the wood is marked by large pores, which are more numerous and larger in the spring wood, or the inner belt of each annual ring, while they are less numerous and smaller in the autumn wood or outer belt. In this manner the growth of each successive year is marked in the wood, and the age of a tree may be determined by counting the annual rings.

The principal value of teak timber for use in warm countries is its extraordinary durability. In India and in Burma beams of the wood in good preservation are often found in buildings several centuries old, and instances are known of teak beams having lasted more than a thousand years. Being one of the most durable of Indian timbers, teak has always been used for buildings, particularly for temples, and in India it has been the chief timber employed for shipbuilding. When iron commenced to be extensively used for the last-named purpose, it was supposed that the demand for teak would decrease. This, however, was not the case, for the wood was for long very largely used in shipbuilding, and though its employment in war-vessels has diminished, it is still in very great demand for "liners" and similar ships. It is also used for furni-
ture, for door and window frames, for the construction of railway carriages, and for many other purposes. White ants eat the sap-
wood, but rarely attack the heartwood of teak. It is not, however,

proof against the borings of the teredo, from whose attacks the teak piles of the warwhes in the Rangoon river have to be protected by a sheathing of metal.

Once seasoned, teak timber does not split, crack, shrink, or alter its shape. In these qualities it is superior to most timbers. In contact with iron, neither the iron nor the teak suffers, and in this respect it is far superior to oak. It is not very hard, is easily worked, and takes a beautiful polish. It has great elasticity and strength, and is not very heavy. The average weight of perfectly seasoned wood fluctuates between 38 and 40 lb per cub. ft. Its weight, therefore, is a little less than that of English oak. Green teak timber, however, is heavier than water, so that,
TEAK

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unless thoroughly seasoned, the wood cannot be floated. In Burma, the trees are often used when cut for the ground, from 7 to 16 ft. Larger girths, up to 25 ft, are not uncommon.

The teak tree does not usually form pure forests. It is associated with bamboos and with a great variety of other trees, which have little effect on its economic value. Hence in the plantations established in Burma the object has been to raise forests of teak mixed with bamboos and other trees.

The coast of the teak timber produced in India is used in the country. The produce of the forests of Travancore, Cochin, the Madras presidency, Coorg, Mysore, Bombay, Berar and the Central Provinces is all so consumed. Formerly there was a considerable export from the ports of Moulmein, Rangoon and Mysore to the other teak-producing countries, Java, however, there have been exports from Saigon; and since 1882 Bangkok has sent considerable quantities to Europe. But the Burma coast is the chief source of supply at present. Rangoon was for a long time an important place for shipbuilding, teak being the chief timber used: between 1786 and 1825 111 European vessels were built at Rangoon, aggregating 35,000 tons. At the same time timber was exported, and when the timber began to come down from more distant forests, and in 1841 one-fourth of the supply was brought from the Attarans.

The increase in the export of timber from the Burma ports was slow at first, but has gone on rapidly since Rangoon became a British port. Since that time the timber brought to the Burma ports has come from the following sources: (1) from the forests in the British coast provinces, Pegu and Tenasserim; (2) from the forests of the former Portuguese kingdom, Cochin and the Malabar; (3) from the Sitang and Irrawaddy rivers; (4) from the forests in the Shan states formerly tributary to Burma, from the Karenni country, and from western Siam, whence it is floated to Moulmein by the Salwin river.

The following table shows the figures of the imports and exports of British India for the years 1901-2 to 1905-6:

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<tbody>
<tr>
<td>1901-2</td>
<td>17,842</td>
<td>13,083,908</td>
<td>66,071</td>
</tr>
<tr>
<td>1902-3</td>
<td>34,888</td>
<td>30,595,808</td>
<td>75,913</td>
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<tr>
<td>1903-4</td>
<td>46,015</td>
<td>42,461,190</td>
<td>60,053,950</td>
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<tr>
<td>1904-5</td>
<td>61,760</td>
<td>52,477,331</td>
<td>72,506</td>
</tr>
<tr>
<td>1905-6</td>
<td>61,500</td>
<td>50,215,557</td>
<td>61,482,291</td>
</tr>
<tr>
<td>Average</td>
<td>44,433</td>
<td>38,048,454</td>
<td>55,094</td>
</tr>
</tbody>
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Nearly the whole of the imports came from Siam, and of the exports four-fifths were from Burma. The balance of the imports consisted of timber from Java, that of the exports of supplies sent from peninsular ports. Two-thirds of the exports went to theRangoon presidency, the remaining third being ordinarily Germany, Ceylon and Australia. The recent great increase in the general teakwood trade is evidenced by the fact that the imports increased in six years from 17,842 tons in 1901-2 to 61,482 in 1905-6.

In British India, including Burma, a large portion of the teak-producing tracts have since 1856 been placed under conservancy management with the object of preventing overcutting and maintaining the forests. This is the object of the working plans referred to. The area of teak forest

1 It has been erroneously stated that the tree in Burma is tapped for its oil before felling.
available in India and Burma is considerable, and every endeavour is made to conserve it and increase its production. Similar measures have taken in Siam under the advice of officers borrowed from British India; and in the teak-producing native states in the peninsula the necessity for careful management is now well understood. The teak plantations in Java had come into bearing by 1908 and it was expected that the teak area in the Philippine Islands would be similarly developed.

(De Beers: J. S. Ca.)

TEAL (O.E. tele), a variety of duck, whose name is of uncertain origin, but doubtlessly cognate with the Dutch Tailing (formerly Tailen and Taling), and this apparently with the Scandinavian Ateling-And (Brunnich, Ornithol. Bow. 1838), and the Dutch possibly, or the Latin Atelis, to be found in many old records, though this last word (however it be spelt) is generally used in conjunction with teal, as if to mean a different kind of bird; and commentators have shown a marvellous iniquitude in surmising what that bird was.

The Teal is the Anas crecca of Linnaeus, Nettion crecca of modern ornithology, and the smallest of the European Anatidae, as well as one of the most abundant and highly esteemed for the table. It breeds in many parts of the British isles, and is present on the shores of some of the largest lakes, such as those formed by the Wild Duck, A. bosca; but there is no doubt that by far the greater number of those that are taken in decoys, or are shot, during the autumn and winter are of foreign origin. While the female presents the usual inconspicuous mottled plumage of the same sex in most species of Anatidae, the male is one of the handsomest of his kind. His deep chestnut head and throat are diversified on either side by a line of buff, which, springing from the neck, runs upward to the eye, in front of which it forms a fork, one prong passing backward above and the other below, enclosing a dark glossy-green patch, and both losing themselves in the elongated feathers of the hind-head and nape. The back and sides of the body appear to be grey, an effect produced by delicate transverse pencilling of black on a dull white ground. The outer lanceolate scapulars have one-half of their webs pure white, forming a conspicuous stripe along the side of the back. The breast is of a pale salmon or peach-blossom colour, each feather in front bearing a roundish dark spot, but these spots lessen in number and size lower down, and the warm tint passes into white on the belly. The tail coverts above and below are velvety black, but those at the sides are always chested by the Wild Duck, A. bosca: and these peculiarities to a great extent are the causes to which the Teal is so frequently and so appropriately applied.

The teal inhabits almost the whole of Europe and Asia, from Iceland to Japan,—in winter visiting Northern Africa and India. It occasionally occurs on the western shores of the Atlantic; but its place in North America is taken by its representative, A. carolinensis, the male of which is easily to be recognized by the absence of the upper buff line on the side of the head and of the white scapular stripe, while he presents a whitish crescentic bar on the sides of the lower neck just in front of the wings.

Species more or less allied to these two are found in most other parts of the world, and among such species are some (for instance, the N. gigolofrons of the Australian region) in which the male wears the same inconspicuous plumage as the female. But the determination of the birds which should be technically considered "Teals," and belong to the genus Netton, as distinguished from other groups of Anatidae is a task not yet successfully attempted, and much confusion has been caused by associating with them such species as the Garganey (q.v.) and its allies of the group Querquedula. Others again have not yet been discriminated from the Wigeons (q.v.), the Pintail-Ducks, D. Dailla, or even from the typical form of Anas (see Duck), into each of which genera the Teals seem to pass without any great break. In ordinary talk "Teal" seems to stand for any Duck-like bird of small size, and in that sense the word is often applied to the members of the genus Nettopus, though some systematists will have it that they are properly Geese. In the same loose sense the word is often applied to the two most beautiful of the family Anatidae, belonging to the genus Anas (commonly misspelt, Azas)—the Carolina Duck of North America, A. spona (not to be confounded with the above-named Anas carolinensis, and Netton carolinensis), and the Mandarin-Duck of China, A. gulericulata. Hardly less showy than these are the two species of the subgenus Emetta,—the Falcated Duck, E. falcata, and the Baikal Teal, E. formosa,—both from Eastern Asia, but occasionally appearing in Europe. Some British authors have referred to the latter of these well-marked species certain Ducks that from time to time occur, but they are doubtless hybrids, though the secret of their parentage may be unknown; and in this way a so-called Bimaculated Duck, Anas bimaculata, was for many years erroneously admitted as a natural species to the British list, but of late this has been properly discarded.

(AN.)

TEANO (anc. Teanum Sidicinum), a town of Campania, Italy, in the province of Caserta, 21 m. N.W. of that town on the main line from Rome to Naples, forming conjointly with Calvi an episcopal see. Pop. (1901) 6607 (town); 15,505 (commune). It stands at the S.E. foot of an extinct volcano, Rocca Monfina (3297 ft.), 643 ft. above sea-level. The cathedral dates from 1350, but has many columns obtained from the ruins of the ancient town. There is a feudal castle built by count Hugo of Sessa in the 11th century. Below the town on the S.E. is the old church of S. Paride.

The ancient Teanum Sidicinum (there is a Teanum Apulum, q.v., in Apulia) was the capital of the Oscan tribe of the Sidicini which drove the Aurunci from Rocca Monfina. They probably submitted to Rome in 334 B.C. and their troops were grouped with those of Campania in the Roman army. Thus the garrison of Regium, which in 280 attacked the citizens, consisted of one cohort of Sidicini and two of Campanians. Like Caes, Teanum continued to have the right of coinage, and, like Sessa and Calvi, remained faithful to Rome in both the Hannibalic and the Social wars. Its position gave it some military importance, and it was apparently made a colony by Claudius, not by Augustus. Strabo speaks of it as the most important town on the Via Latina, and only coming after Capua among the towns in the interior of Campania. It lay on the Via Latina, here joined by a branch road from Sessa, of which remains still exist, and which continued E. to Alliae. Remains of a theatre and an amphitheatre still exist, and some extensive baths, containing several statues, and some Roman dwellings, both some way below the modern town, were excavated in 1908. The church of S. Maria in Campo, 334 ft. above sea-level, representing the visit of the three kings to Bethlehem was found in 1907 (V. Spinaazzola in Notizie degli Scavi, 1907, 607; E. Gabrici, ibid., 1908, 309).

TEANUM APULUM, an ancient town of Apulia, Italy, on the road between Larinum and Spicuntm, 18 m. E. of the former, at the crossing of the Fortore near the modern village of S. Paolo di Civitate. It was called Teate in earlier times, as appears from its numerous coins, which have Oscan legends. It submitted to Rome in 316 B.C., being then the chief town of Apulia. It was afterwards known as Teanum Apulum, and was a municiplum. Some ruins and an old bridge over the Fortore still exist.

TEA-POY (Hindustani ñpdy), a small table, supported upon a tripod, or even upon four legs, for holding a tea-service or an urn. The word was also sometimes applied to a large porcelain or earthenware tea-caddy, and more frequently to the small bottles, often of Battersea enamel, which fitted into receptacles in the caddy and actually contained the tea.

TEAR, a drop of the liquid secretion of the lachrymal gland, commonly produced in a certain quantity and flowing through the nasal duct without notice, but, when stimulated by an allied smell, emotion or artificial excitation, increasing so that it flows over the eyelids and runs down the cheeks and is the visible result of crying or weeping (see Eye). The O.E. ñær, taer, is represented in other Teutonic languages by Dan. taar; Swed. lår; Goth. lagr, &c. The O.H. G. was zahar; the mod. Ger. Zähre was formed from the M.H. G. plural Zahere. The common word in Ger. Thräne, cf. Du. troon, is closely allied. The original root is seen in Gr. ñapox, Lat. lacrima, lacruma, for dracona, whence Fr. larme, and It., Sp., and Port. lagrima.
The generally accepted Indo-Germ. root is dak-, to bite, cf. Gr. ὀξέω, and Skt. dać, to bite, tears being "biting" or "bitter" things. The Du. troon, in the sense of tear-drop, was particularly applied to the blubber of whales reduced to oil by boiling, whence has come the tautological English "train-oil," often identified with the lubricant for the wheels of railway trains. For the so-called "tear-vessels," which are properly small vases containing unguents, see LACRYMATORY.

"Tear" (O.E. tere), to pull apart violently, to rend, is, of course, a distinct word; it is cognate with Gr. ἀκραίω, to flay, pull off, and the root is seen in Gr. ὀξύς, skin, whence "dermatology," "epidermis," &c.

TEASEL. Wild teasel is a common plant of the English copse, hedges, with a tall, stout, rigid, prickly stem, bearing large spreading opposite leaves, the middle one of which is oblong and conspicuous. The round heads, the purplish flowers in which are subtended by very long, narrow, stiff, upright bracts. The plant is known botanically as Dipsacus sylvestris. Fullcrum's teasel, D. Fullorum, in which the bracts are hooked, is probably a cultivated form of the wild species; the dry heads are used to comb up the nap on cloth. The genus Dipsacus gives its name to the family Dipsacaceae, to which also belongs the Scabions (Scabiosa), represented in Britain by several species.

TEATRE MARRUCINORUM [mod. Chieti, q.v.], the chief town of the Marrucini, the whole of whose territory was placed under its municipal jurisdiction by the Romans, and called "Social War." It was thus a town of some importance. Under the church of Ss. Pietro e Paolo and the adjoining houses are extensive substructures (opus reticulatum and brickwork) of the 1st century A.D., belonging to a building erected by M. Vectius Marcellus (probably mentioned by Pliny, H.N., II, 190) and Helvidia Priscilla. There are also remains of large reservoirs and of a theatre.

TEBESSA (the Roman Theveste), a town of Algeria in the department of Constantine, 145 m. S.E. of Bona by rail and 12 m. W. of the Tunisian frontier, on a plateau 2090 ft. above the sea. Pop. (1906) 5723. The modern town, which is within the walls of the Byzantine citadel, boasts nothing of interest save a church built out of the ancient ruins. The Byzantine walls, pierced by three gates, are in tolerable preservation. They are strengthened by numerous square towers. One of the gates is formed by the quadrifilar arch of Carcalla, a rare form of construction. The arch, erected about A.D. 212, is in good preservation. A pair of monolithic columns, disengaged, flank each façade. An inscription on the frieze gives the history of its construction; it was built by two brothers and a condition of inheriting the property of a third brother. The most important ruins are those of the great basilica. This building, one of the finest Roman monuments in Algeria, bears evidence of having been built at various epochs; the earlier portions probably date from not later than the beginning of the 2nd century A.D. The basilica was partially destroyed by the Berbers in the 5th century, and was rebuilt in A.D. 535 by the Byzantine general Solomon, who surrounded it with a wall about 25 feet high, still standing. The main building, consisting of a nave with apsidal end and two aisles, was approached through a peristyle, which was surrounded by two colonnades, the columns of which supported a roof. The building was completed by the emperor Justinian, and though several parts of the basilica have fallen, but the bases of all are in their original positions. A quadrifoil chapel on the east side of the basilica is a Byzantine addition. The tessellated pavement which covers the basilica proper is in almost perfect condition. It is kept covered, for purposes of preservation, by a layer of earth. Next the basilica (and within the same enclosing walls) are the ruins of the forum, converted into a monastery in the 4th or 5th century, and regarded by Sir R. Lambert Playfair as the oldest known example of the monasteria clericorum. The whole of the basilica and its dependencies have been cleared and are kept in order by the Service des Monuments historiques, the principal work being accomplished by Héron de Villefosse. Noteworthy among the buildings within the ancient citadel is a small tetrastyle temple, variously ascribed to Jupiter and Minerva, the portico supported by six monolithic columns of cippolino, four being in front. After the French occupation in 1842, the building was used successively as a soap factory, a prison, a canteen, a parish church, and, finally, as a museum. The monastery was founded towards the close of the 1st century A.D. In the succeeding centuries it was an important Carthaginian "great house." In the 5th century, under Vandal dominion, it declined in importance. Refounded by the Byzantines in the 6th century, the city disappeared from history at the time of the Arab conquest of the country in the 7th century. In the 16th century the Turks placed a small garrison of janissaries in the place, but Tebessa continued to be but a small village until the establishment of French rule.

Nine miles from Tebessa are the extensive phosphate quarries of Jebel Dyr, where is also an interesting megalithic village.


TECHNICAL EDUCATION. The term now generally adopted to designate the special training of persons in the arts and sciences that underlie the practice of some trade or profession, is called "technical education." Schools in which this training is provided are known as technical schools. In its widest sense, technical education embraces all kinds of instruction that have direct reference to the career a person is following or preparing to follow; but it is usual and convenient to restrict the term to the special training which helps to qualify a person to engage in some branch of productive industry, and the instruction so provided is generally known as "technical instruction." This specialized education may consist of the explanation of the processes concerned in production, or of instruction in art or science in its relation to industry, but it may also include the acquisition of the manual skill which production necessitates.

The terms "technical" and "technological" (Gr. τεχνη, art or craft) as applied to education, arose from the necessity of finding words to indicate the special training which was needed in consequence of the altered conditions of production during the 19th century. Whilst the changed conditions of production, consequent mainly on the application of steam power to machinery, demanded a special training for those who were to be engaged in productive industry, the prevalent system of education was not adapted to the requirements of these persons, and schools were wanted in which the necessary instruction could be obtained. Other circumstances resulting mainly from the application of steam power to machinery, production and rendered technical education necessary. Production on a large scale led to a great extension of the principle of the division of labour, in consequence of which it was found economical to keep a man constantly engaged at the same kind of work, since the more he practised it the quicker and more skilful he became. Thus employed, the workman learned little or nothing of the process of the manufacture at which he assisted, or of other departments of the work than the particular one in which he was engaged, and his only opportunity of acquiring such knowledge was outside the workshop or factory in a technical school. The employment of skilled labour, which was an essential part of the principle to other industries than those in which machinery is largely employed. There are many trades in which manual skill is as necessary now as ever, but in these the methods of instruction prevailing under the old system of apprenticeship are now almost obsolete.

In many industries, including trades in which machinery is not as yet extensively employed, production on a large scale has increased the demand for unskilled labour, numbers of hands being required to prepare the work to be finished by a few skilled artisans. Rapidity of execution is attained by keeping a workman at the same work, which after a time he proceeds to mechanically and continues to do until some machine is invented to take his place. In most trades, as formerly practised, the master...
employed a few apprentices who assisted him in his work, and who learnt from him to understand the details of their craft, so that, when the term of their apprenticeship was over, they were competent to practise as journeymen. But now the master frequently has neither time nor opportunity to instruct young lads, and the old relation of master and apprentice is changed into that of manufacturer and workman. In consequence of these altered relations between employer and employed, there has arisen an acknowledged want of properly trained workmen in a number of trades in which skilful hand work is still needed; and in these trades a demand has arisen for technical schools, or some other system of the training of the unskilled labourer by direct apprenticeship, as a means of suitably training workmen and foremen. The ever-increasing competition in production has led to the employment, in many trades, of children to do work of a mechanical kind requiring little skill; but, whilst thus employed, these young people have little opportunity of learning those parts of their trade in which skill and special knowledge are needed; and when they are grown up, and seek higher wages, they are dismissed to make room for other children. Numbers of young people are thus thrown upon the labour market, swelling the unskilled numbers of the unemployed. We are competent to do nothing more than children's work, and to earn children's wages, and who know no trade to which they can apply their hands. To remedy this, by creating some substitute for the old apprenticeship, is one of the objects of a system of technical education; though in suitable trades an independent movement for reviving apprenticeship (q.v.) under improved conditions has also made some way.

A complete system of technical education should provide the necessary instruction for the different classes of persons engaged in productive industry. It is usual to divide these persons into three classes:—(1) workmen or journeymen; (2) foremen or overseers; (3) managers or masters.

The industries in which they are employed may be grouped under four heads:—(1) those involving the use of extensive machinery, such as iron and steel manufacture, machine-making, the textile industries, and some of the chemical trades; (2) those which mainly require the use of hand tools, as cabinet-making, brick-work, plumbing, and tailoring; (3) those depending on artistic skill, as woodwork, metal-working, enamelling, decorative work, and industrial designing generally; (4) agriculture in all its branches, and forestry. These industries will be referred to as manufactures, handicrafts, art industries and agriculture. The foregoing classification comprises groups which necessarily, to some extent, overlap one another. Every factory contains a carpenter’s and smith’s shop, and handi- craftsman of group (2) are required in every manufacturing concern. Whilst the industries in which hand labour is exclusively employed are becoming fewer and fewer, there are many trades which, owing to the frequent invention of labour-saving appliances, are passing gradually from the class of handicrafts to that of manufactures. In these trades, of which watch- and clock-making and boot- and shoe-making may be taken as examples, there is still a demand for goods largely if not entirely produced by hand work. In such trades, owing to the absence of facilities for instruction in the ordinary shops, there is a want of skilled hand labour which there is an increasing difficulty in satisfying, and to supply this want technical schools of different kinds have been established. Then, again, there are many branches of manufacturing industry which greatly depend for their success upon the designer’s art, and it is necessary that the industrial designer should possess a knowledge of the processes of the manufacture in which his designs will be utilized, as well as of the properties and capabilities of the material to which they will be applied. Indeed, it is the possession of this knowledge which mainly distinguishes the industrial designer from the ordinary artist. To determine the best training for such designers is one of the problems of technical education. There are many trades, too, in which the handicraftsman and the designer should be united. This is the case in such industries as silversmith’s and goldsmith’s work. In these and other trades the true artisan is the artist and handicraftsman combined.

In order to reconcile some of the different views which are held as to the objects of technical education, it is necessary to keep in mind the broad distinction, above referred to, between the conditions of production on a large scale, as in those industries in which goods are manufactured by the use of extensive labour-saving machinery, and in those trades in which hand work still prevails, and which are frequently engaged in to and from countries, where the objects of opinion regarding the objects of technical education is due to the difference of standpoint from which the problem is regarded. The volume of the trade and commerce of Britain depends mainly on the progress of its manufacturing industries. It is these which chiefly affect the exports and imports. The aim of manufacturers is to produce cheaper and better goods than can be produced by other manufacturers at home or abroad; and technical education is valuable to them, in so far as it enables them to do so. It also helps to widen the area of productive industry, and to encourage varieties of activity which the existing system of free trade and free competition tends to all but to restrict. On the other hand, the artisan engaged in hand industries looks to technical education for self-improvement, and for the means of acquiring that general knowledge of the principles and practice of his trade, which he is unable to obtain in the commercial shop. Hence the artisan and the manufacturer approach the consideration of the question from different sides. To the spinner or weaver who almost exclusively employs women to tend his machinery, or to the manufacturing chemist whose workpeople are little more than labourers employed in carrying to and from materials, knowing little or nothing of the scientific principles underlying the complicated processes in which they are engaged, the technical education of the workpeople may seem to be a matter of little moment. What such manufacturers require are the services of a few skilled engineers, artistic designers or scientific chemists. From the manufacturer’s point of view, therefore, technical instruction is not so much needed for the hands he employs in his work as for the heads that direct it. But in trades in which machinery plays a subsidiary part, technical teaching supplies the place of that instruction which, in former times, the master gave to his apprentices, and the competition tended to make them attend technical classes with a view to acquiring that knowledge of the theory and practice of his trade, on the acquisition of which his individual success greatly depends. In the former class of industries, technical education is needed mainly for the training of managers; in the latter, for the training of workmen. Hence has arisen a double cry,—for the teaching of art and of the higher branches of science, with a view to their application to manufacturing industry, and for the specialized instruction in drawing, and in the scientific facts which help to explain the processes and methods connected with the practice of different crafts and trades. This double cry has led to the establishment of technical universities and of trade schools.

Owing to the conditions under which manufacturing industry is now carried on, it is difficult to select competent foremen from the rank and file of the workmen. The ordinary hands gain a very limited and circumscribed acquaintance with the details of the manufacture in which they are engaged, and have little opportunity of acquiring that general knowledge of various departments of work, and of the structure and uses of the machinery employed, which is essential to the foreman or overseer. It is in evening technical classes that this supplementary instruction, which it is the workman’s interest to acquire and the master’s to encourage, can be obtained; and it is from the more intelligent workmen who attend these classes that masters and employers will select as foremen those students who are found to possess the essential qualifications. The history of invention shows how frequently important improvements in machinery
are made by the workman or minder in charge of it, and adds weight to the arguments already adduced for giving technical instruction to persons of all grades employed in manufacturing industry. To these advantages of technical education, as affecting the workmen themselves as well as the progress of the industry in which they are engaged, must be added the general improvement in the character of the work produced, resulting from the superior and better-trained intelligence of those who have had the benefit of such instruction.

It will be seen from the foregoing that a complete system of technical education must make provision for the training of those who are to be occupied as journeymen or foremen in different branches of trade or industry, and also for those who aim at becoming managers or masters or heads of manufacturing firms, scientific advisers or professional engineers. As technical education necessarily implies specialized teaching, the curriculum and methods of instruction adopted in the elementary and secondary schools, where students receive their preliminary training, are matters closely related to any scheme of technical instruction, and the trend of public opinion in favour of amending the general instruction given in those schools with the specialized teaching of the technical institutions. Indeed, it is daily becoming more difficult to draw any hard-and-fast line between professional and general education. It is now universally recognized that the foundations of technical instruction must be laid in the elementary and the secondary schools, and many of the changes which have been made in the organization of those schools had their origin in the requirements of technical institutions.

A short survey of the methods adopted in different countries to provide the specialized teaching applicable to different pursuits, and of its relation to the general school system of those countries, will serve as a fitting introduction to the consideration of the legislative and other changes which have gradually been made in the British school system with a view to modern industrial conditions. The study of foreign systems of education is serviceable as showing the relation of such systems to the industrial needs of each country and to the genius and character of the people. In the organization of technical education in England, full advantage has been taken of foreign experience, although much attention has been given to amending the general foreign methods. Detailed information as to what has been done abroad is found in the published reports of the several English commissions which have been appointed to inquire into the subject, and in the valuable series of special reports issued from the Board of Education. From these reports which show how varied have been the attempts to adapt school training to modern industrial requirements, certain general principles may be inferred, which are equally applicable to the conditions under which the trade and commerce of different countries is now carried on.

These general principles may be briefly enunciated as follows:

1. The education of all persons who may expect to be occupied in some form of productive industry may be considered as consisting of two parts, (a) general, (b) special.

2. The general education is the preliminary training provided in elementary and secondary schools, and the curriculum of those schools should be varied so as to have some reference to the future pursuits of the pupils.

3. The specific or supplementary instruction should be adapted to the requirements of different grades and classes of workers, and to different trades or occupations as practised in different localities.

A complete system of technical education would afford facilities of training adapted to every kind and grade of industry; but, owing to the complexity of the subject, such a system is nowhere to be found. In every country the scheme of education and method of instruction have varied from time to time, as the conditions regulating trade and industry have changed. But recently in all civilized countries, the effort has been made to provide a general and specialized education adapted to different pursuits for each of these great classes of workers: (1) operatives, (2) foremen and overseers, (3) masters and managers.

1. Workmen.—Many attempts have been made to provide a substitute for apprenticeship, but hitherto with no great success. We have, therefore, to consider, as connected with the workpeople in manufacturing industries, and (2) those engaged in handicraft industries. The education of all classes of workpeople begins in the public elementary schools; and, in view of the future occupation of these children, it may be taken that the general technical instruction should be practical, and should include drawing and elementary science. It should indeed be closely associated with manual training, connecting workpeople with workshops in various branches of trade in urban and rural schools respectively, and in instruction of the domestic arts in the case of girls. The lessons in drawing and in elementary science should form part of the manual training, and the school should be so arranged that all the subjects of instruction should be grouped together as parts of an organized system. The desired diversity should be found in the different kinds and grades of manual work. Reading, writing and arithmetic would be taught incidentally in close connexion with the practical exercises. In nearly every country of Europe, and in the United States, the trend of education is in this direction. Swedish handicraft instruction is generally included in the curriculum of elementary schools. Rudimentary science is also taught in nearly all the primary schools of Europe. Modelling is taught both boys and girls in many Continental schools; and in Sweden ‘'loyd’’ (Sw. , manual dexterity, cf. Eng. 'sleight') is a system of manual training, in which simple and useful articles, especially of wood, are constructed with the fewest possible tools, is taught with considerable success in both France and Sweden.

In Germany and Switzerland, there exists an excellent system of evening continuation schools, known as Fortbildungs- or Ergänzungs- schulen, in which every child who leaves school before fourteen, and of those who leave at that age, is continued. In all these schools drawing is taught with special reference to local industries. In England great progress has been made in recent years in developing evening classes; but the pupils’ elementary instruction is continued with a view to the specialized teaching provided in the technical school. The teaching in these continuation schools is generally varied according as the pupil is occupied in trade or office work, and the practice is becoming general of requiring him to pass a qualifying examination to secure admission to classes in technology. It will be seen, therefore, that the training of most workpeople, and of nearly all those who are engaged in manufacturing industry, consists of:—(1) primary teaching in elementary schools; (2) practice in the factory or shop, supplemented by further elementary teaching in evening classes; (3) technical examination. In all the principal towns throughout Europe evening classes have been established for teaching drawing, painting and designing, and the elements of science in their application to special industries. Their conduct, however, has not been always uniform; they are supported in some cases by the local governments and in others by the corresponding schools in England. The classes are usually supported by the municipalities, by the chambers of commerce, by industrial associations, or by funds contributed by some cases by the fees of the pupils. They receive little or no support from the state. They are well attended by workpeople of all grades, who are encouraged by their employers to profit by these opportunities of instruction. In England evening technical instruction is more systematically organized than in any other country. It is under the general direction of the Board of Education, of the City, and Guilds of London Institute.

The Board of Education prescribe the conditions under which grants are paid to schools providing technical instruction. In former years these grants were paid on the results of the examination of individual students; but this method ofappraisal being found insufficient, the system of state aid has been almost entirely abandoned. The Board still hold annual examinations in science and art and in certain branches of applied science; but the more specialized examinations in technical instruction are annually held by the City and Guilds of London Institute, through its department of technology. These latter examinations are utilized by the Board, and the certificates granted for the results are recognized by the employers of apprentices. The technical schools in which these classes are held are under the direct control of the local educational authorities, and are largely supported by grants from local rates, and in recent years by means of contributions from the local authorities, with a view to encouraging greater variety of instruction and further adaptation of the teaching to local needs. The Board continue, however, to indicate the range of subjects to be taught for each class of workpeople, and the City and Guilds of London Institute issues each year a programme containing suggested courses of training in nearly a hundred trade subjects.

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In the evening classes in science, art, and technology, which have been established throughout the United Kingdom, the workman or foreman in the artisanal industries has been enabled to benefit by payment of a very small fee, of studying art in all its branches, science theoretically and practically, and the technology of any particular industry. Provided his early education enables him to take advantage of the classes, the technical evening system has already supplanted temporary instruction in the United Kingdom. It is suggested enabling workmen, whilst earning wages at an early age, to acquire manual skill by continuous practice, and at the same time to gain a knowledge of the principles of science connected with their trade, and the economy of the processes of the manufacture in which they are engaged.

For those engaged in handicraft trades this evening instruction is of the highest value on other workmen, the latter as a substitute for the shop. In such a school the pupils have the advantage of being taught their trade systematically and lend them to the practical men and women engaged. Such an artificial system of production, the pupil is less likely to acquire excellence of workmanship and smartness of habit than in the mercantile shop, under the strain of severe competition. Moreover, sending an able and practical men and women to look at them as a substitute for apprenticeship. By sending into the labour market, however, a few highly trained workmen, who are absorbed in various works, and exert a beneficial influence on other workmen, they become the leaders and the leaders of the shops serve a double purpose. Schools of this kind have been tried with more or less success in different countries. In France there is the well-known École des Arts et Métiers, which has the object of practical education, and similar schools have been established in other parts of France. For many years a society of Christian Brethren has directed a large school situated in the Rue Vaugirard, Paris, in which different trades are taught. The system combines many of the advantages of shop work and school work, and it depends financially for its success upon the religious spirit which actuates its promoters and supporters. The Ariane school, near Dublin, is conducted on similar lines, and a number of similar schools are established in other parts of France. In Austria, particularly in the rural districts, there are numerous day schools for the training of carpenters, joiners, turners, cabinetmakers, workers in stone and marble, in silver, gold, brass, &c. In Germany, Germany, and Holland, and schools very similar in character have been organized to a limited extent in England. The demand that called them into existence in other parts of Europe and America is likely to be felt in the United Kingdom in the future. The difficulty of securing apprentices in a commercial shop systematic training in handicraft has led to the establishment of a few trade schools which receive children from the elementary school about the age of fifteen for a three years' course of instruction. In such schools the time is about equally divided between ordinary school subjects and the practice of some handicraft, such as cabinet-making, upholstery, waist-coat-making, millinery. Parents are encouraged to allow their children to receive this further education by the offer of free teaching and maintenance grants. Such schools, however, must be regarded as educational experiments, to be superseded if not improved. A system by which the trade can secure organized instruction in the craft which they are engaged. Any system of technical education, however, should be sufficiently elastic to permit of such experiments and of the introduction of types of instruction to meet special and temporary needs. It is only in certain cases that apprenticeship schools can be said to answer satisfactorily the purpose for which they have been established. Where a new industry, especially one employing at least a few hundred skilled workmen, industries need to be revived; where machinery is superseding hand work, and, owing to the demands for ordinary hands, there is a valuable demand for older hands, the workmen; where the requirements for the various special hands in the trade are different, and that general knowledge of their work, and to acquire that general knowledge of their work, and to exhibit those special aptitudes, which may qualify them for the position of special workmen. The type of a technical education is, though, limited to the middle class and to the working classes, although having some bias towards the future career of the pupil, is disciplinary in character, and consists of the subjects of primary instruction further pursued,—of drawing, modelling, science, arithmetic, &c.,—as far as they have practical application, according to local requirements, the technology of the staple industries forming in many cases part of the instruction. Such
schools, under varied forms, have been established in most European countries, some of the best examples of them being found in Paris, London, Berlin, Rouen, and in other towns of France. One of the oldest of these schools is the Collège Royal at Paris, which was founded in 1280 by a bequest from Major-General Martin, who had fought against the English under Tippoo Sahib. In this school instruction is given in the arts of stonecutting, mining, and higher elementary schools of France, instruction is given in drawing, modelling, chemistry, mechanics and physics, in the working of wood and iron, and in German and English in addition to the subjects given in the common schools. The technical education given to some of the pupils, and the instruction generally is of a very practical character. The students visit factories under the guidance of men of practical experience in their full appreciation of the work of the future. The school hours are from seven till eleven in the morning and from one till seven in the afternoon. The boys from this school rapidly obtain places in the commercial and industrial houses, and in the various branches of the great state. A large number obtain high positions. A very similar school, on more modern lines, has been established at Reims, and is accommodated in a building especially adapted to the purpose. In this school instruction is directed towards the staple industries of the district, namely, weaving, dyeing and engineering. There are many other similar schools in France, the object of which is to give the children of the merchant and industrial classes an education, as to qualify them for higher posts in industrial works. The cost of this higher education seldom exceeds 5 per annum. In Bavaria there is a type of school called 'Industrie-Schule', which serves very well for the training of engineers and industrial chemists, who are trained to higher intermediate posts, and desire to enter upon commercial work at an earlier age than students attending a university or technical college. The instruction in these Industrie-Schulen is largely practical, but is also attended with some amount of literary and linguistic training. Some of the students proceed to the technical university, but the majority find posts as foremen or overseers soon after completing their courses of instruction. In the United States technical instruction is nearly all branches of technology. Other schools in Germany are less complete, but most of them have one or more departments which are specially organized with a view to the highest grade of technical instruction. Both the universities and in the technical high schools facilities for scientific research are provided, and the students are encouraged to undertake original investigations. The technical high schools are now placed in the same educational platform as the universities and have the power to confer the degree of Doctor of Engineering on students fulfilling the required conditions.

In France, the institutions in which the highest technical instruction is obtained are the Polytechnic schools, which are usually founded in the capital. There are a large number of provincial colleges such as the Ecole Centrale at Lyons, the Ecole des Mines at St Etienne and the Ecole des Mines de Dijon. The Ecole Centrale at Paris, which is the highest technical school and has been in existence since 1803, has a great reputation, and was founded in 1843 at a cost of about £50,000. It is situated in what was a suburb of Berlin, and is generally known as the Charlottenburg Institution. It includes departments for the higher degree of masters in civil and military engineering, the theory of structures, and the science of iron and steel. The educational departments of the Ecole Centrale are well provided with workshops and laboratories, and are on a high technical level. The school, by having a large number of professors attached to it, is able to give the highest degree of instruction in all the branches of technology. There are nearly all branches of technology. Other schools in Germany are less complete, but most of them have one or more departments which are specially organized with a view to the highest grade of technical instruction. Both the universities and in the technical high schools facilities for scientific research are provided, and the students are encouraged to undertake original investigations. The technical high schools are now placed in the same educational platform as the universities and have the power to confer the degree of Doctor of Engineering on students fulfilling the required conditions.

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TECHNICAL EDUCATION

of managers in engineering and industrial works—are found in the United States. From the opening of a school, the student may go at once into business; or he may proceed to a college, with a four years' course of general instruction; or he may enter a professional or technical school. In higher education which adapts itself to the desire of students of all classes to obtain it, in many cases at considerable individual sacrifice, and by the value which masters and employers attach to a college-trained youth, is partly due to the large proportion of practice instead of theory at these schools. The schools are of two general types, the ordinary and technical high school.

Higher technical training in United States

To the foundation and maintenance of these schools wealthy citizens have given or bequeathed enormous sums of money, and they further endow the system of the college, the college system, by which there was set up the Morrill Act of 1862 to give assistance to institutions providing instruction in agriculture and the mechanical arts. Several colleges whose work was mainly literary took advantage of this act to endow institutions and technical high schools in order to secure the income to be obtained by compliance with its provisions.

Without entering into great detail, it may be said that the schools providing advanced technical instruction may be grouped under three headings: (1) those which are free from state or federal control and are maintained from funds arising out of endowments and students' fees, such as the Massachusetts Institute of Technology and Boston University; (2) those supported by the federal government, which are under the control of the federal government, as those which are equal in public control, such as Columbia University, New York, and the Sidney College of Mechanical Arts, Cornell University, and member of the state, such as the universities of Illinois and Michigan.

Contributions from private sources towards the establishment and equipment of these institutions are far in excess of those in any other part of the world. Between the years 1890 and 1901 these contributions amounted to about $23,000,000.

The American universities, with which the technical institutions are in many cases closely associated, differ from those in the United Kingdom in their examinations for degrees. In this respect they have adopted the practice of the German and other continental universities. The examinations are almost uniformly conducted by the teachers. The external examiner is practically unknown. This system allows considerable freedom to the teacher, and is said by some of his best and most eminent professors to be one of the most efficient methods of training many of the states, particularly in the east, even the matriculation, or entrance examination, being superseded by a system known as the "accrediting" system of the secondary of high or schools, where the students receive their general education. According to this system, the schools are inspected by the professors of the university, and those in which the equipment, the courses of instruction, and the method of teaching are found to be satisfactory, are included in a list of "accredited" or approved schools, and the pupils of such schools, who produce a certificate of having satisfactorily attended the prescribed course of study, are admitted to the university without further examination. This is the system that it brings the professors of the university into direct relationship with the schools in which the students receive their preliminary training, and closely connects the instruction provided in the school with the higher orders of specialized teaching of the university.

The widespread appreciation of the advantages of the higher education among all classes of the American people, and the general recognition by manufacturers, engineers, and employers of labour, of the value to them, in their own work, of the services of college-trained men, has largely helped to increase the number of students who reach the universities and technical high schools and to encourage in every state the foundation of schools for advanced professional training.

The institutions in which the highest technical instruction is provided are largely devoted to the preparation of engineers in all its branches, including mining engineering, and of chemistry in its application to manufacturing industry; besides schools of agriculture and forestry and schools of design.

One of these, the Massachusetts Institute of Technology at Boston is the most typical. It was founded in 1859 with a view to supplying a need in the education of men trained in the general training of other institutions. In 1861 an act was passed incorporating a body of persons for the purpose, inter alia, of aiding in the advancement of science in its application to the arts, agriculture, and health, and establishing a school of science, with the power to conduct the instruction of its students, and to confer degree certificates on them in such of the liberal arts, sciences, and practical arts as the school may prescribe. The character of the instruction is such as to provide for technical courses as well as general courses of instruction. This was the first of the systems of technical education in the United States. In 1859 the school was established for the purpose of providing the highest grade of engineering education. In this respect it compared more nearly than any other institution with the highest schools of Europe. The School of Mines, connected with the Royal College of Science, was a similar institution, providing the highest teaching for mining engineers. In Birmingham, Leeds and Sheffield, schools of applied science were established under the names respectively of the Mason College, the Yorkshire College of Science, and Firth College, which gradually developed into technical colleges to which a literary side has been added. The first of these colleges was the Owens College, Manchester, which combined the curriculum of a university with that of a technical high school. Its school of applied chemistry was, for many years, of the most flourishing kind in the United Kingdom. A similar school was founded in Liverpool as a university college, and the Yorkshire College of Science similarly widened its curriculum. To this college, a technical school, including a department for dyeing and design, was added in 1855, and in 1864 another was added in the area of over twenty-five acres, contains blocks of buildings devoted to the teaching of mining and engineering, and at Shefield there is a special school dealing with the metallurgy of iron and steel.

The University of Manchester soon after its incorporation entered into arrangements with the municipal school of technology in that city, which took the first steps to provide the students of the well-equipped buildings of the municipal school, the largest institution of the kind in Great Britain. It was publicly opened in the year 1892. In these new universities ample provision is made for the instruction of students in advanced technical courses, and the laboratories provided for this purpose are well equipped with machinery and apparatus, and compare favorably with some of the most recently erected in Germany. Schools for mining engineers have been established at the universities of Saxon Switzerland and the universities of Saxon Switzerland and the universities of Saxon Switzerland and the universities of Saxon Switzerland. They have been provided for the students of the universities of Saxon Switzerland and the universities of Saxon Switzerland. In Saxon Switzerland, technical instruction forms part of the ordinary university courses in which degrees are granted.

Some other colleges outside London, besides those named, which participate in the government grant, also give high technical training. The most notable, giving higher grade instruction of a technical character,
are University College, Bristol; Armstrong College, Newcastle-on-Tyne; and the university colleges at Nottingham, Reading and Southampton.

The University of Cambridge has a school of engineering with well-endowed scholarships for the study of pure and applied sciences. The universities of Edinburgh and Glasgow recognized at an early date, as part of a university course, the teaching of science in its application to engineering; and at University College, Dublin, in 1853, the foundation of the department of spinning and weaving, more particularly with reference to the manufacture of jute and linen.

In London, the Middlesex College and King's College fulfilled for many years the function of a university and technical high school. Soon after the reorganization of the University of London in 1901, by which that institution was changed from an educational into a university corporation, the Middlesex College and King's College, which were named in the charter as schools of the university, transferred their funds, buildings, &c., to the University of London. King's College, which was founded in 1829, and the Middlesex College, which was originally founded as a technical school in connexion with the People's Palace at Mile End, was admitted in 1907 as a school of the university, and under the statutes of the university certain teachers in the Polytechnic institutes became university teachers, and their students were admitted to graduation as internal students. Most of the students so admitted graduated in the faculty of engineering. For several years it was apparent that the work of the City Guilds Central College and that of the Royal College of Science and School of Mines overlapped to some extent, and that the teaching in each separate institution was incomplete and needed to be supplemented. A report of a joint committee was accordingly appointed by the president of the Board of Education in the year 1904 to consider the working of the government College of Science and the School of Mines and their relation to other institutions. In this report a recommendation was published in 1906, a charter of incorporation was granted in 1907 to a new institution under the name of the Imperial College of Science and Technology, in which the teaching given in the three schools would be co-ordinated under a new governing body, consisting of members appointed by the Crown, the Board of Education, the City and Guilds of London Institute, the University of London and the principal engineering societies, with power to negotiate with the university for the transfer to the new institution of the engineering departments of University College and of King's College. The Exhibition Commissioners of 1851 agreed to grant unoccupied sites of about 9 acres to King's College for the extension of, and the building of new departments to, the existing colleges, and large annual endowments were promised by the government and the London County Council in addition to sums of money from private sources. The new Imperial College of Science and Technology began teaching in 1888, by charter a school of the university, and is intended to provide the highest instruction in engineering and applied science, with facilities for advanced research work. The scheme was intended, when complete, to supply the metropolis with a technical school of the highest grade, similar to some extent to the well-known institutions in Berlin (Charlottenburg) and Massachusetts, but adapted to the special industrial needs of the British empire.

Legislative enactments.—The state organization of technical education in the United Kingdom is mainly the result of enactments passed in and after the year 1850. Before that date, however, as early as 1877, the Livery Companies of London, with a view to fulfilling the purposes for which by charter they were originally incorporated, began to consider how best they could initiate a national scheme of technical education, for which they could not act under the changed conditions under which British industries were conducted, a strong demand had arisen. They consulted leading manufacturers and some of the best-known scientific authorities, and in 1880 an association was formed of the City corporation and some of the wealthier City companies under the name of the City and Guilds of London Institute for the advancement of technical education. The scheme of the institute was to establish a central institution at South Kensington, somewhat on the lines of the high schools of Germany, and one or more technical schools of intermediate grade in London, and to encourage, by means of grants, money and by examination certificates technical classes and trade schools in different parts of the United Kingdom. In March 1888, an organizing director and secretary was appointed to develop and give effect to the scheme. As indicating the importance of the movement King Edward VII., then prince of Wales, accepted the office of president of the institute, which thus led the way to the establishment, under the direction of the government and under the control of local authorities, of a national system of technical education. The successive steps by which the system was evolved, and how it was gradually incorporated into the general scheme of education, are matters of interest in the history of education. A definition of "technical instruction" applicable to the varied teaching of the United Kingdom was, in the first instance, fixed by act of parliament. The term included instruction in science, art, and technology, and also in manual training; and by "technology" was understood the practical application of different kinds of knowledge to a particular trade, or industry, or occupation.

The progress of technical education was very much helped by the formation of the "National Association for the Promotion of Technical Education," which was inaugurated at a meeting held on the 1st of July 1887 and dissolved when its objects had been fulfilled, in June 1907, after twenty years of useful work. The general objects of the association were to promote and watch legislation, to spread information, and to discuss and assist in giving effect to the recommendations of royal commissions appointed to inquire into educational methods and organizations. To this activity the educational department of the then In England had been largely due. The first legislative effort to give effect to the recommendations of the Royal Commission on Technical Instruction, whose report was published in 1884, was a bill introduced into parliament in July 1887. The purpose of this bill was to enable school boards and local authorities to provide out of the rates technical schools, or to contribute to their support. A special provision of the bill was that a poll might be demanded by fifty ratepayers before any action could be taken under the powers it conferred. Technical instruction was also defined as to include subjects aided or sanctioned by the Science and Art Department. The bill was read a second time on 9th of August 1887, but never reached the committee stage. In the following March a new bill was introduced on behalf of the "National Association." It empowered school boards to provide technical instruction in schools under their management, and to contribute to the maintenance of higher technical institutes. The definition of technical instruction was widened so as to include the use of tools, commercial subjects, modern languages, and any subjects sanctioned jointly by the Education Department at Whitehall and the Science and Art Department. South Kensington, which at that time were practically separate government departments. The bill gave very extensive powers to school boards. It was withdrawn without a second reading, in view of the avowed intention of the government to deal with the subject. On the 17th of May 1888 the government bill was introduced. It contained several new features which pointed in the direction of subsequent legislation. Whilst school boards were again empowered to provide technical instruction in their own schools, they were also required, under certain conditions, to aid in the supply of technical and manual training in voluntary schools. At the same time the local control of secondary technical instruction was placed in the hands of a separate authority, viz., the "authority empowered to carry out the Public Libraries Acts," Additional rates, limited in each case to 1d. in the £, might be levied. The bill bristled with difficulties. It aimed at placing the voluntary schools, as regards technical instruction, under the control of school boards, but set up a new authority for the control of technical instruction higher than elementary. There was a growing belief, however, that school boards were not the most suitable bodies for the direction or control of technical education. This belief arose from the difficulty of devising means for securing equal advantages to both classes of elementary schools, and from the general unwillingness to extend school board authority beyond the limits of elementary instruction.

No reference was made to technical education in the Queen's Speech in opening the parliamentary session of 1889, but the
subject had been fully discussed during the recess. The difficulties in the way of legislation on the lines previously attempted were considerable, and it was recognized that separate and distinct measures would have to be adopted for providing technical instruction in elementary schools and in schools of a higher grade. During the year 1889 three bills were introduced by private members. Two only of these bills were considered: the one dealing with elementary education, and enabling school boards to give technical teaching in schools under their management; the other enabling local authorities to establish or contribute to technical schools and classes. The former bill was fully discussed, but in the absence of any practical settlement of the voluntary school difficulty the government withdrew its support, and the bill was dropped. About this time the passing of another legislative measure helped very considerably towards the solution of the difficulty. The Local Government bill, which became law in 1888, enacted that “a council shall be established in every administrative county . . . and be entrusted with the management of the administrative and financial business of that county.” A number of new representative bodies known as county councils were thus created, with powers similar in character to those possessed by the local boards of education, and all business previously conducted by the county municipal bodies for educational purposes the necessity of entrusting technical instruction to school boards was avoided; and, accordingly, on the 24th of July 1889, the government introduced into the House of Commons a bill conferring upon county and county borough councils, and also upon urban sanitary authorities, the power to levy a rate not exceeding 1d. in the £ for the purpose of promoting technical and manual instruction in their district. This bill met with serious opposition from school board authorities and their friends, who resented the limitations it imposed on their educational aspirations; but the government was resolved to pass it, and after much obstruction it became law on the 16th of August 1889, having passed through all its stages in the House of Lords in a single sitting. The bill marked an epoch in the history of education, being the first legislative enactment dealing with technical instruction in England.

The act (Technical Instruction Act, 1888) provided that:

The expression “technical instruction,” shall mean instruction in the principles of science and art applicable to industries, and in the practice of the various branches of industry and art, in the local industries or employment. It shall not include teaching the practice of any trade or industry or employment, but, save as aforesaid, shall include instruction in the principles of science and art with respect to which grants are for the time being made by the Department of Science and Art, and any other form of instruction (including modern languages and commercial and agricultural subjects), which may for the time being be sanctioned by that department by a minute laid before parliament, and made on the representation of a local authority that such a form of instruction is required by the circumstances of its district.

Although at first received with no great favour, the act proved useful, and is important as representing the outcome of a number of abortive attempts at legislation, occupying three years, and intended to give practical effect to some of the recommendations of the Royal Commission of 1884. The act definitely settled the question as to the local authority for technical instruction, and decided it against the school board. It contained no provision, however, for the supply of technical instruction to children in a separate voluntary or board schools, and even expressly excluded from any share in its benefits all scholars receiving instruction in the obligatory or standard subjects. A way was soon found, however, of providing for technical instruction in elementary schools without any fresh act of parliament, and the difficulty of reconciling the interests of voluntary and board schools, which had impeded previous attempts at legislation, was thus avoided.

Early in 1886 the School Board for London, finding that it was unable to expend on technical instruction any part of the school board rate, applied to the City and Guilds of London Institute for financial help. The application was favourably received, and in the following year a joint-committee was formed, consisting of representatives of the Board, of the Institute and of the Drapers’ Company. With the funds supplied by the Company and the Institute the committee were enabled to try some interesting educational experiments. Six centres for workshop instruction were equipped, and children were received into the classes from voluntary and board school. A scheme was devised for grading the work of the institutions, the prominence the disciplinary character of the teaching, and of distinguishing it from the rule-of-thumb methods adopted in the workshop of commerce; and the experience of foreign schools, especially those in France, was utilized. The fears of trade unions lest the action of the school board would have the effect of increasing the number of trade carpenters were minimized, and the real value of manual training as a part of general education was for the first time illustrated. The experiment proved so successful that H.M. inspectors reported most favourably on the usefulness of the teaching, and on the value of the instruction in improving the general intelligence of the pupils, and particularly in rendering them more skilful and observant. Indeed, it was found that their progress in ordinary school studies was quickened by the practical training of the shop. As the result of these experiments the “use of tools” was recognized in the government code of 1890 as a subject of school instruction on which grants were to be paid, and towards the cost of which the school board rate was applicable. Later, following further experiments by the joint-committee, laundry-work and housewifery were included in the curriculum, and the problem of introducing so-called technical teaching into elementary schools was solved without any special legislation. Since 1890 manual training has formed a part of the elementary school system. The instruction includes the use of wood-working and metal-working tools, but stops short of teaching any particular trade, and is thus differentiated from the teaching given in the municipal schools of Paris. The new code also provided for a more rational system of object-lessons and of rudimentary science teaching, encouraging practical exercises and experiments to be worked by the pupils themselves. The joint-committee having completed its work, ceased to exist in 1900.

The act of 1889 and the code of 1890 enabled local authorities and school boards to provide out of the rates technical instruction for the working classes. The rate available under the act was limited to one penny in the pound, and very gradually, and with some hesitation, certain local authorities put the act in force. The motive power required for promoting technical instruction, other than that in elementary schools, was, however, still wanting, and might have remained so for some time longer if it had not been for the accident that in the following year, during the discussion in parliament of the question of compensation relating to public-houses, the residue of the beer and spirit duty was found to be unappropriated, and was allocated to county and county borough councils and made available for the purposes of technical education. The Local Taxation (Customs and Excise) Act, which became law on the 18th of August 1890, was “an act for the distribution and application of certain duties of customs and excise,” and it provided that the residue of the English share of these duties should be distributed between county and county borough funds, and made applicable “for the purposes of technical education within the meaning of the Technical Instruction Act, 1888.” By the express terms of this act this disposition of the residue, which then amounted to £743,000 for England and Wales, was revocable by parliament, and the allocation of the fund to education was left to the discretion of the local authorities. The grant accordingly was not generally regarded as permanent, and local
authorities hesitated to commit themselves to any definite educational schemes. Indeed, it was seriously doubted whether such a measure was likely to be made a permanent annual contribution from the state to the purposes of technical education. But gradually small sums were provisionally voted in aid of existing schools; and when the then Chancellor of the Exchequer declared that, if the "whisky" money (as it was commonly called) were found to be well and carefully expended, no future Chancellor would be able to divert it to any other purpose, local authorities began to consider how the money that had fallen into their hands might be best employed to meet local educational needs. Special committees were accordingly formed, consisting in many cases not only of members of the county or town council, but also of persons versed in educational matters, to whom the preparation of schemes of instruction suitable to the several districts was referred. The committees so constituted, known as technical instruction committees, were established in different parts of the country, and to these bodies was delegated, subject to periodic reports to the council, the responsibility of dealing with the moneys at their disposal. The technical instruction committees proceeded in nearly all cases to elect as secretary a gentleman of scholarly attainments and educational experience, capable of setting on foot and in- terpreting the organization of schools and classes in accordance with the terms of the act and the special requirements of the districts. As a result of the acts of 1889 and 1890 local educational authorities altogether distinct from school boards came into existence, each with an organizing secretary acting as educational officer for the district. The creation of these educational authorities, with functions, however, limited to technical instruction, marks the most important step in the organization of education since the establishment of school boards.

By special minutes of the School and Art Department, new subjects were from time to time included under the term "technical," and the definition of technical education was gradually widened. Among the subjects first added to the list were those included in the "programme of technological examinations" of the City and Guilds of London Institute, and the teaching of technology, as distinct from science, was thus for the first time officially recognized and aided by grants from public funds. Later, commercial subjects and modern languages, the theory and practice of agriculture, and the arts and crafts underlying various cottage industries were accepted as branches of technical instruction; and whilst, on the one hand, the definition was so widened as to include nearly all that is comprised in the curriculum of a secondary school, the teaching of certain technological subjects approached so near to trade teaching that the provision excluding "the practice of any trade or industry or employment" from the teaching sanctioned by the act appeared likely to be overlooked. Practical instruction in engineering, weaving, printing, photography, plumbing, carpentry, brickwork, book-binding and other subjects was encouraged by the City and Guilds Institute, acting as a central authority for education of a distinctly technological character; but notwithstanding the continued increase in the number of practical classes in different branches of technology, the teaching of technology as distinct from that of science and art received at this time no direct support by means of grants in aid from the state. Under the new conditions, however, of assessing the government grant, introduced into the Directory of 1901-02, instruction in technology received some form of recognition.

The county of London remained for some time behind other counties in utilizing the provisions to the Technical Instruction Schemes for London. Act of 1889, by devoting to educational purposes the funds placed at its disposal by the Local Taxation (Customs and Excise) Act, 1890. The funds applicable to London, which in the first instance amounted to about £165,000, but soon reached a total of about £200,000, were wholly employed for a period of two years in relief of the rates. The wants of London were not at first understood; and it was thought that sufficient funds for educational purposes might be obtained from other sources. A scheme for the utilization of a fairly large income arising from the City parochial charities had been under the consideration of the Charity Commissioners. It was first published in 1888, and, after some discussion and modification, was sanctioned by parliament. According to that scheme a capital sum of about £50,000, supplemented by a like amount obtained from the City companies and other sources, was made available for the building of technical and recreative institutions for the poorer classes of the working population of London, similar to the Polytechnic in Regent Street and the People's Palace in Mile End. The scheme created a central governing body for the general supervision and control of such institutions, and placed its disposal an income of about £50,000 available for educational purposes, which, with the falling-in of leases, was certain to increase. Provision for the endowment of eight polytechnics and of other educational institutions was made in the scheme, and the Goldsmith's Company undertook to erect and maintain from its corporate funds a ninth, which has since been presented by the Company to the University of London, and under the name of the Goldsmiths' College is used mainly as a school for the training of teachers. Since then other similar but somewhat smaller schemes have been established.

Before the erection of these new institutions was completed it was ascertained that the annual income at the disposal of the trustees for the purposes of maintenance and equipment was altogether inadequate; and a committee of inquiry having been appointed by the London County Council, an exhaustive report on the educational needs of the metropolis was prepared, which led to the formation of a Technical Education Board for London, consisting of members of the County Council, who formed the majority of the board, and also of representatives of the City Parochial Trustees, of the City and Guilds Institute, of the School Board, and of other bodies; and to the board so constituted the council entrusted the spending of the funds available under the Local Taxation Act, 1890. The board held its first meeting on the 28th of April 1893, but ceased to have a separate existence in 1903 on the passing of the London Education Bill. During those eleven years the board, with the assistance of its organizing secretary, succeeded in arranging a comprehensive and varied scheme of scholarships, which, among other benefits, enabled children from the elementary schools to continue their education in technical instruction in the larger cities, in the intermediate technical schools, and in the higher technical institutes and universities. It supplemented by large grants the income of the polytechnic institutions; it established or assisted in establishing new trade schools; it provided laboratories, and aided in the teaching of practical science in a large number of secondary schools; it encouraged the teaching of modern languages and commercial subjects; it assisted in founding a school of economics, which has become a constituent part of the new University of London, and utilized in nearly all instances with the best possible results the large and increasing income allocated by the County Council to technical education.

The close connexion between technical and secondary education was clearly indicated in the comprehensive definition of the former term given in the act. But it soon became manifest that no great progress could be expected in technical education unless further provision were made for secondary education, and unless some improvement could be effected in the methods adopted in secondary schools. The cry of Mr. Arnold for the better organization of secondary education had, so far, met with no adequate response. There was still an insufficient supply of secondary schools, and a complete absence of advice or control by any central authority. The urgency of this subject was recognized by the National Association for the Promotion of Technical Education, which at a meeting held in July 1889 resolved to alter its title by the addition of the words "and Secondary," after Technical.

This revolt against the widespread conviction that technical and secondary education are of necessity closely associated, and that future efforts should be directed towards the improvement and organization of secondary education and the union of different grants of technical education under a single government department. That the Technical
Instruction Act would need to be followed by a Secondary Edu-
cation Act. This was generally recognized. According, after much dis-
cussion, the government in the year 1896 introduced into parliament a
comprehensive measure dealing with education as a whole and
embodied the principal recommendations of the Royal
Commission of 1892. The bill was well received, and, if the
government had persevered with it, would have passed into law,
and the question would have been settled for a generation. It
was withdrawn before the Easter Recess of 1896, an opportunity
of the 1903-1904 session of the House of Commons to
be taken to affect the ratepayers, and although in 1903 an act was passed for the extension of
education in London, the Board of Education had undertaken
the preparation of a scheme prepared by the London County Council which vested the
control of education in the hands of a committee consist-
ing exclusively of members of the council with the
The London Act of
1903;
The Bill of 1906;
The Act
of 1907;
The Bill
of 1906,
Scotland.

The Act
of 1907.

The London Act of 1903.

The Bill of 1906.

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teaching of technology and helped to promote a better system of instruction in Irish schools.

The work was successfully commenced under the direction of the newly constituted Department of Agriculture and Technical Instruction, consisting of an Agricultural Board, a Board of Technical Instruction, a Council of Agriculture, and a Consultative Committee of Education. The department had an endowment of £166,000 a year, which was distributed among the several branches. It took over the duties of several other administrative bodies, and the grant for the instruction of agriculture in Ireland, as an additional and necessary contribution to the development of agriculture in the country. Thanks to its activities and the unimpeachable honesty with which public money was administered, the department was able to carry on the work of the State Education Board, which was done in an manner in Ireland as defined by the Technical Education Act of 1889, previously administered from South Kensington, was transferred to the new department. Among the industries for which the department is now occupied in organizing courses of instruction are engineering, textiles (particularly linen manufac-

The municipal school of technology at Belfast, opened in 1907, is an institution similar in many respects to those of Manchester and Birmingham, and providing technical instruction in connexion with a great variety of industries. There is also a large school at Dublin, and schools have been established in Cork, Limerick and elsewhere.

Results of Experience.—Experience has helped to establish certain principles as applicable to technical education. It is now generally admitted that whilst the age at which the ordinary school training should cease, and technical or professional education should commence, must vary for different classes of workers, the teaching special to any industry or employment should supplement, and not form part of, general education. The subjects entering into the school curriculum may be, and in certain cases should be, selected with reference to their applicability to certain callings, but they should be so taught as to become instrumental in the formation of mental habits and in the development of character, the mere knowledge and skill acquired being of secondary importance. In the teach-
ing of science there has been a marked change in method. Formerly the usefulness of the knowledge to be derived from the study of nature gave to physical science its chief claim to a place in the school curriculum, but it is now held that the real value of the study consists in the opportunities it affords of exercising the pupil in accurate observation, and of developing resourcefulness and powers of independent thought and reason-
ing. Whilst the opinion in favour of postponing as long as circumstances permit all specialized instruction has been lent to this tendency, there is also a growing tendency, not only in England but also on the Continent and in the United States, to associate technical teaching more closely with work-
shop practice. The professional or trade teaching, which is supplementary to primary or secondary education, is more practical and less easily distinguishable by the ordinary ob-
server from the training of the factory or workshop. This tendency is shown in all grades of technical education. The technical institutes established in London and in the large English manufacturing towns, attended mainly by evening students, are more closely connected with the development of character, the mere knowledge and skill for the teaching of applied science, but also with tools and machines for the teaching of technology; and some of the departments of these schools are equipped so as to resemble a small factory. This is the case in the departments devoted to the teaching of mechanical and electrical engineer-
ing, weaving, and spinning, watch- and clock-making, boot and shoe manufacture, and the different branches of the building and printing trades.

So far, however, no attempt has been made, except in very special cases, to teach the practice of any special trade. The teaching of technology is distinctly different. In all the technical institutes of London, and in most of those of other towns, none but persons actually engaged in the industry, the technology of which they are desirous of studying, are admitted to the workshop classes. The instruction given in such classes is very different as regards method, and also in its aims and objects, from the training of apprentices in the factory or trade shop. The tools and appliances are the same, but they are used rather as a help to the teachers in illustrating principles than as a means of training for technological practice. This is essentially different from the instruction of men in the strict sense of the term. The position of these higher-grade schools in the general educational scheme was the subject of an important action (Rex v. Cockerton, 1901) in which it was
decided by the law courts that the school boards were unable to apply the rates to the support of such schools. They were accordingly withdrawn from the sphere of elementary education, and have since been treated as schools of a secondary type. The judgment on appeal was conclusive, that the school board rates could be employed only for the provision of elementary education for children, whether in the day or evening, and this decision paved the way for the dissolution of school boards, and to the transfer of their duties and functions to the county and borough councils under the Act of 1902.

As regards secondary schools proper, in their relation to technical education, it is important that the curriculum of such schools should be sufficiently varied to afford a sound liberal and preparatory training for the different branches of professional work. It is generally admitted that at least three types or departments of schools are needed—(a) the classical, (b) the mathematical, and (c) the modern language type; and that each of these divisions should contain sub-departments. The first of these varieties would be available for the general training of students wishing to enter the legal, theological or literary professions; the second for those preparing for scientific, medical or agricultural pursuits; and the third would be found best fitted as a preparation for a commercial calling. These schools would correspond to some extent to the three kinds of secondary schools found in Germany, and would be available for students preparing to enter one or other of the faculties of a modern university. The organization of different types of secondary schools, and the curriculum appropriate to each, are matters which continue to occupy the attention of educational experts. In accordance with the regulations for secondary schools issued by the Board of Education in 1907, substantial grants were made to secondary schools which conformed to certain conditions as regards local control and undenominational religious instruction, or the directive influence of the board as regards curriculum and management over all such schools was strengthened. At the same time, manual training and domestic science were made essential parts of the curriculum in boys' and girls' schools respectively.

The demand for technical education, which originally led to the formation of the City and Guilds of London Institute, directed attention to the methods of teaching science, drawing and other subjects, and to the necessity of including science, manufacture and various agricultural pursuits; and the third would be found best fitted as a preparation for a commercial calling. These schools would correspond to some extent to the three kinds of secondary schools found in Germany, and would be available for students preparing to enter one or other of the faculties of a modern university. The organization of different types of secondary schools, and the curriculum appropriate to each, are matters which continue to occupy the attention of educational experts. In accordance with the regulations for secondary schools issued by the Board of Education in 1907, substantial grants were made to secondary schools which conformed to certain conditions as regards local control and undenominational religious instruction, or the directive influence of the board as regards curriculum and management over all such schools was strengthened. At the same time, manual training and domestic science were made essential parts of the curriculum in boys' and girls' schools respectively. The methods of science teaching have been greatly improved. Experimental work has become essential, and methods of investigation and research have been applied to the teaching of a number of subjects to which formerly they would have seemed inapplicable. A close connexion has thus been established between the workshop and the classroom, and practical instruction is now regarded as a necessary part of general education both elementary and secondary, and as no less disciplinary than the merely literary and oral teaching which it has partly superseded. This change in the school curriculum and in the methods of instruction has narrowed the true significance of the term "technical" as applied to education. By the term "technical" as commonly used is now understood "technological" or "professional," and whilst technical instruction may supplement either primary or secondary education, it is necessarily distinct from either.

The conviction has been steadily gaining ground that success in manufacturing industry, in the higher walks of commerce, and in every pursuit requiring technical knowledge, depends very largely upon the thoroughness and completeness with which those who are charged with the control of the different kinds of work in which the army of operatives are engaged. Intelligent and highly skilled workers are indispensable; but unless they are properly directed by efficient and expert officers they can effect but little. It is undoubtedly due to the careful training of the masters and leaders of industry that the Germans have achieved so large a measure of success in different technical pursuits. The recognition of this fact is slowly but surely influencing educational thought and action in Great Britain; but Germany is still ahead in the facilities afforded for higher education, and in the advantage taken of the facilities that exist. The number of students in her universities and technical high schools is still in excess of those receiving a similar training in Great Britain. The establishment, however, of local universities and the schemes for the award of scholarships adopted by local education authorities, will tend year by year to lessen this disparity. Meanwhile, Germany has relaxed none of her former efforts, but is steadily occupied in the enlargement and improvement of educational institutions. New schools have been erected wherever and for whatever purpose they are needed, equipped with every modern appliance for scientific investigation and research. Each professional career has its corresponding high school or university department. The economy of a wise and liberal expenditure on higher education is a recognized fact in German statecraft.

For those who are intended to occupy the highest posts in industrial life, a sound secondary education, supplemented by appropriate university training, is the best preparation. It is only in the university or tertiary grade of educational training that specialized or technological training for the higher industrial posts should commence. At this stage of education, general and professional teaching are more closely associated, and the names of the faculties of the new universities in the United Kingdom will in future indicate the several branches of professional work to which the different courses of university study are intended to lead. Of late there has been a marked development of distinctly technical instruction in connexion with the colleges of university rank. The error of restricting university studies to a certain limited range of subjects, which led in Germany to the establishment of technical high schools as institutions distinct from the universities, has been avoided. Engineering, in the broadest sense of the term, has been recognized as a branch of university education of the same order as medicine or law. Laboratories and workshops have for many years formed part of the equipment of the principal university colleges. In the statutes of the university a separate faculty is assigned to engineering, and part of the work of the polytechnic institutes is correlated with that of the reconstituted university. A survey of the field of education and research has been applied to the teaching of a number of subjects to which formerly they would have seemed inapplicable. A close connexion has thus been established between the workshop and the classroom, and practical instruction is now regarded as a necessary part of general education both elementary and secondary, and as no less disciplinary than the merely literary and oral teaching which it has partly superseded. This change in the school curriculum and in the methods of instruction has narrowed the true significance of the term "technical" as applied to education. By the term "technical" as commonly used is now understood "technological" or "professional," and whilst technical instruction may supplement either primary or secondary education, it is necessarily distinct from either.

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TECK, a ducal castle in the kingdom of Württemberg, immediately to the N. of the Swabian Jura and S. of the town of Kirchheim, crowning a ridge (2544 ft.) of the same name. It was destroyed in the Peasants' War (1525).

The duchy of Teck was acquired early in the 11th century by Berthold, count of Zähringen, whose great-grandson Albert, accordingly wallaced himself duke of Teck and general both by the ancient and composite descent, to Württemberg. The title, which had lapsed with the extinction of the Zähringen line in 1439, was revived in 1495 by the German King Maximilian I., who bestowed it upon the dukes of Württemberg. The dignity was renounced by Duke Frederick William Charles upon his elevation to the rank of king in 1806. In 1863 the title "prince of Teck" was conferred by King William I. of Württemberg upon the children of Duke Alexander of Württemberg
TECUCI—TEETH

TECUMSEH, TECUMTHA, or TECUMTI (c. 1768–1813), American Shawnee chief, was probably born in the old Shawnee village of Piqua, near the site of Springfield, Ohio, between 1768 and 1780. While still a youth he took part in attacks on settlers passing down the Ohio and in widely extended hunting expeditions or predatory forays to the west and south; and he served in the Indian wars preceding the Treaty of Greenville in 1795. About 1800 his eloquence and his self-control made him a leader in conferences between the Indians and whites. After 1805 the Indians of the Northwest were aroused by a series of cessions of their territory and by the prospect of war between Great Britain and the United States. This presented to Tecumseh and to his brother Tenskwatawa (i.e. the Open Door), popularly called “the Prophet,” the opportunity to put into operation a scheme which followed the ambitious dream of Pontiac. With some scattered Shawnee clans as a nucleus, the brothers proceeded to organize, first near Greenville, Ohio, and later on the White and Tippecanoe rivers in Indiana, “the Prophet’s town,” which was based on a sort of communism and was apparently devoted to peace, industry and sobriety, their actual plan was to combine all of the Indians from Canada to Florida in a great democratic confederacy to resist the encroachment of the whites. Tribal organizations were to be disregarded, but all warriors were to be represented at periodical assemblages where matters of interest to all Indians were to be definitely decided. The twofold influence that was to dominate this league was the eloquence and political ingenuity of Tecumseh and the superstitious reverence aroused by “the Prophet.” This programme alarmed the whites along the north-western border. In the course of the next three years Governor William Henry Harrison of Indiana held interviews with each of the brothers, and during one of these, at Vincennes in 1810, the respective leaders narrowly avoided a hostile encounter. Nevertheless “the Prophet” and Tecumseh reiterated their determination to remain at peace with the United States if the Indians were unmolested in their territory, and if all cessions beyond the Ohio were given up by the whites. The treaty of Fort Wayne in 1809, which called for the cession to the whites of some three million acres of land in central Indiana, was a direct challenge to this programme, and when, during Tecumseh’s absence in the South, Harrison made a hostile move against “the Prophet’s” town, the latter ventured to meet him, but was defeated on the 17th of November 1811 in the famous battle of Tippecanoe, which broke the personal influence of “the Prophet” and largely destroyed the confedera-
yacy built up by Tecumseh. Tecumseh still professed to be friendly toward the United States, probably because his British advisers were not ready to open hostilities, but a series of border outrages indicated that the fatal moment could not long be postponed. When, in June 1812, war broke out Tecumseh joined the British, was commissioned a brigadier-
genral in the British army, and participated in the skirmishes which preceded General William Hull’s surrender at Detroit. He took an active part in the sieges of Fort Meigs, where he displayed his usual clemency toward his prisoners. After the battle of Put-in-Bay, when Colonel Henry Proctor began to withdraw to Malden, Tecumseh bitterly reproached him for his cowardice and finally forced him to join battle with Harrison on the Thames, the 5th of October 1813. In this battle Tecumseh was killed, as is generally supposed by Colonel Richard M. Johnson of Kentucky, although this has never been fully substantiated. Like Pontiac, whom he doubtless imitated consciously, he had a wonderful eloquence and a power of organization rare among the Indians. His brother, “the Prophet,” remained with a small band of Shawnees and died west of the Mississippi in 1834.

See Benjamin Drake, The Life of Tecumseh and of his Brother the Prophet, 2 vols. (1841); and Homer J. Webster, Harrison’s Administration of Indiana Territory (Indianapolis, 1907).

TEDDINGTON, an urban district in the Uxbridge parliamentary division of Middlesex, England, close to the Thames, 13 m. W.W.S. of St Paul’s Cathedral, London, on the London and South-Western railway. Pop. (1901) 14,037. The district is residential and the town is a resort of visitors both to the river and to Bushy Park, which lies immediately south (see HAMPTON). The National Physical Laboratory, for making scientific investigations of industrial importance, and for mechanical testing, was opened in Bushy House in 1902.

TEES, a river of England, rising on the eastward slope of Cow Green Fell in the county of Durham, and running westward, past the scene of the battle 85 m. in length to the North Sea. In the earliest part of its course it forms the boundary between the counties of Westmorland and Durham. The head of the valley, of which the upper portion is known as Teesdale, is not without desolate grandeur, the hills, exceeding 2500 ft. in height at some points, consisting of bleak moorland. A succession of falls or rapids, where the river traverses a hard series of black basaltic rocks, is known as Cauldon Snout; and from a point immediately below this to its mouth the Tees forms the boundary between Durham and Yorkshire almost without a break. Thedale becomes bolder below Cauldon Snout, and trees appear, contrasting with the broken rocks where the water dashes over High Force, one of the finest falls in England. The scenery becomes gentler but more picturesque as the river descends past Middleton-in-Teesdale (Durham), the terminus of a branch of the North-Eastern railway from Darlington. In this locality lead and ironstone are worked. The ancient town of Barnard Castle, Eggleston Abbey, and Rokeby Hall, well known through Sir Walter Scott’s poem, are passed; and then the valley opens and the Tees escapes the throng of hills to outcrop on the rich plain east and south of Darlington. The eastern side of the valley hitherto has been generally E.S.E., but it now turns N.E. and, nearing the sea, becomes an important commercial waterway, having on its banks the ports of Stockton-on-Tees, Thornaby-on-Tees and Middlesbrough, and forming an outlet for the rich ironworking district of Cleveland in the North Riding of Yorkshire. It is also navigable for barges up to High Worsall, 11 m. above Stockton. For the last five miles the course, below Middlesbrough, is estuarine. The drainage area is 708 sq. m. No important tributary is received.

TEETH (O.E. teō; plural of tooth, O.E. teō), The modified papillae or elevations of the mucous membrane of the mouth, impregnated with lime salts. Each tooth has a biting part or crown covered by enamel, a neck where the gum surrounds it, and one or more roots or fangs fitting into sockets (alveoli) in the jaw bone. For surgery of the teeth see DENTISTRY.

There are thirty-two permanent teeth in man, sixteen in the upper and sixteen in the lower jaw; they are also arranged in symmetrical sets of eight teeth on each side. The two teeth on each side of the mid-line in front are “incisors” and have chisel-shaped crowns. The incisors are followed by the “canines” or central incisor of the lower jaw, which are broader than any of the others, consequently it bites against the central and lateral incisors of the lower jaw, and the same way of exact adaptation continues throughout the series, so that every tooth in the upper jaw except the last molar bites against its corresponding tooth of the lower jaw and the tooth behind that.
Next to the incisors comes the "canine tooth," the crown of which is somewhat peg-shaped, while behind this are the two "premolars" or "bicuspids," whose crowns are flattened from before backward and bear two cusps, the larger of which is somewhat more prominent than the other. They are readily distinguished from the canines by being placed farther apart from each other and from the incisors. As a rule there is a single root, though sometimes in the upper premolars it is double.

The three "molars" are placed behind the premolars, and the upper and lower sets can be easily distinguished because the upper have three roots while the lower have only two. Of the three roots which the upper molars bear two are lateral or external and one mesial (see fig. 2), so that it is easy to tell the outer from the inner side of an upper molar. The front can, as a rule, be identified by the fact that the roots are generally bent a little backward at their tips, and this applies to other teeth than the upper molars. In the lower jaw, owing to the two fangs being anteroposterior, it is not possible to tell the lateral from the mesial surface of the molars by them, although the backward inclination of their tips shows the front from the back. When it is remembered that the upper teeth overlap the lower externally it is reasonable to expect that the lower molars would show some rounding due to wearing away of the edge of the crown on the outer side, and this is the case.

The grinding surface of the crowns of the upper molars shows three or four cusps, while on that of the lower four or five are found.

Of the three molars the first is the largest, and the third, or wisdom tooth, the smallest, while the upper wisdom tooth is smaller than the lower.

The "milk teeth" or temporary dentition of the child are only twenty teeth, ten in each jaw and five in each segment. They are two incisors, one canine, and two so-called molars. These molars occupy the position which the permanent premolars later on take, and it is held by many that the adult molars really belong to the milk dentition, although they cannot appear until the jaw has grown backward sufficiently far to make room for them. The temporary teeth differ from the permanent in their smaller size, their whiter colour, the greater constriction of their necks, and in the fact that the roots of the molars are widely splayed.

The dates at which the milk teeth are cut are very variable. The lower central incisors come first between the sixth and seventh month, or even later; then, after a few months, come the central and lateral upper incisors; again a few months' rest and the lower lateral incisors appear, followed closely by the first molars. After another rest of four or five months come the canines, the eruption of which is a slow process, while by about the end of the second year the second molars have appeared, and the milk dentition is complete. It will be seen from the above that the milk teeth are cut in batches with resting intervals between.

As C. S. Tome's points out, we do not know what causes the eruption of the teeth; the growth of the roots is not of itself enough to account for it. It is possible, however, that blood-pressure may be the determining cause. The first permanent tooth to be cut is the first molar, and this happens during or soon after the sixth year. It does not displace any of the milk teeth, but comes down behind the second milk molar. During the seventh year the central milk incisors fall out and their place is taken by the permanent ones; the shed teeth are mere shells of the crown, all the root having been absorbed, though not, as might be thought, owing to direct pressure of the succeeding tooth.

The lateral incisors succeed their milk predecessors at about eight years old, the first premolar takes the place of the first temporary molar about nine, the second premolar that of the second temporary molar about ten, the canine about eleven, while the second molar comes down behind the first about twelve, and so is known as the "twelve-year-old tooth." The third molar, or wisdom tooth, usually appears between eighteen and twenty, but may be much later, indeed it is sometimes never cut at all, and when it is, it often does not come down to a level with the other teeth. It is believed that man is gradually undergoing a suppression of his last molar teeth, which, if the process continue, will lead to our successors having a different dental formula from our own. It is interesting to notice that in some of the lower races of mankind the last molar tooth is nearly as large as those in front of it, and this is the case in the anthropoid apes. A. Keith and D. Braden Kyle have pointed out that the second and third molar teeth are successively formed in the posterior wall of the maxillaty antrum.
and their crowns look backward. It is owing to the gradual growth backward of this antrum and the maxilla that they are rotated round a quarter of a circle and so at last look downward (see A. Keith, British Journal of Dental Science, vol. xiv., June 16, 1902).

Extra teeth are occasionally met with in the incisor, premolar and molar regions; their significance will be better realized after the embryology and comparative anatomy of the subject have been sketched.


**HISTOLOGY.**

If a section be made vertically through a tooth all the exposed part or crown is seen to be covered with enamel, which, microscopically, is composed of a number of fine hexagonal prisms arranged at right angles to the surface of the tooth, and formed chiefly of calcium phosphate with small amounts of calcium carbonate, magnesium phosphate and calcium fluoride, but containing practically no organic matter. The enamel rests on the “dentine,” of which hard yet elastic substance by far the greater part of the tooth is composed. It is made of the same salts as the enamel, but contains in addition a good deal of organic matter and forms a structureless mass through which the fine “dental tubes” run from the pulp cavity to the periphery.

Surrounded by the dentine is the “pulp cavity,” which is filled by the pulp pulp, a highly vascular and nervous mass of branched connective tissue cells, which, in a young tooth, has a layer of epithelial cells, the “odontoblasts,” lying close against the wall of the cavity and forming new dentine. Slender processes (“Tomes’s fibris”) project from these cells into the dental tubules, and are probably sensory. A nerve and artery enter the apex of the root of the tooth, but it is not understood how the nerve ends.

Surrounding the dentine where it is not covered by enamel is the “cement” or “crusta petrosa,” a thin layer of bone which is only separated from the bony socket by the alveolar periosteum.

**EMBRYOLOGY.**

The lip is marked off from the rest of the mouth region by a “lip groove,” which, in the case of the lower jaw, grows obliquely downward and backward, and the mass of ectodermal cells bounding it penetrates for some distance into the surrounding mesoderm below the bottom of the groove. This is known as the ‘tooth band.’

On the under surface of this oblique tooth band (still taking the lower jaw), and close to its edge, appear ten thickening, below each of which, the mesodermal layer, the dental papilla, “appears, the moulds the thickening into a cap for itself—the ‘enamel organ.’ The superficial cells of the dental papilla become the ‘odontoblasts’ and manufacture the dentine, while those cells of the cap (enamel organ) which are on its inner surface and therefore nearest the dental papilla are called ‘ameloblasts,’ and form the enamel. The cutting or grinding part of the tooth is first formed, and the crown gradually closes round the papilla, so that at last the root is formed, the central part of the papilla remains as the pulp cavity surrounded by dentine except at the apex of the root. The roots, however, are formed slowly, and as a rule are not complete until some time after the tooth is cut. The dental cavity following the developing tooth becomes condensed into a fibrous bag which is called the tooth-sac, and round this the lower jaw grows to form the alveolus. The crista petrosa which covers the tooth, is developed from the tooth-sac. It will be realized that, of the various structures which make up a tooth, the enamel is derived from the ectoderm, while the dentine, pulp and crista petrosa, or cement are mesodermal.

So far only the milk dentition of the lower jaw has been accounted for.

Returning to the tooth band, it was noticed that the enamel organs were formed not at the extreme edge but a little way from it. From the extreme edge, which, it will be remembered, points inward toward the tongue, the permanent tooth germs are derived, and it is therefore clear that the permanent teeth must come up on the lingual side of their milk predecessors.


**COMPARATIVE ANATOMY.**

The details of the teeth vary so greatly in different animals and groups of animals, and, on account of their being the most durable tissues of the body, are so important for classificatory purposes, that they are dealt with freely in the various zoological articles. All that can be done here is to give a broad general survey of the subject, taking the details of man’s dentition, already set forth, as a point of departure.

In some fishes the teeth are continuous over the edges of the jaws with the scales on the surface of the body, and there is no doubt that teeth should be regarded as modified scales which have migrated into the mouth.

In the Cyclostomata (lampreys and hags) the teeth are horn-like, but beneath them there are papillae of the mesoderm covered with ectoderm which resemble the dental papilla and enamel organs although no calcification occurs except in Bdellostoma. In the Elasmo-branchii (cartilaginous fishes) the teeth are arranged in several rows, and as those of the front row fall out the hinder row take their place; sometimes they are triangular and very sharp as in the sharks, sometimes flattened and arranged themselves for crushing as in rays. These teeth only represent the crowns of man’s teeth, and they are not embedded in sockets except in the case of the teeth in the jaw of the saw-fish (Pristis); moreover the dentine of which they are largely composed resembles bone and fills up the whole pulp cavity. From its structure it is known as osteodentine.

In the Teleostomi (teleostean and ganoid fishes) there is great variability; sometimes, as in the sturgeon, there are no teeth at all, while at others every bone bounding the mouth, including the branchial arches, bears teeth. As an example of a very full tooth armature the pike’s mouth and pharynx may be instanced. Both in the pike and the hake hinged teeth occur; these bend backward during the passage of prey down the throat, but are re-erected by elastic ligaments. As a rule, the dentine of the Teleostomi of the variety already described as osteodentine, but sometimes, as in the hake, it is vascular and is known as vasodentine.

In the Amphibia teeth are not so numerous as in the fishes, though still, they are present in the jaws, though the teeth are very constant. The toad is edentulous, while the frog has no teeth in the lower jaw. An extinct order of tailed amphibians, the Stegocephali, are often called labyrintodonts or condylodonts, but in the case, of both in which the enamel is cellular, the teeth of which are largely composed resembles bone and fills up the whole pulp cavity. From its structure it is known as osteodentine.
to do so, to let any prey which had once entered its mouth escape. The poisonous snakes have a special poison fang in the maxilla of each side; these have a deep groove or canal running down them which transmits the poison from the poison gland. In the colubrid snakes, the fangs are elongated and fixed to the palate by a great number of ligaments and muscles, but in the viperine, such as our own adder and the rattlesnake, there is a mechanism by which the tooth is only erected when the jaws are opened for striking. At other times the teeth lie flat in the gums.

In the lizards or Lacertilia the teeth usually consist of a series of pegs in the upper and lower jaw, each resembling the one in front of it in place and in shape. The chisel-shapes are impossible, as their bases to the bone, but at others, as in the iguana, they are fused by their sides to a ridge of bone which forms a low wall on their lateral surface. In the former case the dition is spoken of as "homodont," but in the latter as "pleurodont.

In the Crocodilia the teeth are fitted into definite sockets as in mammals and are not ankylosed with the jaws. This arrangement is spoken of as "heterodonto.

In all these lower vertebrates, then, the teeth are similar or nearly similar in character; at least they are not divided into incisor, canine, premolar and molar regions. Their dition is therefore known as "homodont." Another characteristic is that in almost all of them there is an arrangement for a continuous succession of teeth, so that when one is lost another from behind takes its place, and to this arrangement the term "polyphyodont" is applied. With a few exceptions a homodont dition is also polyphyodont.

In the Mammalia the different groups of teeth (incisor, canine, &c.) already noticed in man are found, and these animals are characterized, with some exceptions, by having a "heterodont" as opposed to the "homodont" dition. In the dog, for instance, the succession of teeth is reduced to a "diphyodont" dition, which means that only one pair of teeth is replaced in the mandible.

In the marsupials the reduction of the succession is carried still further, for there is only one premolar in each segment of the jaw is replaced, while in the toothed whales there is no succession at all. When one set has to do duty throughout life the succeeding is called the "metaphyodont." There is a good deal of discussion as to how the complex back teeth of mammals with their numerous cusps were derived from the simple conical teeth which are generally assumed, though not by all, to have been the primitive arrangement. One simple way of accounting for the change is by the concrescence theory, namely that several conical homodont teeth have fused and so formed a single multibuccal toothen; but, although this process may be partly true, it does not account for all the facts at our disposal. Another theory, which is more favoured at the present time, is known as the "tribute," and is largely based on the researches of E. D. Coe and H. F. Osborn, two American palæontologists. According to this theory a simple peg-like, or, as it is called, "hapolodont," tooth develops two additional smaller pegs or cones, one in front and one behind the original main cone, possibly owing to the irritation of the teeth against which it bites. This is known as the "triconodont stage, and it is found in some of the oldest extinct mammals. As a later adaptation it is found that the two small cones, the interior of which is called the "paracone" and the posterior the "metacone," become external to the original "protocone" in the upper jaw and internal in the lower.

The surface of the tooth has now a triangular shape with a cone as its acme, and this is the "tribute" tooth which is of very common occurrence among the ancestral mammals. Other cusps may be developed later, and so the quadricuspid and quinquecuspid molar teeth of man and other mammals are accounted for. This theory, although in a brief outline it sounds feasible enough, has really many points of difficulty, and those who are interested in the subject will find a fuller account in C. S. Tomes' Dental Anatomy and Palæontology, and in W. L. Clark's Morphology and Anthropology (Cambridge, 1901), in which references to the original literature, which is now very voluminous, are given. Marett Tima (J. Anat. and Phys., vol. xxxvi, p. 131) suggests that the evolution of the mammalian teeth is to be explained partly by the tribute and partly by the concrescence theory.

It is impossible, in the space assigned, to give even a brief review of mammalian odontology, but it may clear the ground for the special zoological articles if an attempt is made to define what is meant by the different classes of teeth.

Incisor teeth are those which in the upper jaw have their sockets in the premaxillary-maxillary suture, provided it be not far behind it; it is almost always the first of the premaxillary series, speaking accurately, which is elongated and sharply pointed. As its name implies it is well marked in dogs and other Carnivora, but is found in many other orders. It is the principal offensive and defensive weapon of many mammals, and is greatly developed in some of the ungulates which are without horns, e.g., the musk deer. The tusks of the walrus and wild boar are canines.

In many of the Insectivora, especially the mole, the canine is very hard to identify, as in these animals an incisor or a premolar may take on caniform characters, or there may be no tooth at all with these characters.

The premolar teeth are those in the maxillary bone which are preceded by milk teeth. This definition, of course, includes the canine as a modified premolar, and so it should no doubt be considered, though, if it is desired to keep it distinct, "behind the canine" must be added.

Unfortunately for an accurate definition the first premolar behind the canine is not always preceded by another tooth, and so it becomes an unsettled question whether, in these cases, the tooth is really a premolar tooth or a permanent one which has had no predecessor; it is probable, however, that the latter is the right interpretation.

The molar teeth are those, behind the premolars, which are not preceded by temporary teeth. As was pointed out, in man's dition they are probably teeth of the first or milk dition which appear late.

In front of the premolar teeth, and between them and the canine, if it be present, or the incisors, if it be absent, there is often a space called the "diastema." It is best marked in the orders of Rodentia and Ungulata, and in the horse is familiar as the place where the bit lies.

In recording the teeth of any particular mammal it saves time and space if a dental formula be used. This simply means setting down the number of each kind of tooth in one side and lower jaw, and in their order from before backwards. Thus man's formula would be, incisors 2\(\frac{3}{3}\), canines 1\(\frac{1}{1}\), premolars 2\(\frac{2}{2}\), molars 3\(\frac{2}{1}\). This is condensed into 2.1.3.2.

Some other types of dental formulae are—

- Carnivora (old world monkeys) 2.1.3.2
- Platyrhine (new world monkeys) 2.1.3.3
- Marmosets 2.1.3.3
- Most lemurs 2.1.2.3
- Insectivorous bats (full series) 3.1.3.3
- (The upper incisors and both premolars may be reduced by one)
- Frugivorous bats 2.1.3.3
- (The molars may be reduced)
- Insectivora (teeth variable and somewhat uncertain) 3.1.3.3
- Hedgehog 2.1.2.3
- Mole 3.1.4.3
- (Five different dental formulae have been assigned to this animal)

Carnivora—

- Cat family (Felidae) 3.1.3.1
- Dog family (Canidae) 3.1.4.2
- Bear family (Ursidae) 3.1.4.3
- Civet family (Vivirridae) 3.1.4.2
- Raccoon family (Procyonidae) 3.1.4.2
- Hyaena family (Hyaenidae) 3.1.4.3
- Weasel family (Mustelidae) 3.1.4.3
- Eared seal family (Otariidae) 3.1.4.1 or 2
- Seal family (Phocidae) 3.1.4.1
- Walrus family (Trichechidae), adult 3.1.3.0
- In a young animal (probably) 3.1.3.2
In this animal there are no premolars, but the milk molars (d.m) and true molars gradually replace one another from before backward throughout life, so that there are never more than two back teeth in each segment of the jaw at any one time.

Rodents—

Typical rodents (Simplicidentata) 1.0 (0-1).3 1.0 (0-1).3

Hares and rabbits (Duplicidentata) 2.0.3.3 1.0.2.3

Cetacea.—In the living toothed whales (Odontoceti) the dentition is homodont and may be as great as 50. There is every reason to believe, however, that they are derived from heterodont ancestors. In the whalebone whales (Mystacoceti) the teeth are replaced by the whalebone in the adult, but in the embryo slightly calcified teeth are present which are afterwards absorbed.

The homodont dentition of the whales is a retrograde process, and is therefore not comparable to the homodont dentition of the vertebrates below mammals.

Sirenia.—The dentition is monophyodont. The manatee has i. 2 c. 0 back teeth 11.

In the Edentata the ant-eaters (Myrmecophagidae) and pangolins (Manidae) are toothless, though the latter have toothed foot gums. The aard varks (Orycteropodidae) are somewhat heterodont, while the armadillos (Dasyopodidae) and sloths (Bradypodidae) have a homodont dentition, which, like that of the whales, is retrogressive.

In the giant armadillo (Priodon gigas) the formula is 25. 25

This animal therefore has a hundred teeth. In none of the Edentata are the teeth covered with enamel.

In the Marsupialia the typical formula is 3.1.4.3; 3.1.4.3. They are divided into diprotodont, in which there are not more than 2 incisors, often 3 as in kangaroos, and polyprotodont, in which the incisors are more than 2 as in the Tasmanian devil (Thylacinus) and Tasmanian devil (Sarcophilus). The marsupial teeth are often regarded as all milk teeth, yet the order is not really monophyodont because the germs of the permanent teeth are formed and aborted. Modern research, however, casts grave doubt on the accuracy of this view.

In the Monotremata the Echidna or spiny ant-eater is quite edentulous, while the duck-mole (Ornithorhinchus) has functional molar teeth in youth, though in the adult these are lost, and their place is taken by horny plates.

Reviewing the various tooth formulae of mammals the following is usually regarded as typical:—

| Ungulata — | 2.1.4.3 |
| Hippiopotamus | | 2.1.4.3 |
| Pig family (Suidae) | | 3.1.4.3 |
| Camel | | 1.1.3.3 |
| Chevrotain (Tragulidae) | | 3.1.2.3 |
| Deer family (Cervidae) | | 0.0 (or 1).3.3 |
| Hollow-horned ruminants (Bovidae) | | 3.1.3.3 |
| Tapir | | 3.1.3.3 |
| Horse (Equidae) | | 3.1.3.3 |
| Rhinoceros | (0-1). (0-1) 1.4.3 |
| Procapia (Hyrax) | (1-2).0.4.3 |
| Elephant | d.i. i. c. o. d. m. (3-4) m. 4 |

This, it will be noticed, is the formula of the pig, and it is also that of almost all the Eocene Ungulata. Although the majority of mammals are diphyodont, or, in other words, the working teeth belong to two dentitions, evidences have lately been submitted of vestiges of two other series, one on the labial side of the milk teeth and one on the lingual side of the permanent series. If these are substantially there would be four dentitions—(1) premilk; (2) milk; (3) permanent; (4) post-permanent. The theory, though it bridges over the gap between the polyphyodont lower vertebrates and the apparently diphyodont mammals, is not by any means established. As the teeth are of such importance in the classification of animals, it will save continually repeated explanations in other articles if some of the chief terms by which they are described are recapitulated and briefly defined here.

1. Acrodont, a tooth which is anchylosed by its base to the summit of a pariet on the jaw.

2. Bilophodont, a molar tooth having two transverse ridges on its grinding surface, as in the tapi.

3. Brachydont, a low-crowned molar tooth—the opposite of hypsodont.

4. Bunodont, a tooth bearing conical cusps.

5. Diphyodont, having two series of teeth (milk and permanent).

6. Diprotodont, a marsupial with not more than 2 incisors, often only one on each side of the mandible.

7. Haploidont, a tooth having a simple conical crown with a single root.

8. Heterodont, a dentition in which the teeth are not all alike, chiefly characteristic of the Mammalia.

9. Homodont, a dentition in which the teeth are all alike as in many of the lower vertebrates and some mammals.

10. Hypsodont, a high-crowned molar tooth, such as that of the horse,—the opposite to brachydont.

11. Lophodont, a transversely ridged molar tooth; cf. bilopho-dont.

12. Monophyodont, having only one dentition (cf. diphy- and polyphyodont).

13. Multituberculate, a tooth, the crown of which bears numerous conical cusps; held by some to be the primitive condition of the mammalian teeth.

14. Pleurodont, a tooth anchored to the inner side of a parapet on the jaw.

15. Polybunodont, a synonym for multituberculate.

16. Polyphycodont, having an endless succession of teeth, as in most vertebrates below the mammals.

17. Polyprotodont, a marsupial having an incisor formula of more than 3. 3.

18. Protodont, a stage met with in fossil mammals which is an advance on the haploidont tooth in that two small cusps are added to the main cone.

19. Secodont, a back tooth adapted to cutting as in many of the Carnivora.

20. Selenedont, a molar tooth with crescentic ridges on its grinding surface as in most ruminants.

21. Thecodont, a tooth embedded in a socket or alveolus, as in mammals.

22. Triquodont, a fossil stage in advance of the protodont. There are three well-marked cones in an antero-posterior line.

23. Tritubercular, a fossil stage succeeding the triquodont. The main cone extends over the lower teeth and internal in the common form of back tooth in fossil forms and one which gives its name to the "tritubercular theory." (F. G. P.)

**TEETOTALISM—TEETOTUM**

TEETOTALISM, the practice of total abstinence from all intoxicating liquors, hence that form of the temperance movement of which the basis is the "pledge" to abstain from all intoxicating liquors (see Temperance). There seems no doubt that the word, whatever its actual origin, is a strengthened form of "total," probably influenced by "teetotum" (q.v.). According to the Century Dictionary, the secretary of a New York temperance society introduced a total abstinence pledge among its members, who were thus divided into those who had taken the old pledge, the O.P.'s, to abstain from spirituous liquors, and the T.'s, who had taken the new or total pledge. The English version, taken from the account by Joseph Livesey in the *Staunch Teetotaler*, January 1867, is that one Richard Turner, a Preston artisan and popular temperance speaker, declared at a meeting about 1833, that "nothing but teet-teetotal would do." This repetition of the initial letter does not appear to have been due to hisammering but to have been a mere emphasis on the word. The expression seems to have obtained instant recognition and popularity. Both versions are apparently authentic, and there seems no reason to suppose that they are not independent.

**TEETOTUM**, a form of top, used in various games of chance; the body is of polygonal shape, marked with letters or numbers, which decide the result of the game, according to the side which
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remains uppermost on the fall of the top after spinning. Strutt, who was born in 1749, mentions (Sports and Pastimes) the teetotum as used in games when he was a boy. It seems that in its earliest form it was used as a game of chance, when the player throws the top to the right or left as it will fall. In the form of the teetotum, which was thrown from the right hand and caught by the left, it was used as a game of chance, when the player takes one from the pool, D. (Lat. depone, put down), when a fine has to be paid, N. (Lat. nihil, nothing), and T. (Lat. totum), when the whole pool is taken. Other accounts give such letters as P.N.D. (dimidium, half), or H. and T. or other combinations of letters.

TEGEA, an ancient Greek city of Arcadia, situated on a plateau which is enclosed by Mt. Parthenium and Maenalus on E. and W., and by two transverse ranges which separate it from the plateau of Orchomenus and the Eurotas. The Tegean territory occupied the southern part of this space; the northern half, surrounded by projecting spurs from the parallel ranges, belonged to Mantinea. The entire plain was well adapted for pasture and corn-growing, but was liable to floods owing to the lack of free outlets for its water-courses. Hence the regulation of the zereutha or subterranean conduits which drained away the overflow southward was a matter of vital importance both to Tegea and to Mantinea, and a cause of frequent quarrels. By its vicinity to the water-sheds of the Eurotas and Alpheus, and its command over the main route from Argos to Arcadia and the Isthmus, Tegea likewise was brought into conflict with Sparta.

Tegea was one of the most ancient cities of Peloponnese; tradition ascribed its concentration (synoecism) out of eight or nine primitive cantons to a mythical king Aleus. From the fact that several Cretan towns passed for colonies of Tegea, it may be inferred that this city had oversea connexions in prehistoric days. The prominence which legend assigns to its king Echemus in opposing the Heraclid invasion shows that it was one of the chief Peloponnesian communities in the pre-Dorian epoch. For several centuries it was supposed as a rival of Sparta against the expanding power of Sparta; though ultimately subdued about 550 B.C., it was allowed to retain its independence and its Arcadian nationality. During the Persian invasion the Tegeans displayed a readiness unusual among Peloponnesian cities; in the battle of Plataea they were the first to enter the enemy's camp. A few years later they headed an Arcadian and Argive league against Sparta, but by the loss of two pitched battles (Tegea and Dipasa) they were induced to resume their former loyalty (about 468-467). In 425 they broke out into open war with Sparta. In 423 Sparta, under the command of Argos and the Isthmian League, invaded the plain, and Tegea and its allies submitted to Sparta and Athens, the Tegeans stood firmly by Sparta's side: in the decisive battle of Mantinea (418) their troops had a large share in the overthrow of the coalition. During the early 4th century before Christ Tegea continued to support Sparta against the Mantineians and other malcontents. After the battle of Leuctra the philo-Laconian party was expelled with Mantineian help. Tegea henceforth took an active part in the revival of the Arcadian League and the prosecution of the war in alliance with Thebes against Sparta (371-362), and the ultimate detection of Mantinea confirmed it in its federalist tendencies. The foundation of the new federal capital Megalopolis threw Tegea somewhat into the shade. It showed itself hostile to the Macedonians, and in 266 joined the Chremonidean League against Antigonus Gonatas. To the incorporation of Mantinea into the Achaean League (233) Tegea replied by allying itself with the Aetolians, who in turn made it over to Cleomenes III. of Sparta (228). From the latter it was transferred by Antigonus Doson to the Achaeans (222); in 218 it was again occupied by the Spartans but reconquered in 207 by the Achaean general Philomel Lampon. In August 207 B.C. the Tegeans were the only important town of Arcadia, but its history throughout the Roman and Byzantine periods is obscure; it ceased to exist as a Greek city after the Gothic invasion of 395. During the Frankish occupation its place was taken by the fortress of Nikli. At the time of the Turkish conquest (1458) Nikli had been superseded by a fair-sized town called Mouchli, which in turn disappeared when the new city of Tripolitsa was founded about 3 m. N.W. The site is now occupied by the small village of Piali.

AUTHORITIES.—Strabo pp. 337, 388; Pausanias viii. 44-49, 53-54; Herodotus i. 65 ff., ii. 35, 70; Thucydides v. 32-73; Xenophon, Hellenica, vi. 7.; Polibius ii. 46, 54 sq., v. 17, xi. 18; W. M. Leake, Travels in the Morea (London, 1830), i. pp. 88-100, ii. 142-210; E. Curtius, Peloponnesos (Gotha, 1851), i. pp. 247-264; W. Loring in Journal of Hellenic Studies, xix. (1899) pp. 25-89; Schwedler, De Rebus Tegetiatrics (Leipzig, 1886); "Istoria tif Penthaleon Egeon", 1892, by V. A. B. Head, Historia Numerum (Oxford, 1887), pp. 350-351; and art. Numismatics, section Greek, § "Arcadia." (M. O. B. C.)

Archaeology.—The temple of Athena Alea at Tegea is described by Pausanias as excelling all others in the Peloponnese both in size and in beauty of construction. The original temple was said to have been built by Aeis, the founder of Sparta, and was called "the temple which was superseded by a larger one which was destroyed by fire in 395 B.C. The rebuilding was entrusted to Scopas, the great sculptor; and it is probable that he not only acted as architect, but also provided the sculptural groups which ornamented the pediments. Like the temple at Phigalia, it combined the forms of all three orders—Doric, Ionic and Corinthian. Pausanias asserts that the outer order was Ionic; but excavations have proved that it was Doric. The pedimental groups of the temple represented at the front, the hunt of the Calydonian boar, and, at the back, the battle of Achilles and Telephus. Both subjects were intimately associated with the temple, for Atalanta had dedicated in it the face and tusks of the boar, which had been awarded to her as the first to wound it; and Telephus was the son of Heracles and the priestess Auge. Two heads of heroes and that of the boar were found before 1880; later excavation, in 1883, showed the plan of the temple, which had six columns at front and back, and thirteen at the sides. In 1900 the French school at Athens recovered more fragments of sculpture, including a head of Heracles and the torso and possibly the head of Atalanta, these last two of Parian marble. The other heads are badly damaged, owing to the fact that the white marble from Doliana, of which they are made, does not resist damp. But they still show in the intensity of their expression the power of expressing the will for which Scopas was famous beyond all other ancient sculptors. See GREEK ART, fig. 63.


TEGERNSEE, a lake of Germany, in the province of Upper Bavaria, situated in a beautiful mountain country, 235 ft. above the sea, 34 m. S. from Munich by rail to Gmund, a village with a station on the north shore. The lake is 4 m. long, averages 1.7 m. broad, and is about 235 ft. deep. Its waters discharge through the Mangfall into the Inn. The southern part is enviroined by high and well-wooded hills, while on the northern side, where it debouches on the plain, the banks are flat and less attractive. Prosperous villages and handsome villas stud its shores, and it is one of the most frequented summer resorts in the vicinity of Munich.

The village of Tegernsee, 1744, on the east bank, has a parish church dating from the 15th century, a ducal castle which was formerly a Benedictine monastery, and a hospital, founded in connexion with the large ophthalmic practice of the late Duke Charles Theodore of Bavaria.

See Freyberg, Aktenthe Geschichte von Tegernsee (Munich, 1882); Hack, Tegernsee (Munich, 1888); Breu, Der Tegernsee, iumalogische Studien (Munich, 1906).

TEGETTHOFF, WILHELM VON, BARON. (1827-1871), Austrian admiral, son of Lieutenant-Colonel Karl von Tegetthoff, was born at Marburg, in Styria, on the 23rd of December 1827. After passing through the naval college at Venice, he first served afloat in 1845, and in 1848 was made an ensign. In 1849 he was present at the blockade of Venice, resulting in its surrender. In 1852 he was promoted to be a lieutenant, and during the Crimean war was employed on a sort of police
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duty at the Sulina mouth of the Danube, which brought him to the favourable notice of the Archduke Maximilian, who in 1834 had been appointed head of the navy with the style of rear-admiral. After some time in a semi-official scientific expedition in Egypt, Arabia, and the Red Sea down to the island of Socotra, Tegnér was promoted to the rank of captain of the third class, and in 1838 he commanded the corvette "Erzherzog Friedrich" on the coast of Morocco, then in a very disturbed state. The corvette returned to Trieste on the imminence of the war with France; but during 1839 the French fleet commanded the Adriatic in vastly superior force, against which the Austrians were powerless. After the peace Tegetthoff made a voyage to Brazil as aide-de-camp to Maximilian, and in 1860-63 commanded a large frigate in the Levant during the disturbances in Syria, and on the coast of Greece in 1862, and subsequently the Adriatic fleet. Towards the end of 1863 he was sent to the North Sea as commodore in command of two frigates, with which, together with three small Prussian gunboats, he fought an action with the Danish squadron, and though without any decisive success, succeeded in raising the blockade of the mouths of the Elbe and Weser.

The Austrian emperor answered Tegetthoff's telegraphic despatch by another promoting him to be rear-admiral, and conferring on him the Order of the Iron Crown. In 1865 he commanded a small squadron in the Mediterranean, and in the war of 1866 was placed in command of the whole effective force of the Austrian navy. With all his efforts this was markedly inferior to the Italian force opposed to it, and when the two fleets met off Lissa on the 20th of July, the decisive victory of the Austrians was entirely due to the personal superiority of Tegetthoff and the officers whom he in great measure had trained. In numbers, in ships, and in armament the Italians were much the more powerful, but they had neither a capable chief nor efficient officers. Tegetthoff was immediately promoted, by telegraph, to the rank of vice-admiral, and among the many decorations conferred on him was one from his former commander, the unfortunate Maximilian, at this time emperor of Mexico, whose body was in the following year brought home by Tegetthoff. In March 1868 he was appointed head of the naval section of the War Office and commander-in-chief of the navy, which offices he held till his death at Vienna, after a very short illness, on the 7th of April 1871—in the words of the semi-official notice—"zu früh für Österreich."

(J. K. L.)

TEGGIANO (anc. Teggiunum, formerly called Diano), a town in Campania, Italy, in the province of Salerno, 45 m. S.E. of that town. Pop. (1901) 5005. It is situated 3200 ft. above sea-level on an isolated eminence above the upper part of the valley of the Negro (anc. Tavagia), to which it gives the name of Val di Diano. It represents the ancient Teggiunum a municipal town of Lucania, made into a colony by Nero, of which the ruins can be traced at the foot of the hill, with an ancient Roman bridge. An Olympic inscription in Greek letters has been found here (cf. W. Corssen in Ephemeris Epigraphica, ii. 153). It possesses a castle, several churches of some interest, and three conventual buildings. In 1497 it was strong enough to resist, under Antonio Sanseverino of Salerno, the siege undertaken by Frederick of Aragon. (T. A.)

TEGNÉR, ESAIAS (1752—1846). Swedish writer, was born on the 13th of November 1782, at Kyrkrud in Värmland. His father was a pastor, and his grandparents on both sides were peasants. His father, whose name had been Esaias Lucasson, took the surname of Tegnerus—altered by his fifth son, the poet, to Tegnér—from the hamlet of Tegnöy in Småland, where he was born. In 1792 Tegnerus died. In 1799 Esaias Tegnér, hitherto educated in the country, entered the university of Lund, where he graduated in philosophy in 1802, and continued as tutor until 1810, when he was elected Greek lecturer. In 1806 he married Anna Maria Gustava Myhrman, to whom he was never attached since his earliest youth. In 1812 he was named professor of history and finance at Lund until 1824, when he was made bishop of Vexiö. At Vexiö he remained until his death, twenty-two years later. Tegnér's early poems have little merit. He was comparatively slow in development. His first great success was a dithyrambic war-song for the army of 1808, which stirred every Swedish heart. In 1811 his patriotic poem Skrä i his great prize of the Stockholm Senate, and made him famous. In the same year he founded in Stockholm the Gothic League (Gotiska församlingen), a sort of club of young and patriotic men, of whom Tegnér quickly became the chief. The club published a magazine, entitled Iduna, in which it printed a great deal of excellent poetry, and ventilated its views, particularly as regards the study of old Icelandic literature and history. Tegnér, Geijer, Afzelius, and Nicander became the most famous members of the Gothic League. Of the very numerous poems written by Tegnér in the little room at Lund which is now open to visitors as the Tegnér museum, the majority are short, and even occasional. He celebrated Song to the Sun dates from 1817. He completed three poems of a more ambitious character, on which his fame chiefly rests. Of these, two, the romance of Axel (1822) and the delicately-chiselled idyl of Nattvardsbarnen ("The First Communion," 1820), translated by Longfellow, take a secondary place in comparison with Tegnér's masterpiece, of world-wide fame. In 1820 he published in Iduna certain fragments of an epic or cycle of epical pieces, on which he was then working, Frikjöfads saga or the Story of Frithiof. In 1822 he published five more cantos, and in 1825 the entire poem. Before it was completed it was famous throughout Europe; the astute Goethe took upon himself to commend to his countrymen this "alte, kräftige, ehrgeizige, barbarische Dichtart," and desired Amalie von Imhoff to translate it into German. This romantic paraphrase of an ancient saga was composed in twenty-four cantos, all differing in verse form, modelled somewhat, it is only fair to say, on an earlier Danish masterpiece, the Helge of Ohlenschläger. Frikjöfads saga is the best known of all Swedish productions; it is said to have been translated twenty-two times into English, twenty times into German, and once at least into every European language. It is far from satisfying the demands of more recent antiquarian research, but it still is allowed to give the freshest existing impression, in imaginative form, of life in early Scandinavia. In later years Tegnér began, but left unfinished, two important epic poems, Gerda and Kronbruden. The period of the publication of Frikjöfads saga (1825) was the critical epoch of his career. It made him one of the most famous poets in Europe; it transferred him from his study in Lund to the bishop's palace in Vexiö; it marked the first breakdown of his health, which had hitherto been excellent; and it witnessed a singular moral crisis in the inner history of the poet. For a long time without words, much about which little is known. Tegnér was at this time passionately in love with a certain beautiful Euphrosyne Palm, the wife of a town councillor in Lund, and this unfortunate passion, while it inspired much of his finest poetry, turned the poet's blood to gall. From this time forward the heartlessness of woman is one of Tegnér's principal themes. It is a remarkable sign of the condition of Sweden at that time that a man not in holy orders, and so little in possession of the religious temperament as Tegnér, should be offered and should accept a bishop's crosier. He did not hesitate in accepting it: it was a great honour; he was poor; and he was anxious to get away from Lund. No sooner, however, had he begun to study for his new duties than he began to regret the step he had taken. It was nevertheless too late to go back, and Tegnér made a respectable bishop as long as his health lasted. But he became moody and melancholy; as early as 1833 he complained of fiery heats in his brain, and in 1840, during a visit to Stockholm, he suddenly became insane. He was sent to an asylum in Schleswig, and early in 1841 he was cured, and able to return to Vexiö. It was during his convalescence in Schleswig that he composed Kronbruden. He wrote no more of importance; in 1843 he had a stroke of apoplexy, and on the 2nd of November 1846 he died in Vexiö. From 1810 he had been a member of the Swedish
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Academy, where he was succeeded by his biographer and best imitator Böttiger.

See Böttiger, Teckning af Tegners Løjfæ; Georg Brandes, Essais Tegné; Thonmander, Tank och Løjen. (E. G.)

TEGUCIGALPA, the capital of Honduras and of the department of Tegucigalpa; situated 3200 ft. above sea-level, on the river Choluteca, and at the head of a railway to the port of San Lorenzo on Fonseca Bay. Pop. (1905) about 35,000. Tegucigalpa is the largest and finest city in the republic. The majority of its houses are of one storey, built round a central court; the windows are usually unglazed but protected by iron bars which project into the narrow cobble-paved streets. The focus of civic life is near the central park, in which stands a bronze equestrian statue of Francisco Morazán (1792–1842), the Honduran statesman and soldier. Fronting the park is a domed cathedral, one of the largest and most ornate churches in Honduras. Other noteworthy buildings are the government offices, university, school of industry and art, national printing works, and law courts. A lofty ten-arched bridge over the Choluteca connects the city with its principal suburb, Concepción or Comayagua. Tegucigalpa became capital of Honduras, a status it had previously shared with Comayagua, in 1880. During the 18th century the neighbourhood was famous for its gold, silver and marble, but in modern times the mines and quarries have greatly declined in value, and farming is the chief local industry. In 1907 Tegucigalpa was occupied by the Nicaraguan invaders.

TEGULA, the Latin term for the convex covering tile of a roof, as distinguished from the imbre, the concave tile (see TILES).

TEHERAN (more properly TEHRAN), a province of Persia, with capital of the same name (which is also the capital of the Persian empire). It pays a yearly revenue of about £100,000, and comprises the districts of Saujbulag, Shahriar, Feshaviyeh, Shimiran, Kasran and Veramin. The first three, situated north-west, west and south of the city of Teheran, are very fertile, and supply the capital with grain, grapes and melons. Shimiran, the district north of the city, and on the slopes of the Elburb (rising to an elevation of 12,600 ft.) has 63 villages (one, Tajrish, the seat of the governor, with a population of over 2000), which are much frequented during the summer months by the inhabitants of the city seeking relief from the great heat. One of the villages, Gulhek or Gulahke, but correctly Kulheh (with a guttural k, and meaning a small, reedy mere), situated 800 ft. above the city of Teheran and 63 m. from it, was given in feef to the British government by Fath Ali Shah about 1830 for the summer quarters of the British legation. Zergendeh, a village adjoining Gulhek, is held in a similar manner by the Russian government, and the Russian legation stays there during the summer. Kasran is a hilly district north-east of Teheran, with numerous coal mines (inferior coal of the Jurassic period) and streams abounding with salmon trout. The Veramin district, south-east of Teheran city, has 123 villages, and supplies the city and surrounding districts with wheat, barley and rice. It is watered by the Jajrud river, and is considered one of the most fertile districts of Persia.

TEHERAN, the capital of Persia and of the province of the same name, 70 m. S. of the southern shore of the Caspian Sea. It is situated on an immense gravel deposit which slopes down from the foot of the Elburb mountain (rising to an altitude of 12,600 ft.) 8 or 9 m. N. of the city, and extends for 16 m. to near Shah-abad-Azim, 53 m. S. of it. Teheran was formerly a kind of polygon about 4 m. in circumference, with a mud wall and towers, a dry ditch and six gates, but in 1869 Nasr-ud-din Shah decided upon enlarging the city; the old wall and towers were demolished, the ditch was filled up and used for building sites, and an enceinte consisting of a ditch and 58 unequal bastions according to Vauban's first system was constructed and completed in 1874. The city then took the form of an octagonal pentagon, and its circumference (a line through the salient angles of the bastions) measures 19,596 metres, or 1218 m. The area within the bastions is about 72 sq. m. There are twelve gates, which are closed from two hours after sunset to an hour before sunrise. According to observations taken in 1895 by British officers in connexion with determining the longitude of Madras, the longitude of Teheran (pillar at the north-western corner of the British legation grounds) is 51° 25′ 3-8″ E. The latitude of the old telegraph office, which was situated almost due S., is 35° 41′ 6-83″ N., and its elevation 3810 ft. The northern gates of the city, however, are 282 ft. above the level of the International Mercantile Marine, and little has been done in general outward appearance from other cities of the country, though in recent years (since the above-mentioned extension) many broad and straight streets and a number of buildings of western architecture, shops with show windows, electric lamps, cafes, &c., have been introduced. "We are in a city which was born and nurtured in the East, but is beginning to clothe itself at a West-End tailor's" (Curzon). Most of the innovations are to be seen only in the northern part of the town where the Europeans and many wealthy Persians have settled. The ark or citadel, situated nearly in the centre of the town, contains the shah's palace and a number of modern buildings of respectable appearance, for instance the foreign office, the war office, customs, telegraph station, arsenal, &c. Immediately north of the ark are the Maidan Tupkhaneh (Artillery Square), 270 yds. by 120, and the great Maidan i Mash (Maidan of drill), the military parade ground, 550 yds. by 350. South of the ark are the bazaars, the central arcade and caravanserai built c. 1850 by the prime minister Mirza Taki Khan, commonly known as the amir, and beyond them, as well as on the east and west, are the quarters of the old town, with narrow, crooked and mostly unsanitary and unclean streets. Teheran has 65 m. of tramways (single lines) and is connected with Shah-abad-Azim by a single line of railway of one-metre gauge and 53 m. long (the only railway in Persia). Water is freely supplied to the town by means of about thirty underground canals (kanats), led from the slope of the northern hills and running 5 to 10 m. at considerable depths below the surface. The water supply would be ample for the requirements of the population if it could be regularly and equally distributed; but the supply in the months of October and November is only about one-half of that during March, and much water is lost through open ditches and by leakage. The distribution therefore is irregular: in winter and early spring, when the gardens require very little water from the canals, the supply is too great, and in summer it is too little. It has been calculated that the mean water supply amounts to the enormous quantity of 921,000 gallons per hour all the year round, but that, after deducting the quantity wasted in distribution, irrigation of gardens, filling tanks and baths, watering streets, &c., there remain forty-two gallons per head daily during the month of April, seventeen during July, August and September, and ten during October and November. Even the last quantity would suffice if evenly distributed, but as most of the canals are private property and independent of government or municipal control, the distribution is unequal, and it frequently happens that when some parts of the city have water in abundance others have hardly any. Teheran has many mosques, all of recent date, the finest being the one called Masjed i Sipahsalar, built by Mirza Husain Khan Sipahsalar Azam, who was prime minister for ten years until 1884. It is situated in the new part of the city and adjoining it is the Baharistan palace, once the residence of a cabin or apartments, the last occupied by the national assembly. Another notable mosque is the Masjed i Shah, completed c. 1840. There are also many colleges and schools, some of them with European teachers, including the " German School" (1907) with a yearly subsidy of £2500 from the shah. Before Nasr-ud-din's first voyage to Europe in 1873 only four western states had legations and consulates at Teheran; now twelve states are represented.

The present population of Teheran is about 280,000, including 120,000 Europeans, 4000 Jews, the same number of Armenians, 200 Zoroastrians, and a garrison of 3000 to 4000. The climate is considered unhealthy, particularly in the summer and early
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autumn, when typhoid,ague and other fevers are prevalent, but something in the way of sanitation has been effected and there is a distinct improvement. The author of the Zinat el mojalis, writing in 1596, states that cholera frequently visited the city, and, the north being shut off by high mountains, the air was hot and evil-smelling and the water unwholesome. In fact the climate was so bad that even the Angel of Death ran away from it. The mean yearly temperature calculated from observations taken for a number of years ending 1902 was 62-6° F., the highest temperature observed was 111°, the lowest 3°, giving a difference of 108° between extremes. The hottest month is July, with a mean of 85-2°, the coldest January, with a mean of 34-25°. The mean annual rainfall during a period of 15 years ending 31 December 1907, was 10 ins.

In the Jehanshah i Safawni, a Persian history written in the 13th century, the name of the town is written Tir'an, while other works have the name as it is now written, viz. Tehran. The latter spelling is due to Arabic influence, old Persian names being frequently Arabicized and sometimes becoming unrecognizable. Two villages in the neighbourhood of Isfahan appear as Tir'an in old documents, while in modern revenue accounts and lists they are written Tehran. The Mujem el Budan, a geographical dictionary written in 1224, describes Tehran as a village 4 m. distant from Rai (Rahges). Pietro della Valle, who passed a night (June 6-7, 1618) at Tehran, writes "Taherm" (perhaps thinking it to be a plural of taher, "the pure "); and Sir Thomas Herbert, who visited it on 14th June 1615, calls it Tehran and states that it contained 3,000 houses built of sun-dried bricks and had its water supply from a little river which flowed through it in two branches. Almost the whole of the city was destroyed by the Afghans in 1723, and Tehran did not regain any importance until the close of the century when Agha Mahommed Khan, the founder of the Kajar dynasty, made it his capital and residence. Dr Olivier, who visited Tehran in 1796, says, "In spite of Agha Mohammed Khan's efforts to induce people to settle and merchants and manufacturers to establish themselves there, the population of Tehran does not amount to 15,000 souls, including 1 garrison of 3,000."

(A. H.-S.)

TEHRI, a native state in Northern India, in political sub-division to the United Provinces: area, 4,000 sq. m.; population (1901) 268,885; estimated revenue, £28,000. It lies entirely amid the Himalayas, containing ranges from 20,000 to 25,000 ft. above sea-level, and also the sources of both the Ganges and the Jumna, with the places of pilgrimage associated with them. The forests, which have been leased to the British government, are very valuable, yielding several kinds of pine, oak and cedar. The crops are rice, small millets, potatoes and a little sugar. Tahri chowk, whose title is raja, is descended from a Rajput family which formerly ruled over all Garhwal. The existing state was acquired by the British after the war with Nepal in 1816. The town of Tehri, on the river Bhagirathi (as the Ganges is here called) has a pop. (1901) of 3,387.

TEHUANTEPEC (from tehuani-tepec—"jaguar-hill"), the town which gives its name to the isthmus, gulf and railway, stands on the Tehuantepec river about 15 m. from its mouth and 13 m. by rail from Salina Cruz. Pop. (1904, estimated) 10,000. It is a typical struggling frontier town, occupying the slope of a hill on the Pacific side of the divide, with a beautiful view of the river valley and the distant sierras to the N. The streets are little more than crooked paths up the hillside, and the habitations are for the most part thatched, mud-walled huts. The population of the town and of the surrounding district is composed almost wholly of Indians of the great Zapoteca family. The Tehuanas of Tehuantepec are noted for the beauty and graceful carriage of their women, who are reputed to be the finest-looking among the native races of Mexico. The women are the traders in Tehuantepec and do little manual work—a result, apparently, of the influence of beauty. The local industries include the making of "caña," a cane spirit, and the weaving of cotton fabrics, dyed with the juice of a marine shell-fish (Purpura patula) found on the neighbouring coast. Indigo was formerly grown in the vicinity and cochineal gathered for export, but both of these industries have declined.

TEHUANTEPEC, an isthmus of Mexico lying between the Gulfs of Campeche (Campeachy) and Tehuantepec, with the states of Tabasco and Chiapas on the E., and Vera Cruz and Oaxaca on the W. It includes that part of Mexico lying between the 94th and 96th meridians of W. longitude, or the south-eastern parts of Vera Cruz and Oaxaca, with perhaps small districts of Chiapas and Tabasco. It is 125 m. across at its narrowest part from gulf to gulf, or 120 m. to the head of Laguna Superior on the Pacific coast. The Sierra Madre breaks down at this point into a broad, plateau-like ridge, whose elevation, at the highest point reached by the Tehuan-tepec railway (Chivela Pass) is 735 ft. The northern side of the isthmus is swampy and densely covered with jungle, which has been a greater obstacle to railway construction than the grades in crossing the sierra. The whole region is hot and malarial, except the open elevations where the winds from the Pacific render it comparatively cool and healthful. The annual rainfall on the Atlantic or northern slope is 136 in. (Enoch) and the maximum temperature about 95° in the shade. The Pacific slope has a light rainfall and dryer climate.

Since the days of Cortés, the Tehuantepec isthmus has been considered a favourable route, first for an interoceanic canal, and then for an interoceanic railway. Its proximity to the ports of international trade gives it some advantage over the Panama route, which is counterbalanced by the narrower width of the latter. When the great cost of a canal across the isthmus compelled engineers and capitalists to give it up as impracticable, James B. Eads proposed to construct a quadruple track ship-railway, and the scheme received serious attention for some time. Then came projects for an ordinary railway, and several concessions were granted by the Mexican government for this purpose from 1857 to 1882. In the last-named year the Mexican government resolved to undertake the enterprise on its own account, and entered into contracts with a prominent Mexican contractor for the work. In 1888 this contract was rescinded, after 67 m. of road had been completed. The next contract was fruitless through the death of the contractor, and the third failed to complete the work within the sum specified (£2,700,000). This was in 1893, and 37 m. remained to be built. A fourth contract resulted in the completion of the line from coast to coast in 1894, when it was found that the terminal ports were deficient in facilities and the road too light for heavy traffic. The government then opened into a contract with the London firm of contractors of S. Pearson & Son, Ltd., who had constructed the drainage works of the valley of Mexico and the new port works of Vera Cruz, to rebuild the line and construct terminal ports at Coatzacoalcos, on the Gulf coast, and Salina Cruz, on the Pacific side. The work was done for account of the Mexican government. Work began on the 16th of December 1899, and was finished to a point where its formal opening for traffic was possible in January 1907.

The railway is 192 m. long, with a branch of 18 m. between Julle and San Juan Evangelista. The minimum depth at low water in both ports is 33 ft., and an extensive system of quays and railway tracks at both terminals affords ample facilities for the expedient handling of heavy cargoes. The general offices, shops, hospital, &c., are located at Rincon Antonio, at the entrance to the Chivela Pass, where the temperature is cool and healthful conditions prevail. At Santa Lucrecia, 100 m. from Salina Cruz, connexion is made with the Vera Cruz & Pacific railway (a government line), 213 m. to Cordova and 311 m. to Mexico city.

TEHUELCHE, CHUELCHE, or HUILICHIE ("Southern People"), the generic name given by the whites of Argentina to the Indian tribes speaking Patagonian or Tehuelche tongue. SOUTH, JOHN SHORE, 1ST BARON (1751-1834), governor-general of India, was born on the 8th of October 1751, the son of Thomas Shore, a supercargo in the service of the
East India Company. He was educated at Harrow, and went out to India as a writer in the Bengal Civil Service in 1760. He became a member of the Supreme Council (1787–89), in which capacity he assisted Lord Cornwallis in introducing many reforms, but did not approve his permanent settlement of Bengal. On the retirement of Cornwallis, he was appointed governor-general (1793–98), adopting a policy of non-interference, but deposed Wazir Ali, for whom he substituted Saadat Ali as nawab of Oudh. His term of office was also signalized by a mutiny of the officers of the Indian army, which he met with concessions. He was created a baronet in 1792, and Baron Teignmouth in the peerage of Ireland in 1798. On his retirement from India he was appointed member of the board of control (1807–28), and was for many years president of the British and Foreign Bible Society. He died on the 14th of February 1834.

See Memoirs of Lord Teignmouth, by his son (1843).

**TEIGNMOUTH**, a seaport and market town in the Ashburton parliamentary division of Devonshire, England, at the mouth of the river Teign, on the English Channel, 15 m. S. by E. of Exeter, by the Great Western railway. Pop. of urban district (1901) 8,566. Two parishes, East and West Teignmouth, form the town. It lies partly on a peninsula between the river and the sea, partly on the wooded uplands which enclose the valley and rise gradually to the high moors beneath Heytor. The Den, or Dene, forms a promenade along the sea-front, with a small lighthouse a short way out. St. Michael's church at the old East Teignmouth was rebuilt in 1824 in Decorated style, but retains a Norman doorway and other ancient portions; of St James', in West Teignmouth, the south porch and tower are Norman. There are a theological college for Redemptorists, and a Bene-dictine convent, dedicated to St Scholastica. The entrance to the harbour has been improved by dredging, and the two quays accommodate vessels drawing 13 ft. at neap tides. Pipeclay and china clay, from Kingsteignton, are shipped for the Staffordshire potteries, while coal and general goods are imported. Pithead, herring, whiting and mackerel are taken, and salmon in the Teign. Malting, brewing and boatbuilding are also carried on. East Teignmouth was formerly called Teignmouth Regis, and West Teignmouth, Teignmouth Episcopi.

Teignmouth (Teinemue, Tengenue) possessed a church of St Michael as early as 1044, when what is now East Teignmouth was granted by Edward the Confessor to Leofric, bishop of Exeter, and an allusion to salters in the grant proves the existence of the salt industry at that date. Teignmouth is not mentioned in the Domesday Survey, but in 1276 what is now West Teignmouth appears as a mesne borough held by the dean and chapter of Exeter; what is now East Teignmouth continuing with the bishop, who was accused in that year of holding in his manor a market which should be held in the borough. The bishop's manor was alienated in 1550 to Sir Andrew Dudley, but West Teignmouth remained with the dean and chapter until early in the 19th century. In the middle ages Teignmouth was a flourishing port, able to furnish 7 ships and 120 mariners to the Calais expedition of 1347, and depending chiefly on the fishing and salt industries. In the early part of the 17th century the town had fallen into decay, but had again recovered, and in 1744 could contribute twenty vessels to the Newfoundland shipping trade. The borough was never represented in parliament, nor incorporated by charter. The Saturday market, which was held up to the 19th century, is mentioned in 1220, and was confirmed by royal charter in 1525, together with a fair at Michaelmas. Teignmouth was burned by French pirates in 1340, and was again devastated by the French on the 26th of June 1690.

See Victoria County History, Devonshire; The Teignmouth Guide and Complete Handbook to the Town and Neighbourhood (Teignmouth, 1875).

**TEIRESIAS**, in Greek legend, a famous Theban seer, son of Eueres and Charicio. He was a descendant of Udeaen, one of the men who had sprung up from the serpent's teeth sown by Cadmus. He was blind from his seventh year, for which various causes were alleged. Some said that the gods had blinded him because he had revealed to men what they ought not to know. Others said that Athena (or Artemis) blinded him because he had seen her naked in the bath; when his mother prayed Athena to restore his sight, the goddess, being unable to do so, purged his ears so that he could understand the speech of birds, and gave him a staff wherewith to guide his steps (ApolloDorus iii. 6). According to Sostratus, author of an elegiac poem called Teiresias, he was originally a girl, but had been changed into a boy by Apollo at the age of seven; after undergoing several more transformations from one sex to the other, she (for the final sex was feminine) was turned into a mouse and her lover Arachnus into a wasp (Eustathius on Odyssey, p. 1665). Teiresias' grave was at the Tphilus spring; but there was a cenotaph of him at Thebes, and also in later times his "tombstone": for place for was ting omens from birds, was pointed out (Pausanias ix 16; Sophocles, Antigone, 999). He had an oracle at Orchomenus, but during a plague it became silent and remained so in Plutarch's time (De Defectu Oraculorum, 44). According to Homer (Od. x. 492, xi. 90), Teiresias was the only person in the world of the dead whom Proserpine allowed to retain his memory and intellect unimpaired, and Circe sends Odyssey and to consult him concerning his return home. He figured in the great paintings by Polygnotus in the Lesche at Delphi.

**TEISSERENC DE BORT, PIERRE EDMOND** (1814–1892), French writer and politician, was born at Châteauroux on the 17th of September 1814, and entered the civil service after the completion of his education at the École Polytechnique. He was a railway expert, becoming secretary-general of the Railway Commission established in 1842, government commissioner to the authorized railway companies, administrator of the Lyons-Mediterranean railway, and commissioner to examine foreign railways. In 1846 he was returned to the Chamber of Deputies for Hérald, but the revolution of 1848 drove him into private life, from which he only emerged after the downfall of the Empire, when in February 1871 he was returned to the National Assembly. He supported the government of Thiers and was minister of agriculture and commerce in 1872–73. He sat in the Left Centre, and steadily supported republican principles. He entered the Senate in 1876, and was minister of agriculture in the Dufaure-Ricard cabinet of that year, retaining his portfolio in the Jules Simon ministry which fell on the 16th of May 1877. In 1878, when he joined the new Dufaure cabinet, he opened the Paris exhibition of agriculture and manufactures, the original suggestion of which had been made by him during his Jules Simon ministry. In 1879 he was sent as ambassador to Vienna, where he next year recalled on the score of health. Two years later he re-entered the Senate, where he did good service to the cause of "Republican Defence" during the Boulangist agitation. He died in Paris on the 29th of July 1892. His works consist of discussions of railway policy from the technical and economic side.

**TELANONES** (Gr. τέλαμον, supporter, from τλήνω, to bear), in architecture the term used by the Romans as equivalent to Atlantes (the Greek term) for male figures employed to carry arches and cornices. The best-known examples are those in the tepidarium and in the baths of Pompeii, which consist of small figures in terra-cotta, 2 ft. high, placed between niches and carrying a cornice.

**TELANG, KASHINATH TRIMBAK** (1850–1893), Indian judge and oriental scholar, was born at Bombay on the 30th of August 1850. By profession an advocate of the high court, he also took a vigorous part in literary, social, municipal and political work, as well as in the affairs of the university of Bombay, over which he presided as vice-chancellor from 1892 till his death. At the age of five Telang was sent to the Amarnachand Wadi vernacular school, and in 1859 entered the high school in Bombay which bears the name of Mounstuart Elphinstone. Here he came under the influence of Narayan Mahadev Purmanand, a teacher of fine intellect and force of character, afterwards one of Telang's most intimate friends.
TELAV—TELEGONY

From this school he passed to the Elphinstone College, of which he became a fellow, and after taking the degree of M.A. and LL.B., decided to follow the example of Bal Mangesh Wagle, the first Indian admitted by the judges to practise on the original side of the high court, a position more like the status of a barrister than a vakil or pleader. He passed the examination and was enrolled in 1872. His learning and other gifts soon brought him into the good graces of the English-speaking elements, and he completed command of the English language, and his intimacy with Sanskrit enabled him to study and quote the Hindu law-books with an ease not readily attained by European counsel. Telang, finding his career assured, declined an offer of official employment. But in 1889 he accepted a seat on the high court bench, where his judgments are recognized as authoritative, especially on the Hindu law. He was syndic of the university from 1883, and vice-chancellor from 1893 till his death. In that year also he was elected president of the local branch of the Royal Asiatic Society. These two offices had never been held by a native of India before. The decoration of C.I.E. conferred on him in 1882 was a recognition of his services as a member of a mixed commission appointed by the government to deal with the educational system of the whole of India. He was nominated to the local legislative council in 1884, but declined a similar position on the viceroy's council. Along with P.M. Metha, he was the originator of the Bombay Presidency Association. When a student he had won the Bhugwandas scholarship in Sanskrit, and in this language his later studies were profound. His English was brought into English prose and verse by a hard word; and he criticized Professor Weber's hypothesis that the story of the Ramayana was influenced by the Homeric epics. While devoted to the sacred classics of the Hindus, Telang did not neglect his own vernacular, Mahārāṭā literature being enriched by his translation of Lessing's Nathan the Wise, and an essay on Social Compromise. He died at Bombay on the 1st of September 1893.

TELAV, a town of Russian Transcaucasia, in the government of Tiflis, 63 m. N.E. of the town of Tiflis, on the river Alazar and at an altitude of 2450 ft. Pop. (1897) 11,810, chiefly Jews. Tiflis (9000). Telav is a very old town, founded in 803, and until 1797 it was the capital of Kakhetia, and has ruins of old forts. In the neighbourhood are the Ikalto monastery (6th century), the Shunaty monastery (16th century), and the originally 10th century Alaverdi church, visited by many pilgrims. Wine is exported.

TELEGONY (Gr. τελέγον, far, and ὑστα, offspring), the name now given to the hypothesis that offspring sometimes inherit characters from a previous mate of their dam. Until recent years the supposed inheritance of characters acquired by a dam from one or more of her male progenitors, and usually by virtue of breeding only back and forth, has been considered by physiologists, “infection of the germ,” or simply “infection.” The doctrine of “infection,” like the somewhat allied doctrine of “maternal impressions,” seems to be alike ancient and widespread. Evidence of the antiquity of the belief in “maternal impressions” we have in Jacob placing peeled rods before Laban's cattle to induce them to bring forth “ring-straked speckled and spotted” offspring; evidence of the antiquity of the “infection” doctrine we have, according to some writers, in the practice amongst the Israelites of requiring the childless Ishmael to give up his deceased husband's brother, that he might “raise up seed to his brother.” Whatever may have been the views of stockowners in the remote past, it is certain that during the middle ages the belief in “infection” was common amongst breeders, and that during the last two centuries it met with the general approval of naturalists, English breeders being especially satisfied of the fact that the offspring frequently inherited some of their characters from a former mate of the dam, while both English and Continental naturalists (apparently without putting the assertions of breeders to the test of experiment) accounted for the transmission of some of the characteristics of the dam having been directly or indirectly “infected” by a former mate. It is noteworthy that L. Agassiz, C. Darwin, W. B. Carpenter, and G. J. Romanes were all more or less firm believers in the doctrine of infection, and that a few years ago, with the exception of Professor A. Weismann, all the leading biologists had either subscribed to the telegony doctrine or admitted that “infection of the germ” was well within the bounds of possibilities. Even Professor Weismann did not deny the possibility of the offspring throwing back to a previous mate. The trouble seems to have been, “may be justifiable, I am not sure,” and founded on fact,” but he was careful to add that “only the confirmation of the theory by methodical investigation, in this case by experiment, could raise telegony to the rank of a fact.” In assuming this attitude Professor Weismann decidedly differed from Herbert Spencer, who some years ago mentioned that he had evidence “enough to prove the fact of a previous sire asserting his influence on a subsequent progeny.”

The importance of determining whether there is such a thing as telegony is sufficiently evident. If a mare or other female animal is liable to be “infected” by her first or by subsequent mates, telegony will rank as a cause of variation, and breeders will be justified in believing (1) that pure-bred females are liable to be “corrupted” when mated with sires of a different breed; and (2) that inferior or cross-bred females, if first mated with a high-class sire, will thereafter produce superior offspring, however inferior or cross-bred her subsequent mates. If, on the other hand, “infection of the germ” is impossible, telegony will not count as a factor in variation, and breeders will no longer be either justified in regarding mares and other female animals as liable to be “infected” by their mates, or benefited by first having offspring to a high-class, or it may be more vigorous, mate. Though, according to breeders, evidence of telegony has been found in nearly all the different kinds of domestic mammals and birds, most stress has been laid on instances of “infection” in the horse and dog families.

Telegony in the Horse Family.—Beecher at the end of the 17th century pointed out that “when a mare has had a mule by an ass and afterwards a foal by a horse, there are evident marks on the foal of the mother having retained some ideas of her former paramour, the ass.” That mares used in mule breeding are liable to be infected is still widely believed, but irrefragable evidence of the influence of the ass persisting, as Agassiz assumed, is conspicuous by its absence. Darwin says, “It is worth notice that farmers in south Brazil are convinced that mares which have once borne mules when subsequently put to horses are extremely liable to produce colts striped like a mule” (Animals and Plants, vol. i. p. 436). Baron de Parana, on the other hand, says, “I have many relatives and friends who have large establishments for the rearing of mules, where they obtain from 40 to 1000 mules in a year. In these cases the offspring are liable to be infected; but I have never before heard of any case in which this has been actually observed.”

The prevalence of the belief in telegony at the present day is largely due to a case of supposed infection reported to the Royal Society in 1820 by Lord Morton. A chestnut mare, after having a hybrid by a quagga, produced a black Arabian horse three foals showing a number of stripes—in one more stripes were present than in the quagga hybrid. The more, however, the case so intimately associated with that of the quagga. The peculiarity of telegony is the evidence it affords in favour of “infection.” Stripes are frequently seen in high-caste Arab horses, and cross-bred colts out of Arab mares sometimes present far more distinct bars across the legs and other zebra-like markings than characterized the subsequent offspring of Lord Morton's seven-eighths Arabian mare. In the absence of control experiments there is therefore no reason for assuming Lord Morton's chestnut mare would have produced less striped offspring had she been mated with the black Arabian before giving birth to a quagga hybrid. To account for the stripes of the Arabian breeders, it is only necessary to assume that in the cross-bred chestnut mare there lay latent the characteristics of the Kattiavar or other
Indian breeds, in which stripes commonly occur. Darwin and others having regarded Lord Morton's mare as affording very strong evidence in support of the infection hypothesis, it was considered some years ago desirable to repeat Lord Morton's experiment as accurately as possible. The quagga having become extinct, a number of mares were put to a richly striped Burchell zebra, and subsequently mated with Arab, thoroughbred and cross-bred sires. Other mares were used for control experiments. Thirty mares put to a Burchell zebra produced seventeen hybrids, and subsequently twenty pure-bred foals. The mares used for control experiments produced ten pure-bred foals. Unlike Lord Morton's quagga hybrids, all the zebra hybrids were richly, and sometimes very distinctly, striped, some of them having far more stripes than their zebra parent. Of the subsequent foals, three out of Highland mares presented indistinct markings at birth. But as equally distinct markings occurred on two pure-bred Highland foals out of mares which had never seen a zebra, it was impossible to ascribe the stripes on the foals born after zebra hybrids to infection of their respective dams. Further, the subsequent foals afforded no evidence of infection, either in the mane, tail, hoofs or disposition. Of the pure-bred foals, i.e. the foals by pure-bred sires out of mares which had never been mated with a zebra, two were striped at birth and one acquired stripes later—they were revealed as the foal's coat was shed. Moreover, while the faint markings on the foals born after hybrids compared with the foals' coat, the stripes on the three pure-bred colts persisted. One of the consequently striped colts, a bay, was out of a black Shetland mare by a black Shetland sire, one was by a dun Norwegian pony out of a roan-coloured Arab mare, while the third was by a Norwegian pony out of a half-bred bay Arab mare. It has been asserted by believers in teleology that evidence of infection may appear in the second though not present in the first generation. By way of testing this assumption, a bay filly, the half-sister of a richly striped hybrid, was put to a cross-bred Highland pony, and a Highland mare, while nursing her hybrid foal, was put to a colt the half-brother of a hybrid. The result was two fillies which in no single point either suggest a zebra or a zebra hybrid. Similar results having been obtained with horses and asses, there is no escape from the conclusion that the teleology tradition is not confirmed by such methodical investigations as were suggested some years ago by Professor Weismann (see Cossar Ewart, The Pennycuik Experiments, 1899).

Telegony in Dogs.—Breeders of dogs are, if possible, more thoroughly convinced of the fact of telegony than breeders of horses. Nevertheless, Sir Everett Millais, a recognized authority, has been led to the conclusion by his own experience, during which he made all sorts of experiments, he had never seen a case of telegony. Recent experiments support Millais's conclusion. Two of the purest breeds at the present day are the Scottish deerhound and the Dalmatian (spotted carriage-dog). A deerhound after having seven pups to a Dalmatian was put to a dog of her own breed. The result was five pups, which have grown into handsome hounds without the remotest suggestion of the previous Dalmatian mate of their dam. A similar result was obtained with a deerhound fathered by a mongrel. Many cross-bred experiments on telegony are made annually with dogs. Two such experiments may be mentioned. A black-brindled Scottish terrier belonging to a famous breed had first a litter of pups to a curly-haired liver-and-white cocker-spaniel. The pups were spaniel-like in build, and of a brown-and-white colour. Subsequently this terrier had pups to a black-brindled terrier. All the pure-bred pups were typical terriers, and evidence of their dam having escaped infection is the fact that three of them proved noted prize-winners. The subject of the second undesigned experiment was a half-bred fox-terrier. In this case the first sire was a white Pomeranian and the second a thoroughbred Irish terrier. Having had ample opportunity of being "corrupted," the fox-terrier was mated with a prize dog of her own strain. The result was three pups, all in make and markings pure terriers, and one of the three was regarded as an unusually good specimen of the breed.

Experiments with cats, rabbits, mice, with sheep and cattle, with fowls and pigeons, like the experiments with horses and dogs, fail to afford any evidence that offspring inherit any of their characters from previous mates of the dam; i.e. they entirely fail to prove that a female animal is liable to be so influenced by her first mate that, however subsequently mated, the offspring will either in structure or disposition give some hint of the previous mate. In considering telegony it should perhaps be mentioned that some breeders not only believe the dam is liable to be "infected" by the sire, but also that the sire may acquire some of the characteristics of his mates. This belief seems to be especially prevalent amongst breeders of cattle; but how, for example, a long-horned Highland bull, used for crossing with black hornless Galloway cows, could subsequently get Galloway-like calves out of pure Highland heifers it is impossible to imagine.

In conclusion, it may be pointed out that it was only natural for breeders and physiologists in bygone days to account for some of their results by the "infection" hypothesis. Even now we know surprisingly little about the causes of variation, and not many years ago it was frequently asserted that there was no such thing as reversion or throwing back to an ancestor. But even were the laws of heredity and variation better understood, the fact remains that we know little of the origin of the majority of our domestic animals. On the other hand, from the experiments of Mendel and others we now know that cross-bred animals and plants may present all the characters of one of their pure-bred parents, and we also know that the offspring of what are regarded as pure-bred parents sometimes revert to remote, it may be quite different, ancestors. The better we understand the laws of heredity and variation, and the more we learn of the history of the germ cells, the less need will there be to seek for explanations from teleology and other like doctrines.

**TELEGRAPH** (Gr. τῆλε, far, and γράφω, to write), the name given to an apparatus for the transmission of intelligence to a distance. Etymologically the word implies that the messages are written, but its earliest use was of appliances that depended on visual signals, such as the semaphore or optical telegraph of Claude Chappe. The word is still sometimes employed in this sense, as of the ship's telegraph, by means of which orders are mechanically transmitted from the navigating bridge to the engine room, but when used without qualification it usually denotes telegraphic apparatus worked by electricity, whether the signals that express the words of the message are visual, auditory or written.

Land and Submarine Telegraphy will be considered in Part I., with a section on the commercial aspects. In Part II. Wireless Telegraphy is dealt with.

**PART I.—LAND AND SUBMARINE TELEGRAPHY**

**Historical Sketch.**—Although the history of practical electric telegraphy does not date much further back than the middle of the 19th century, the idea of using electricity for telegraphic purposes is much older. It was suggested again and again as each new discovery in electricity and magnetism seemed to render it more feasible. Thus the discovery of Stephen Gray and of Granville Wheeler that the electrical influence of a charged Leyden jar may be conveyed to a distance by means of an insulated wire gave rise to various proposals, of which perhaps the earliest was that in an anonymous letter to the Scots Magazine (vol. xv. p. 73, 1753), in which the use of as many insulated conductors as there are letters in the alphabet was suggested. Each wire was to be used for the transmission of one letter only, and the message was to be sent by charging the proper wires in succession, and received by observing the

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1 From correspondence found among Sir David Brewster's papers after his death it seems highly probable that the writer of this letter, which was signed " C. M.," was Charles Morrison, a surgeon and a native of Greenock, but at that time resident in Renfrew.
TELEGRAPH

movements of small pieces of paper marked with the letters of the alphabet and placed under the ends of the wires. A very interesting modification was also proposed in the same letter, viz. to attach to the end of each wire a small light ball which, when actuated by the galvanic current, would strike the adjacent bell and strike it. Some twenty years later G. L. Le Sage proposed a similar method, in which each conductor was to be attached to a pitball electrometer. An important advance on this was proposed in 1797 by Lomond, who used only one line of wire and an alphabet of motions. Besides these we have in the same period the spark telegraph of Reiser, of Don Silva, and of Cavallo, the pitball telegraph of Francis Ronalds (a model of which is in the collection of telegraph apparatus in the Victoria and Albert Museum), and several others. The application of this to telegraphic purposes was suggested by Laplace and taken up by Ampere, and afterwards by Triboulet and by Schilling, whose work forms the foundation of much of modern telegraphy. Faraday's discovery of the induced current produced by passing a magnet through a helix of wire forming part of a closed circuit was held of in the telegraph of Gauss and Weber, and this application was at the request of Gauss taken up by Steinheil, who brought it to considerable perfection. Steinheil communicated to the German Academy of Sciences in September 1837 an account of his telegraph, which had been constructed about the middle of the preceding year. The currents were produced by a magneto-electric machine resembling that of Clarke. The receiving apparatus consisted of a multiplier, in the centre of which were pivoted one or two magnetic needles, which either indicated the message by the movement of an index or by striking two bells of different tone, or recorded it by making ink dots on a ribbon of paper.

Steinheil appears to have been anticipated in the matter of a recording telegraph by Morse of America, who in 1827 constructed a galvanometer; this within a few years was so perfected that with some modification in detail it has been largely used ever since (see below). In 1836, to whom the idea appears to have been suggested by Schilling's method, invented a telegraph in which an alphabet was worked out by the single and combined movement of three needles. Subsequently, in conjunction with Wheatstone, he introduced another form, in which five vertical index needles, each worked by a separate multiplier, were made to point out the letters on a dial. Two needles (for some letters, one only) were acted upon at the same time, and the letter at the point of intersection of the direction of the index was read. This telegraph required six wires, and was shortly afterwards displaced by the single-needle system, still to a large extent used on railway and other less important circuits. The single-needle instrument is a vertical needle galvanoscope worked by a battery and reversing handle, or two "tapper" keys, the motions to right and left of one end of the index corresponding to the dashes and dots of the Morse alphabet. To increase the speed of working, two single-needle instruments were sometimes used in the action of a double-needle telegraph. This system required two line wires, and, although a remarkably serviceable apparatus and in use for many years, is no longer employed. Similar instruments to the single and double needle apparatus of Cooke and Wheatstone were about the same time invented by the Rev. H. Highton and his brother Edward Highton, and were used for a considerable time on some of the railway lines in England. Another series of instruments, introduced by Cooke and Wheatstone in 1830, and generally known as "Wheatstone's step-by-step letter-showing" or "ABC instruments," were worked out of the great ingenuity of detail by Wheatstone in Great Britain and by Bréguet and others in France. The Wheatstone instrument in the form devised by Stroh is still largely used in the British Postal Telegraph Department. Wheatstone also described and to some extent worked out an interesting modification of his step-by-step instrument, the object of which was to produce a letter-printing telegraph. But it never came into use; some years later, however, an instrument embodying the same principle, although differing greatly in mechanical detail, was brought into use by Royal Telephone, and was very successfully worked on some of the American telegraph lines till 1860, after which it was gradually displaced by other forms. Various modifications of the instrument are still employed for stock telegraph purposes.

Construction of Telegraph Circuits.—The first requisite for electro-telegraphic communication between two localities is an insulated conductor extending from one to the other. This, with proper apparatus for originating electric currents at one end and for discovering the effects produced by one of them at the other end, constitutes an electric telegraph. Faraday's term "electro," literally "a way (δρος) for electricity to travel," might be well applied to designate the insulated conductor along which the electric messenger is despatched. It is, however, more commonly and familiarly called "the wire" or "the line." The apparatus for generating the electric action at one end is commonly called the transmitting apparatus or instrument, or the sending apparatus or instrument, or sometimes the transmitter or sender. The apparatus used at the other end of the line to render the effects of this action perceptible to the eye or ear, is called the receiving apparatus or instrument.

In the aerial or ground system of land telegraphs the use of copper wire has become very general. The advantage of the high conducting power which copper possesses is of especial value in moist climates (like that of the United Kingdom), since the effect of leakage over the surface of the damp insulators is much less noticeable when the conducting power of the wire is high than when it is low, especially when the line is a long one. Copper is not yet universally employed, price being the governing factor in its employment; moreover, the conducting quality of copper makes it less suited to telegraphic purposes than silver or gold. The use of copper as a telegraphic conductor has of late years been very greatly improved.

In the British Postal Telegraph system five sizes of iron wire are in general use, weighing respectively 200, 400, 450, 600 and 800 lb per statute mile, and having electrical resistances (at 60° F.) of 26.64, 13.32, 11.84, 8.88 and 6.66 standard ohms per statute mile respectively. The sizes of copper wire employed have weights of 100, 150, 200 and 400 lb per statute mile, and have electrical resistances (at 60° F.) of 8.782, 5.955, 4.391 and 2.195 standard ohms respectively. Copper wire weighing 600 and 800 lb per mile has also been used to some extent. The copper is "hard drawn," and has a breaking strain as high as 28 tons per sq. in.; the last strain required for the iron wire is about 2½ tons. The particulars sizes and descriptions of wires used are dependent upon the character of the "circuits" the longer and more important circuits requiring the heavier wire. The lines are carried on poles, at a sufficient height above the ground, by means of insulators. These vary in form, but essentially they consist of a stem of porcelain, coarse earthenware, glass or other non-conducting substance, protected by an insulating roof or screen. The form in general use on the British postal lines is the "Cordeaux screw," but the "Varley double cup" is still employed, especially by the railway companies.

The latter form consists (fig. 1) of two distinct cups (c, C), which are moulded and fired separately, and afterwards cemented together. The double cup gives greater security against loss of insulation due to wind, the metal cups, and are more easily cleaned by pouring hot water upon the surface insulation. An iron bolt (b) cemented into the centre of the inner cup is used for fixing the insulator to the pole or bracket.

\[ See \ Arthur \ Young, \ "Travels \ in \ France," \ page \ 3.\]
This form of insulator is still largely used and is a very serviceable pattern, though possessing the defect that the porcelain cup is not removable from the iron bolt on which it is mounted. The Cordeaux insulator (fig. 2) is made in one piece. A coarse screw-thread is formed in the upper part of the inner cup, and this screws on to the end of the iron bolt by which it is supported. Between a shoulder, $a$, in the iron bolt and a shoulder in the porcelain cup, $c$, is placed an indiarubber ring, which forms a yielding washer and enables the cup to be screwed firmly to the bolt, while preventing the abrasion of the porcelain against the iron. The advantage of the arrangement is that the cup can at any time be readily removed from the bolt. At the termination of a line a large insulator (fig. 3), mounted on a strong steel bolt having a broad base flange, is employed. Connexion is made into the office (or to the underground system, as is often the case) from the aerial wire by means of a copper conductor, insulated with gutta-percha, which passes through a "leading in" cup, whereby leakage is prevented between the wire and the pole. The insulators are planted on creosoted oak arms, 2½ in. sq. and varying in length from 24 to 48 ins., the 24 and 33 in. arms taking two, and the 48 in. four, insulators. The unequal lengths of the 24 and 33 in. arms are adopted for the purpose of allowing one wire to fall clear of that beneath it, in the case of an insulator breaking or the securing binder giving way. The poles are of red fir, creosoted, this method of preservation being the only one now used for this purpose in the United Kingdom. The number of poles varies from about 15 to 22 per m. of line; they are planted to a depth of from 2 to 4 ft. in the ground. For protection from lightning each pole has an "earth wire" running from the top, down to the base.

Gutta-percha-covered copper wires were formerly largely used for the purpose of underground lines, the copper conductor weighing 40 lb per statute mile, and the gutta-percha covering 50 lb (90 lb total). The introduction of "paper" cables, i.e., copper wires insulated with carefully dried paper of a special quality, has practically entirely superseded the use of wires insulated with gutta-percha. The paper cables consist of a number of wires, each enclosed in a loose covering of well-dried paper, and loosely laid up together with a slight spiral "lay" in a bundle, the whole being enclosed in a stout lead pipe. It is essential that the paper covering be loose, so as to ensure that each wire is enclosed in a coating not of paper only, but also of air; the wires in fact are really insulated from each other by the dry air. To ensure paper acting merely as a separator to prevent them from coming into contact. The great advantage of this air insulation is that the electrostatic capacity of the wires is low (about one-third of that which would be obtained with gutta-percha insulation), which is of the utmost importance for high-speed working or for long-distance telephonic communication. As many as 1200 wires are sometimes enclosed in one lead pipe.

Between London and Birmingham a paper cable 116 m long and consisting of 72 copper conductors, each weighing 150 lb per statute mile, was laid in 1900. The conductors are enclosed in a lead pipe, 2½ in. in outside diameter and 1 in. thick, which itself is enclosed in cast iron spiral-ended pipes, 3 in. in internal diameter, and buried 2 ft. below the surface of the roadway. At intervals of 2 m. "test pillars" are placed for the purpose of enabling possible faults to be accurately located. Each conductor has a resistance (at 60° F.) of 5.74 ohms per statute mile, and an average electrostatic capacity per mile between adjacent wires of 0.060 microfarad; or between wire and earth of 0.1 microfarad; the insulation resistance of each wire is about 5000 megohms per mile. The underground system of paper cables has been very largely extended. Cables between London, Glasgow, Dublin, Liverpool, Leeds, Bristol, Exeter and other important towns have been laid, and eventually telephonic communication between every important town in the United Kingdom will be rendered safe from interruptions caused by gales or snowstorms.

The one disadvantage of paper cables is the fact that any injury to the lead covering which allows moisture to penetrate causes telephonic interruption to the whole of the enclosed wires, whereas if the wires are each individually coated with gutta-percha, the presence of moisture can only affect those wires whose covering is defective. There is no reason for doubting, however, that, provided the lead covering remains intact, the paper insulation is imperishable; this is not the case with gutta-percha-covered cables.

In order to maintain a system of telegraph lines in good working condition, daily tests are essential. In the British Postal Telegraph Department all the most important wires are tested every morning between 7.30 and 7.45 A.M., in sections of about 200 miles. The method adopted consists in looping the wires in pairs between two testing offices, A and B (fig. 4); a current is sent from a battery, $E$, through one coil of a galvanometer, $g$, through a high resistance, $r$, through one of the wires, $1$, and thence back from office B (at which the wires are looped), through wire 2, through another high resistance, $r'$, through a second coil on the galvanometer, $g$, and thence to earth. If the looped lines are both in good condition and free from leakage, the current sent out on line 1 will be exactly equal to the current received back on line 2; and as these currents will have equal but opposite effects on the galvanometer needle, no deflection of the latter will be produced. If, however, there is leakage, the current received on the galvanometer will be less than the current sent out, and the result will be a deflection of the needle proportional to the amount of leakage.

The galvanometer being so adjusted that a current of definite strength through one of the coils gives a definite deflection of the needle, the amount of leakage expressed in terms of the insulation resistance of the wire is given by the formula:

$$ \text{Total insulation resistance of looped lines} = \frac{R(D/d - 1)}{}; $$

in which $R$ is the total resistance of the looped wires, including the resistance of the two coils of the galvanometer, of the battery, and of the two resistance coils $r$ and $r'$. (Inserted for the purpose of causing the leakage on the lines to have a maximum effect on the galvanometer deflections.) In practice the resistances $r$, $r'$ are...
of 10,000 ohms each. The deflection observed on the galvanometer when the lines are leaky is \( d \), while \( D \) is the deflection observed through only one coil of the galvanometer with all the other resistances in circuit; and assuming that no leakage exists on the lines, this deflection is calculated from the "constant" of the instrument, \( i.e. \), from the known deflection obtained with a definite current. For the purpose of avoiding calculation, tables are provided showing the values of the total insulation according to the formula, corresponding to various values of \( d \). If the insulation per mile, \( i.e. \), the amount of insulation multiplied by the mileage of the wire loop, is found to be less than 200,000 ohms, the wire is considered to be faulty. The climatic conditions in the British Islands are such that it is not possible to maintain, in unfavourable weather, a higher atmosphere than that named, which is the insulation obtained when all the insulators are in perfect condition and only the normal leakage, due to moisture, is present.

There are three kinds of primary batteries in general use in the British Postal Telegraph Department, viz., the Daniell, the bichromate, and the Leclanché. The Daniell type consists of a teak trough divided into five cells by slate partitions coated with marine glue. Each cell contains a zinc plate, immersed in a solution of zinc sulphate, and also a porous chamber containing crystals of copper sulphate and a copper plate. The electromotive force of each cell is 1.07 volts and the resistance 3 ohms. The Fuller bichromate battery consists of an outer jar containing a solution of bichromate of potash and sulphuric acid, in which a plate of hard carbon is immersed; in the jar there is also a porous pot containing dilute sulphuric acid and a small quantity (2 oz.) of mercury, in which stands a stout zinc rod. The electromotive force of each cell is 1.05 volts, and the resistance 4 ohms.

The Leclanché is of the ordinary type, and each cell has an electromotive force of 1.64 volts and a resistance of 3 to 5 ohms (according to the size of the complete cell, of which there are three sizes in use). Dry cells, \( i.e. \), cells containing no free liquid, but a chemical paste, are also largely employed; they have the advantage of great portability.

Primary batteries have, in the case of all large offices, been displaced by accumulators. The force of the set of accumulators provided is such as to give sufficient power for the longest circuit to be worked. The shorter circuits being brought up approximately to a level, as regards resistance, by the insertion of resistance coils in the circuit of the transmitting apparatus of each shorter line. A spare set of accumulators is provided for every group of instruments in case of the failure of the working set. For working "double current," two sets of accumulators are provided, one set to send the positive and the other set the negative currents; that is to say, when, for example, a double current Morse key is pressed down it sends, say, a positive current from one set, but when it is allowed to rise to its normal position then a negative current is sent out, and the resistance of the second set of accumulators is increased.

It is not possible to work double current from one set alone, as in this case, if one key of a group of instruments is up and another is down, the battery would be short-circuited and no current would flow to line. The size of the accumulators employed varies from a cell capable of an output of 8 ampere-hours, to a size giving 750 ampere-hours.

**Submarine Cables.**—A submarine cable (figs. 5-7), as usually manufactured, consists of a core, a in the centre of which is a strand of copper wires varying in weight for different cables between 70 and 650 lb to the nautical mile. The stranded form was suggested by W. Thomson (Lord Kelvin) at a meeting of the Philosophical Society of Glasgow in 1854, because its greater flexibility renders it less likely to damage the insulating envelope during the manipulation of the cable. The central conductor is covered with several continuous coatings of gutta-percha, the total weight of which varies between 70 and 650 lb to the mile. Theoretically for a given outside diameter of core the greatest speed of signalling through a cable is obtained when the diameter of the conductor is \( \frac{606}{t + 4} \), the diameter of the core, but this ratio makes the thickness of the gutta-percha covering insufficient for mechanical strength. Owing to the high price of gutta-percha the tendency, of recent years, has been to approximate more closely to the theoretical dimensions, and a thickness of insulating material which formerly would have been considered quite insufficient is now generally adopted with complete success. Of two transatlantic cables laid in 1854, the core of one consisted of 300 lb copper and 320 lb gutta-percha per mile, and that of the other of 650 lb copper and 500 lb gutta-percha; whereas for the similarly situated cable laid in 1866 the figures were 300 lb copper and 400 lb gutta-percha. The core is served with a thick coating of wet jute, yarn or hemp (\( h \)), forming a soft bed for the sheath, and, to secure immunity from the ravages of submarine boring animals, \( e.g. \), *Teredo navalis*, it has been found necessary, for depths not exceeding 300 fathoms, to protect the core with a thin layer of brass tape. The deep sea portion is sheathed with galvanized iron or steel wires (in the latter case offering a breaking strain of over 80 tons per sq. in., with an elongation of at least 5 per cent.), the separate wires being first covered with a firm coating of tape and Chatterton's compound (a mixture of gutta-percha, rosin and Stockholm tar). Sometimes the wires are covered with the compound alone, and the whole cable after being sheathed is finally covered with tinned tape. The weight of the iron sheath varies greatly according to the depth of the water, the nature of the sea bottom, the prevalence of currents, and so on. Fig. 5 shows the intermediate type again sheathed with a heavy armour to resist wear in the shallow water near shore. In many cases a still heavier type is used for the first mile or two from shore, and several intermediate types are often introduced, tapering gradually to the thin deep-water type.

The cost of the cable before laying depends on the dimensions of its core, the gutta-percha, which still forms the only trustworthy insulator known, constituting the principal item of the expense; for an Atlantic cable of the most approved construction the cost may be taken at \( £250 \) to \( £300 \) per nautical mile.

In manufacturing a cable (fig. 8) the copper strand is passed through a vessel \( A \) containing melted Chatterton's compound, then through the cylinder \( C \), in which a quantity of gutta-percha, purified by repeated washing in hot water, by mastication, and by filtering through wire-gauze filters, is kept warm by a steam-jacket. As the wire is pulled through, a coating of gutta-percha, the thickness of which is regulated by the die \( D \), is pressed out of the cylinder by applying the requisite pressure.
to the piston P. The newly coated wire is passed through a long trough T, containing cold water, until it is sufficiently cold to allow it to be safely wound on a bobbin B. This operation is repeated, the wire being passed through the troughs from the bobbin to the bottom of the trough, and from the bottom of the trough to the bobbin, at the same time carefully examined for air-holes or other flaws, all of which are eliminated. The coated wire is treated in the same way as the copper strand—the die D, or another of the same size, being placed at the back of the cylinder and a larger one substituted at the front. A second coating is then laid on, and after it passes through a similar process of examination a third coating is applied and so on until the requisite number of layers has been completed. The finished core clings rapidly to its electrical qualities at first, and is generally kept for a stated interval of time before being subjected to the specified tests. It is then placed in a tank of water and kept at a certain frictional resistance, say 50°F., until it has reached a sufficiently uniform temperature by means of water. When the core is thus hardened, it is placed in a tank in a vertical position, with the bottom of the tank at the level of the water-stranded core. The core is then immersed in water, and the temperature is raised to 65°F., and held at this temperature for a stated time. The core is then removed and allowed to cool to room temperature, and the resistance and its electrostatic capacity are then measured. These tests are in some cases repeated at a different temperature, say 50°F., for the purpose of obtaining at the same time greater certainty of the soundness of the core and the rate of variation of the conductor and core temperature. The test specimen of the core to a hydrometric pressure of four tons to the square inch and an electric pressure of 5000 volts from an alternating-current transformer has been adopted, by one manufacturer at least, to secure the detection of mixed faults which might develop themselves after submersion. Should these tests prove satisfactory the core is served with jute yarn, coated in water-tight tanks, and surrounded with salt water. The insulation is again tested, and if no fault is discovered the served core is passed through the sheathing machine and the iron sheath and the outer covering are laid on. As the cable is sheathed it is stored in large water-tight tanks and kept at a uniformly uniform temperature by means of water.

When the cable is to be laid it is transferred to a cable ship, provided with water-tight tanks similar to those used in the factory for storing it. The tanks are nearly cylindrical in form and have a truncated cone fixed in the center, as shown at C, Fig. 9. The cable is carefully coiled into the tanks in horizontal flanges, each of which is begun at the outside of the tank and coiled towards the centre. The different coils are prevented from adhering by a coating of white-wash, and the end of each nautical mile is carefully marked for future reference. After the cable has been again subjected to the proper electrical tests and found to be in perfect condition, the ship is taken to the place where the shore end is to be landed. A sufficient length of cable to reach the shore or the cable-house is paid overboard and coiled on a raft or rafts, or on the deck of a steam-launch, in order to be connected with the shore. The end is then taken into the testing room in the cable-house and the conductor connected with the testing instrument, and the electrical tests are continued. The ship is then put on the proper course and steams slowly ahead, paying out the cable over her stern. The cable must not be overstrained in the process of submersion, and must be paid out at the proper rate to give the requisite slack. This involves the introduction of machinery for measuring and controlling the speed at which it leaves the ship and for measuring the pull on the cable. The several parts of this apparatus are shown in Fig. 10. The lower end e of the cable in the tank T is taken to the testing room, so that continuous tests for electrical condition can be made. The upper end is passed over a guiding quadrant Q to a set of wheels or rollers on the drum R, from which it passes through the dip pulley D, and finally to the stern pulley, over which it passes into the sea. The wheels 1, 2, 3, ... are arranged so that 2, 4, 6, ... can be raised or lowered as to give the cable less or more hold as it passes between them, while 1, 3, 5, ... are furnished with brakes. The whole system provides the means of giving sufficient back-pull to the cable to make it grip the drum R, round which it passes several times to prevent slipping. On the same shaft with R is fixed a brake-wheel furnished with a powerful brake B, by the proper manipulation of which the speed of paying out is regulated, the pull on the cable being at the same time observed by means of D. The shaft of B can be readily put in gear with a powerful engine for the purpose of hauling back the cable should it be found necessary to do so. The length paid out and the rate of paying out are obtained approximately from the number of turns made by the drum P and its rate of turning. This is obtained by the mile marks, the known position of the joints, &c. The speed of the ship is obtained from the speed of the engines; it is more accurately obtained by one or other of the various forms of log, or it may be measured by paying out continuously a steel wire over a measuring wheel. The average speed is obtained by connecting together the various observations for the position of the ship. The difference between the speed of the ship and the rate of paying out gives the amount of slack. The amount of slack is thus regulated to be between one and three per cent., but some is always allowed, so that the cable may easily adapt itself to inequalities of the bottom and may be more readily lifted for repairs. But the mere paying out of sufficient slack is not a guarantee that the cable will always lie closely along the bottom or be free from spans. Whilst it is being paid out the portion between the surface of the water and the bottom of the sea lies along a straight line, the component of the weight at right angles to its length being balanced by the buoyancy of the cable in the water. The angle of the wire is given by the frictional resistance to sinking in the water. If, then, the speed of the ship be v, the rate of paying out u, the angle of immersion i, the depth of the water h, the weight per unit length of the cable w, the pull on the cable at the surface P, and A, B constants, we have:

$$P = h - w \left(\alpha - \cos \theta\right)$$

$$w \cos i = B \left(\sin \theta\right)$$

where \(\theta\) stands for "function." The factors \(A (u - \cos i)\) and \(B (\sin \theta)\) give the frictional resistance to sinking, per unit length of the cable, in the direction of the cable length respectively. It is evident from equation (9) that the angle of immersion depends solely on the speed of the ship; hence in laying a cable on an irregular bottom it is of great importance that the speed should be sufficiently low. This may be illustrated very simply as follows: suppose a a (Fig. 10) to be the surface of the sea, b c the bottom, and c c the straight line made by the cable; and suppose that H, which is the end of the cable, is passed over, the cable touches it at some point t before it touches the part immediately below t, and if the friction between the cable and the ground is sufficient the cable will either break or be left in a long span ready to break at some future time. It is important to observe that the risk is in no way obviated by the increasing slack paid out, except in so far as the amount of sliding which the strength of the cable is able to produce at the points of contact with the ground may thereby increased. The speed of the ship must therefore be so regulated that the friction of the cable against the ground is as great as the inclination of the steepest slope passed over. In ordinary circumstances the angle of immersion i varies between 1° and 2°.

The "slack indicator" of Messrs Siemens Brothers & Co. yields a continuous indication and record of the actual slack paid out. It consists of a long screw spindle, coupled by suitable gearing with the cable drum, and thus rotating at the speed of the outgoing cable; on this screw works a nut which forms the centre of a thin circular disk, the edge of which is pressed against the surface of a right circular cone, the line of contact, as the nut moves along the screw, being parallel to the axis of the latter. This cone is driven by gearing from the wire drum, so that the rate of rotation of the diaphragm of the outgoing wire, the direction of rotation being such as to cause the nut to travel towards the smaller end of the cone. If both...

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by the disk, for any difference in speed between nut and screw will cause the nut to move along the screw until the diameter of the cone is reached which fulfills the condition of equality in speed. In fig. 11 the edge of the disk serves as the pointer and the scale gives the percentage of slack, or \((N-n)/n\). The wire being paid out without slack measures the actual distance and speed over the bottom will be found if the original fregure is being on land or the heaving in of cable will continue until the end comes on board. Another buoy is then lowered to mark this spot, and the cable on either side of the line is spliced for the purpose, as this is not the actual line of the cable. Grappling will be recommended so as to hook the cable near enough to the end to allow of its being hove to the surface. When this has been done an electrical test is made of the connexion, and, if found perfect, the cable is weighed down and the vessel is made fast and, if communication is found perfect with the shore, buoyed with sufficient chain and rope attached to allow of the cable being towed to the bottom. The ship now returns to the position of the buoys, and a proper length of cable is paid out, a mark being placed on it which gives the point of projection. As to cost, one transatlantic cable repair cost \(\$75,000\); the repair of the Aden-Bombay cable, broken in a depth of 190 fathoms, was effected with the expenditure of 176 miles of new cable, and this operation was completed in 11 years. The cost of a repair for the remainder of the time was interrupted by the monsoon; a repair of the Lisbon-Portsmouth cable, broken in the Bay of Biscay at a depth of 130 fathoms, was completed in 215 days, with an expenditure of 300 miles of cable. All interruptions are not so costly, for in shallower waters, with favourable conditions of weather, a repair may be only a matter of a few hours, and, if such waters are nearly always open, a large reserve fund must be laid aside for this purpose. As an ordinary instance, it has been stated that the cost of repairing the Direct United States cable up to 1900 from its submergence in 1858 averaged \(\$800\) per annum. All the cables, however, possess their own steamers, of sufficient dimensions and specially equipped for making ordinary repairs; but for exceptional cases, where a considerable quantity of new cable may have to be inserted, it is sometimes necessary to charter the services of one of the larger vessels owned by a cable-manufacturing company, at a certain sum per day, which may well reach \$200 to \$300. This fleet of cables now number ranging in size from vessels of 300 tons to 10,000 tons carrying capacity.

The life of a cable is usually considered to continue until it is no longer capable of being lifted for repair, but in some cases the duration and frequency of interruptions is so abnormally large as to render repair inadvisable and the public inconvenience, with the loss of revenue and cost of repairs, must together decide the question of either making very extensive renewals or even abandoning the whole cable. The order result in a rupture by so many circumstances determining the environment of the cable, that not even an approximate term of years has yet been authoritatively fixed. It is a well-ascertained fact that the insulator, gutta-percha, is, when kept under water, practically imperishable, so that it is only the original strength of the sheathing wires and the deterioration allowable in them which have to be considered. Cables have frequently been picked up after many years and the sheathing and other materials are in perfect condition. In this respect, while in other cases ends have been picked up which in the course of twelve years had been corroded to needle points, the result probably of metallic losses in the locality. A cable may also be repaired by removing the sheathing for several miles apart, to obtain more than a general idea as to the average depth along the route, while the nature of the constituents of the sea bed can only be revealed by a few small specimens brought up at isolated spots, though fortunately the globigerine ooze which covers the bottom at all the greater ocean depths forms an ideal bed for the cable. The experience gained in the earlier days of telegraphy, from 1850 to 1865, shows that 10 to 20 per cent. of the deep-sea cables within the first twelve years, placed the probable life of a cable as low as fifteen years, but the weeding out of unserviceable types of construction, and the general improvements in materials and technique, have so much increased the life, that an estimate, until now the limit may be safely placed at not less than forty years. In depths beyond the reach of wave motion, and apart from suspension across promontories, the most frequent cause of interruption is seismic or other shifting of the ocean bed, while in shallower waters and near the shore the dragging of anchors or
fishing trawls has been mostly responsible. Since by international agreement the willful damage of a cable has been constituted a criminal offence, and the cable companies have avoided crossing the fishing banks, or have adopted the wise policy at other the value of anchors lost on their cables, the number of such fractures has greatly diminished.

**Instruments for Land Telegraphy.**—At small country towns or villages, where the message traffic is light, the Wheatstone "A B C" instrument is used. In this apparatus electric currents are generated by turning a handle (placed in front of the instrument), which is geared, in the instrumentmost constant pattern, to Siemens shuttle armature placed between the two arms of a powerful horse shoe permanent magnet. When one of a series of keys (each corresponding to a letter) arranged round a pointer is depressed, the motion of the pointer, which is geared to the shuttle armature, is arrested on coming opposite that particular key, and the transmission of the currents to line is stopped, though the armature itself can continue to rotate. The depression of a second key causes the first key to be raised. The currents actuate a ratchet-wheel mechanism at the receiving station, where a small dial is moved on letter by letter. A noticeable feature in the modern A B C indicator, as well as in all modern forms of telegraph instruments, is the adoption of "induced" magnets in the moving portion of the apparatus. A small permanent magnet is always liable to become demagnetized, or have its polarity reversed by the action of lightning. This liability is overcome by making such movable parts as require to be magnetic of soft iron, and magnetizing them by the inducing action of a strong permanent magnet. Although formerly in very extensive employment, this instrument is dropping out of use and the "sounder" (and in many cases the telephone) is being used in its place.

At offices where the work is heavier than can be dealt with by the A B C apparatus, the "Single Needle" instrument has been very largely employed; it has the advantage of slight liability to derangement, and of requiring very little adjustment. A fairly skilled operator can signal with it at the rate of 20 words per minute. The needle (in the modern pattern) is of soft iron, and is kept magnetized inductively by the action of two permanent steel magnets. The coils are wound with copper wire (covered with silk), 10 mils in diameter, to a total resistance of 200 ohms. The actual current required to work the instrument is 3-3 milliamperes (equivalent approximately to the current given by 1 Daniell cell through 3,300 ohms), but in practice 10 milliamperes is allowed. A simple, but important, addition to enable the reader from the instrument to be affected by sound is shown in fig. 13; in this arrangement the needle strikes against small tubes formed of tin-plate. Although a most serviceable instrument and cheap as regards maintenance, the "single needle" has (except for use in telegraph purveying) been discarded in favour of the "sounder," to secure the advantage of using one general pattern of apparatus, as far as possible, and to avoid the necessity of two different types of instrument being learnt by the telegraphist.

The well-known code of signals (fig. 14) introduced by Morse is still employed in the United States and Canada, and the international code in vogue in Europe differs only slightly from it. The instruments used for land telegraphs on this system are of two types—"sounders," which indicate by sound, and "recorders," which record the signals.

Recorders vary in details of construction, but all have the same object, namely, to record the intervals during which the current is applied to the line. In the earlier forms of instrument the record was made by embossing lines on a ribbon of paper by means of a sharp stylus fixed on the end of a lever, which carried at its end the armature of an electromagnet. The form of Morse recorder almost universally used in Europe makes the record in ink, and hence is sometimes called the "ink writer." This method has the advantage of distinctness, and so is less trying to the eyes of the operators. Although the "ink writer" is still in use it is practically an obsolete instrument, and has been displaced by the "sounder.

Operators who used the recorder soon learned to read the message by the click of the armature against its stop, and as this left the hands and eyes free to write, reading by sound was usually preferred. Thus, when it is not necessary to keep a copy, a much simpler instrument may be employed and the message read by sound. The earliest successful form was "Bright's bell" sounder, which consisted of two bells of distinct tone or pitch, one of which was sounded when the current was sent in one direction and the other when it was reversed. This instrument was capable of giving very considerable speed, but it was more complicated than that now in use, which consists only of an electromagnet, with its armature lever arranged to stop against an anvil or screw in such a way as to give a distinct and somewhat loud sound. Dots and dashes are distinguished by the interval between the sounds of the instrument in precisely the same way as they are distinguished when reading from the recorder by sound. Fig. 15 shows the modern pattern of "sounder" as used by the British Post Office. The magnet is wound to a resistance of 40 ohms (or 900 ohms when worked from accumulators), and the instrument is worked with a current of 400 milliamperes (25 milliamperes with accumulators).

**Methods of Working Land Circuits.**—The arrangement on the "open-circuit" system for single-current working is shown in fig. 16, in which L1 represents the line, G a galvanometer, used simply to show that the currents are going to line when the message is being transmitted, K the transmitting key, B the battery, I the receiving instrument, and E the earth-plate. The complete circuit is from the plate E through the instrument I, the key K, and the galvanoscope G to the line L1, then through the corresponding instruments to the earth-plate E at the other end, and back through the earth to the plate E. The earth is always, except for some special reason used as a return, because it offers little resistance and saves the expense and the risk of failure of the return wire. The earth-plate E ought to be buried in moist earth or in water. In towns the water and gas pipe systems form excellent earth.
plates. It will be observed that the circuit is not in this case actually open; the meaning of the expression "open circuit" is "no battery to line." In normal circumstances the instruments at both ends are ready to receive, both ends of the line being to earth through the receiving instruments. A signal is sent by pressing the key K, and so changing the contact from a to b, and thus putting the battery to line. On circuits where the traffic is small it is usual to make one wire serve several stations. At an intermediate wayside station W, a "switch" S, consisting of three blocks of brass fixed to an iron base, is sometimes used (not in Great Britain). W may be made the terminal station of L by inserting plug 3, and of L2 by inserting plug 2, or the instruments may be cut out of circuit by inserting plug 1. In ordinary circumstances the messages from all stations are sent through one line, and thus the operator at any station may transmit, if the line is free, by manipulating his key.

The connexions for single-current working on the "closed-circuit" system are shown in fig. 17. There are three forms of a closed circuit, and the choice of which to adopt is determined precisely as in open circuit sending. This system is more expensive than the open-circuit system, as the battery is always at work; but it offers some advantages on circuits where there are a number of intermediate stations, as the circuit is under a constant electromotive force and has the same resistance no matter which station is sending or receiving. The arrangement at a wayside station is shown at W. When the circuit is long and contains a large number of stations, the sending battery is sometimes divided among them in order to give greater uniformity of current along the line. When only one battery is used the current may be considerably affected by the leakage to earth along the line. If long circuits were worked direct with ordinary instruments, high battery power would be required in order to send sufficient current to actuate the receiving apparatus; in such cases it is usual to employ a local battery to produce the signals, and close the local battery circuit by means of a circuit-closing apparatus called a relay, which is practically an electromagnetic instrument. In such a relay the armature is fixed to the armature of the magnet and which can be worked by a very weak current. The arrangement at a station worked by relay on the "single-current" system is shown in fig. 18, where L is the line wire, joined through the key K to one end of the coil of the relay magnet R, the other end of which is put to earth. When a current passes through R, the armature A is attracted and the local circuit is closed through the switch at b. The local battery B then sends a current through the instrument I and reveals the signal. In the form of relay indicated in the figure the armature is held against the stop o by a spring s.

"Single-current" working by means of a non-polarized relay (fig. 18), although general in America, is not adopted in England. In the latter country, when such working is resorted to, a "polarized relay" (fig. 19) is used, and on all important lines worked by ordinary single current, a "polarized relay" system is employed. In this the tongue of the relay is kept over to the spacing side by means of a current flowing in one direction, but on the depression of the signalling key the current is reversed, moving the relay tongue over to the marking side.

The Siemens polarized relay, shown in fig. 19, consists of an armature a, pivoted at one end a in a slot at one end N of a permanent magnet m, the other pole s of which is fixed to the yoke y of a horse-shoe electromagnet M. The armature is placed between the poles of the electromagnet and is magnetized by the magnet m. It will oscillate to the right or left under the action of the poles of the electromagnet M according as the current passes through M in one direction or the other. This form of relay is largely used in Great Britain; it has been entirely displaced by the form shown in fig. 20, which is the most modern pattern of relay used by the British Post Office, known as the "Post Office Standard Relay." In this instrument there are two soft iron tongues, n, s, fixed upon and at right angles to an axle a, which works on pivots at its ends. These tongues are magnetized by the induction of a strong horseshoe electromagnet, S, N, which is made in a curved shape for the sake of compactness. The tongue plays between the poles of two straight electromagnets. The coils of the electromagnets are differentially wound with silk-covered wire, 4 mils (= 0.002 inch) in diameter, to a total resistance of 400 ohms. This differential winding enables the instrument to be used for "duplex" working, but the connexions of the wires to the terminal screws are such that the relay can be used for ordinary single working. Although the relay is a "polarized" one, so that it can be used for "double-current" working, it is equally suitable for "single-current" purposes, as the tongue can be given a bias over to the "spacing" side, i.e. to

![Diagram](https://example.com/diagram.png)

**Fig. 16.—Open Circuit, Single-current System.**

**Fig. 17.—Closed Circuit, Single-current System.**

**Fig. 18.—Single-current Relay Working.**

**Fig. 19.—Siemens Polarized Relay.**

**Fig. 20.—Post Office Standard Relay.**

**Fig. 21.—Connexions for Double-current Working.**
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[DUPLEX TELEGRAPH]

indicating whether a station is calling, in case the relay sticks or is out of adjustment. The key K (shown in general plan), when worked, sends reversed currents from the battery B. In cases where "universal battery" working, i.e., the working of several instruments from one set of batteries or accumulators, is adopted, the positive and negative currents have to be sent from independent batteries, as shown by fig. 22. The stop a of the key K is connected through a switch S with one pole of the battery B, and the stop b in the usual way with the other pole. Suppose the arm c of the switch S to be in contact with 2; then when the key is manipulated it sends alternately positive and negative currents into the line. If the positive is called the signalling current, the line will be charged positively each time a signal is sent; but as soon as the signal is completed a negative charge is communicated to the line, thus hastening the discharge and the return of the relay tongue to its insulated stop.

When a local instrument such as a sounder (fig. 15) is worked from a relay, the drying away of the magnetism in the iron cores of the electromagnet, when the relay tongue moves from the marking to the spacing side, i.e., when the local battery is cut off, sets up an induced current of high tension, which causes a spark to jump across the contact points of the relay, and by oxidizing them makes it necessary for them to be frequently cleaned. In order to avoid this sparking, every local instrument in the British Postal Telegraph Department has a "spark" coil connected across the terminals of the electromagnet. The spark coil has a resistance about ten times as great as that of the electromagnet it shunts, and the wire of which it is composed is double wound so as to have no retarding effect on the induced current, which circulates through the spark coil instead of jumping in the form of a spark across the contact points. The device is a most effectual one.

On long circuits worked by the Wheatstone fast-speed apparatus, and especially on those in which a submarine cable is included, it is found necessary to introduce "repeaters" half-way, in order to enable a high speed to be maintained. The speed at which a circuit can be worked depends upon what is known as the "KR" of the line, i.e., the product of the total capacity and the total resistance, both the capacity and the resistance having a retarding effect on the signals. By dividing a line into sections or "repeaters," the working speed will be dependent upon the KR of the longest half, and as both K and R are directly proportional to the length of the line, the KR product for the half of a circuit is but one quarter that of the whole length of the circuit, and the retardation is correspondingly small. Thus the speed on a line at which the repeater is situated exactly midway will be four times that of the line worked direct. Repeaters (or translators, as they are sometimes termed) are in Great Britain only used on fast-speed circuits; they are in no case found necessary on circuits worked by hand, or at "key speed" as it is called.

Duplex telegraphy consists in the simultaneous transmission of two messages, one in each direction, over the same wire. Duplex telegraphy. The solution of this problem was attempted by J. W. Gintel of Vienna in 1835 and in the following year by Frischen and by Siemens and Halske. Within a few years several methods had been proposed by different inventors, but none was at first very successful, not from any fault in the principle, but because the effect of electrostatic capacity of the line was left out of account in the early arrangements. The first to introduce a really good practical system of duplex telegraphy, in which this difficulty was sufficiently overcome for land line purposes, was J. B. Stearns of Boston (Mass.). In order that the line between two stations may be worked on the duplex system it is essential that the receiving instrument shall not be acted on by the outgoing currents, but shall respond to incoming currents. The two methods most commonly employed are the differential and bridge methods.

In fig. 23, representing the "differential" method, B is the sending battery, R a rheostat and C an adjustable condenser. Suppose the key to be depressed, then a current flows through one winding of the differential relay and through the other winding and rheostat to earth. Now if the values of the rheostat and condenser are adjusted so as to make the rise and fall of the outgoing current through both windings of the relay exactly equal, then no effect is produced on the armature of the relay, as the two currents neutralize each other's magnetizing effect.

Incoming currents pass from line through one coil of the relay, the key, and either the battery or battery resistance, according as whether the key is raised or depressed. The result is that the armature of the relay is attracted, and currents are sent through the sounder from the local battery, producing the signals from the distant station. When the key is in the middle position, that is, not making connexion with either the front or back contacts, the received currents pass through both coils of the relay and the rheostat; no interference is, however, felt from this extra resistance because, although the current is halved, it has double the effect on the relay, because it passes through two coils instead of one.

![Fig. 22.—Universal Battery Working.](image)

In the "bridge" method (fig. 24), instead of sending the currents through the two coils of a differentially wound relay or receiving instrument as in Frischen's method, two resistances a and b are inserted, and the receiving instrument is joined between P and Q. The currents thus divide at the point D, and it is clear that if the difference of potential between P and Q is unaffected by closing the sending key, then no change of current will take place in the instrument circuit. The relative potential of P and Q is not affected by the manipulation of the sending key if the resistance of a bears the same proportion to that of b as the resistance of the line does to that of the resistance R; hence that is the arrangement used. One very great advantage in this method is that the instrument used between P and Q may be of any ordinary form, i.e., relay, Hughes, siphon recorder, etc.

Most important cables, such as those of the Eastern Telegraph Company and the various Atlantic cables, are worked duplex on Mr. Head's plan. What may be called a mechanical method of duplexing a cable was described by Lord Kelvin in a patent taken out by him in 1858. In this, as in the ordinary methods, a differentially wound receiving instrument was used, one coil being connected with the cable and the other with the earth; but it differed from other methods in requiring no "artificial" or balancing cable. The compensation was to be obtained by working a slide resistance included in the circuit of the compensating coil, either by the sending key or by clockwork released by the key, so as to vary the resistance in that.
circuit according to any law which might be required to prevent the receiving instrument being affected by the outgoing current. Four years later Varley patented his artificial cable, which was the first near approach to a successful solution of the duplex problem on the submarine line. It was not, however, a sufficiently perfect representation of a laid cable to serve for duplexing cables of more than a few hundred miles in length. By a modification of the bridge method, applied with excellent results by Dr. Murchie for submarine work, condensers are substituted for $a$ and $b$, one being also placed in the circuit between $P$ and $Q$. In this case no current flows from the battery through the line or instruments, the whole action being inductive. As we have already stated, the distribution of the capacity along the resistance $R$ must in submarine cable work be made to correspond very accurately with the distribution of the capacity along the resistance of the cable. This is accomplished by Dr. Murchie in the following manner: In the manner of a sheet of paraffined paper is covered with a sheet of conducting substance, say tinfoil, and over the other side narrow strips of the same substance are arranged gridironwise to form a continuous circuit along the cable, the thickness of the strip conductor and the thickness of the paraffined paper are adjusted so that the relative resistance and capacity of this arrangement are the same as those of the cable with which it is intended to be used. A large number of such sheets are prepared and placed together, one over the other, the end of the strip of the first sheet being connected with the beginning of the strip of the second, and so on to the last sheet, by means of the strip conductor. In this manner, the resistance of the whole system of conducting sheets is in parallel with the resistance of the strip conductor along the cable, the capacity of this parallel circuit being equal to that of the strip conductor. Thus in a given case the parallel circuit with the resistance of the strip conductor increased $n$ times can be represented by a parallel circuit with the capacity of that conductor increased $n$ times. If one of these conductors is connected to the earth at one end and the other of them is connected to the earth at the other, and if the capacity of the strip conductor is connected to the earth at the other end, the whole arrangement will be of the same resistance as that of the cable under consideration, the capacity being, however, very much increased.

Quadruplex telegraphy consists in the simultaneous transmission of two messages from each end of the line. The only new problem introduced is the simultaneous transmission of two messages in the same direction; this is sometimes called "duplex transmission." The solution of this problem was attempted by Dr. F. B. Stark of Vienna in 1855, and during the next ten years it was worked on by Bosscha, Kramer, Maron, Schaak, Schroeder, Wartmann and others. The first to attain practical success was Edison, and his method with some modifications is still the one in most general use.

The arrangement is shown in fig. 25, and indicates the general principle of the transmitting apparatus. The telegraph key $K_1$ and the relay $R_1$ are for the former reverses the direction of the line current, the latter increases the strength of the transmitted current, by joining another battery when the key is depressed. $R_2$ and $R_3$ are relays for receiving the currents; the former is polarized and responds to reversals of current, while the latter is a tinfoil relay, $K_2$ being a tinfoil relay. $K_3$ is the increased current from $K_1$ irrespective of the direction of the current. This arrangement can be duplexed in the way already explained, by providing differential relays and arranging for the outgoing currents to divide differentially through the two relays at each end. The "multiplex" system devised by Patrick B. Delany (which was adopted to a limited extent in Great Britain, but has now been abandoned) was based on the principle of connecting the maximum number of instruments simultaneously on one wire. The general principle of the arrangement of the apparatus is shown by fig. 26. Arms $a$ and $b$, one at each station $A$ and $B$, are connected by means of a tinfoil relay, the latter being a relay in the metal segments, $1$, $2$, $3$, $4$, and $1'$, $2'$, $3'$, $4'$, at the two stations, so that when the arm $a$ is on segment $1$ at $A$, then $b$ is on segment $1'$ at $B$, and so on. At each station sets of telegraph apparatus are connected to these metal segments, so that when two relays are kept rotating the set connected to 1 becomes periodically connected to the set connected to 1', the set connected to 2 to the set connected to 2', and so on. In practice the number of segments actually employed is much greater than that shown in fig. 26, and the segments are arranged in a number of groups, as shown by fig. 27, all the segments being connected together, all the segments 2, all the segments 3, and all the segments 4. To each group is connected a set of apparatus; hence during a complete revolution of the arms a pair of instruments (at station $A$ and station $B$) will be in communication four times, and the intervals during which any particular set of instruments at the two stations are not in connection with each other become much smaller than in the case of fig. 26. In practice this subdivision of the segments is so far extended that the intervals of disconnection become extremely small, and each set of apparatus works as if it were alone connected to the line. As many as 162 segments in eight groups are practically used. The arm which moves round over the segments rotates at the rate of three revolutions per second, and is kept in motion by means of an iron toothed wheel, the rim of which is set in close contact with the poles of an electromagnet. Through this pole-magnet pass impulses of current regulated in frequency by a tuning-fork contact breaker; these impulses, acting on the teeth of the iron wheel, make the latter rotate and thus keep it in uniform rotation. If the rates of vibration of the two tuning-forks at the two stations could be maintained precisely the same, the two arms would rotate in synchronism, but as this uniform vibration cannot be exactly preserved for any length of time, a means is provided whereby the rate of vibration of either of the forks can be slowed down, so as to retard the rate of rotation of one or other of the arms, and of his effect is by means of "correcting" segments, of which there are six sets containing three each. Should the rotating arms fail to pass over these correcting segments at their synchronous positions, correcting currents pass to a relay which cuts off momentarily the current actuating the tuning-fork, thereby altering the rate of vibration of the latter until the arms once more run together uniformly. The actual number of sets of apparatus it was possible to work multiplex depended upon the length of the line, for if the latter were long, retardation effects modified the working conditions. Thus between London and Manchester only four sets of apparatus were worked, but between London and Birmingham, a shorter distance, six sets (the maximum for which the system is adapted) were used.

**Chemical Telegraphs.** A method of recording signals in the Morse code, formerly used to a considerable extent, was to use a chemically prepared ribbon of paper. Suppose, for instance, the paper. ribbon to be soaked in a solution of iodide of potassium and a light contact spring made to press continuously on its surface as it is pulled forward by the mechanism. Then, if a current is sent from the spring to the roller through the paper, a brown mark will be made by the spring due to the liberation of iodine. This was the principle of the chemical telegraph proposed by Bain in 1846. Several ingenious applications of his method were proposed and practically worked, as, for example, the copying telegraph of Bakewell and of Cros, by means of which a telegram may be transmitted in the sender's own handwriting; the pantelegraph of Caselli; the autographic telegraphs of Meyer, Lenoir, Sawyer and others; and the autographic typo-telegraph of Bonelli; all forms of the apparatus have, however, fallen into disuse.

**Automatic Telegraphs.** It was found impossible to make the Morse ink writer so sensitive that it could record signals sent over land lines of several hundred miles in length, if the speed of transmission was very much faster than that which could be effected by hand, and this led to the adoption of automatic methods of transmission. One was proposed by Bain as early as 1846, but it did not come into use. That now employed is, however, practically a development of his
TELEGRAPH

WHEATSTONE SYSTEM.

It consists in punching, by means of "a puncher," a series of holes in a strip of paper in such a way that, when the strip is sent through another instrument, called the "transmitter," the holes cause the circuit to be closed at the proper times and for the proper proportionate intervals for the message to be correctly printed by the receiving instrument or recorder.

The most successful apparatus of this kind is that devised by Wheatstone; others were devised by Siemens and Halske, Garnier, Humiston, Siemens, and Little.

In the Wheatstone automatic apparatus three levers are placed side by side, each acting on a set of small punches and on mechanism for feeding the paper forward a step after each operation of the levers. The punches are shown in fig. 28, and the levers are adjusted so that the left-hand one moves a, b, c and punches a row of holes across the paper (group 1 in the figure), the middle one moves b only and punches a centre hole (2 in the figure), while the right-hand one moves a, b, b, and punches four holes (3 and 4 in the figure). The whole of this operation represents a dot and a dash or the letter "a." The side rows of holes only are used for transmitting the message, the centre row being required for feeding forward the paper in the transmitter. The perforation of the paper when done by hand is usually performed by means of small mallets, but at the central telegraph office in London, and at other large offices, the keys are only used for opening air-valves, the actual punching being done by pneumatic pressure. In this way severe thicknesses of paper can be perforated at the same time, which is a great convenience for press work, since copies of the same message have often to be transmitted to several newspapers at the same time.

The mode of using the paper ribbon for the transmission of the message is illustrated in fig. 29. An electric beam B is rocked up and down rapidly by a train of mechanism, and moves the crank, and then a positive current is sent to the line, the effect of the current continuing during the time required for the paper to travel the space between two holes. Again, suppose groups 3 and 4 to be punched. Then there will be, as before, a half stroke of the beam M will not pass through, as there is no hole in the paper; but at the third half stroke it passes through and copper is put to the line. Thus for a dash the interval of time between two positive currents will be as the interval the paper takes to travel over twice the space between two successive holes. Hence for sending both a dot and a dash, reverse currents of short duration are sent through the line, but the interval of the reversal is three times as great for the dash as for the dot.

In the receiving instrument the electromagnet is constructed in practically similar fashion, and if pulled into any position by either current, remains in that position, whether the current continues to flow or not, until a reverse current is made to act on the magnet. For the dot the armature is deflected by the first current, the inking-wheel being brought into contact with the paper and after a short interval pulled back by the reverse current. In the case of the dash, the inking-wheel is brought into contact with the paper by the first current as before, and is pulled by the reverse current after three times the interval.

The armature acts on an inking disk on the principle described above, save only that the disk is supplied with ink from a groove in the inking-wheel, on which it rests. The inking-wheel is grooved at one edge in contact with ink in an inkwell. By this method of transmission the battery is always to the line for the same interval of time, and alternately with opposite poles, so that the correct electric currents are made to pass. This method is also used in telegraphy and telephony.

Although it is quite possible to obtain good signals at a rate corresponding to 600 letters per minute, in practice it is found that such a speed is not advisable, as it is difficult or impossible for even the most skilled operators properly to handle and transcribe from the "slip" on which the signals are recorded.

In Squier and Crehore's "Synchronograph" system "sine waves" of current, instead of sharp "makes and breaks," or sharp reversals, are employed for transmitting signals, the waves being produced by an alternating-current dynamo, and regulated in width and intensity of the paper by means of a Wheatstone automatic system. The arrangement has been found under certain conditions to give better results than those obtained with sharp reversals.

In the undulator apparatus, which is similar in general principle to the "siphon recorder" used in submarine telegraphy, a spring or falling weight moves a paper strip beneath one end of a line silver tube, the other end of which dips into a vessel containing ink. The siphon is supported on a vertical axle carrying two armatures which are acted upon by two electromagnets. It is in fact the electromagnet and spindle of a telegraph relay, with windings and core attached to and reversed, and the armatures are provided for closing or opening the air gap between the electromagnets and armatures, for raising or lowering the siphon, and for adjusting the point of the siphon to the centre or side of the paper. The reciprocating motion of the armatures is transmitted to a horizontal axis through which the siphon is attached, and by means of a rod, is transmitted to a peculum fixed in an undulating continuous line of ink, and are distinguished by the length of deviation from zero. The amplitude of the signals can be set in several positions by means of a control-magnet, or by altering the tension of the controlling springs or by altering the air gap between electromagnets and armatures. Up to 100 words per minute the signals are easily readable, but beyond that speed they are more difficult to translate, although experts can read them when received at 200 words per minute.

In the improved Pollak-Virag system the received signals are recorded in characters similar to ordinary hand-written, the operator acuates a treadle which actuates a train of mechanism which punches varying groups of holes, representing the different characters, in a paper strip about one inch wide. This strip is then carried across a light beam, and a diaphragm is arranged so that the perforated paper strip is conveyed to the two line wires of a metallic loop. One circuit is formed by the loop itself, and a second, quite independent, by the two wires in parallel, earthed at each end. At the receiving end there is an arrangement of diaphragms and glass lense to make these signals visible. The magnet employed is a moving-coil magnet, or by altering the tension of the controlling springs or by altering the air gap between electromagnets and armatures. Up to 100 words per minute the signals are easily readable, beyond that speed they are more difficult to translate, although experts can read them when received at 200 words per minute.
other, being very similar in appearance. The bromide paper is automatically passed through a developing bath, a fixing bath, and drying rollers. This operation occupies about twelve seconds, giving a speed of about five hundred miles per hour delivery. It is not a system likely to have general application.

Type Printing Telegraphs.—The first considerable improvement in type printing telegraphs was made by D. E. Hughes in 1853.

Hughes instrument.

The mechanism, one at each end of the line, are kept moving at the same speed. Each instrument is provided with a set of perforated tape upon which it is arranged to print the letters which communicate with a circular row of vertical pins. A horizontal arm fixed to a vertical shaft in gear with the mechanism sweeps over these pins at the rate of about two revolutions per second. While the arm is being lifted the horizontal arm will pass over it and in doing so will momentarily join the battery to the line. The current thus sent to the line may make short-circuit the electromagnet and cause the horizontal arm to close a local circuit by means of a relay. For simplicity we will suppose direct action. The current then passes through the coils of an electromagnet, which releases the printing mechanism. The electromagnet consists of two coils, each worked on a soft iron core fixed to the poles of a strong permanent horse-shoe magnet. The armature of the electromagnet is normally attracted by the effect of the permanent magnet, but it is furnished with two antagonistic springs to ensure that when the armature is in the position where it would be if a telephone or telegraph is provided, they are not quite able to release the armature. When a current comes in from line it passes through the electromagnet in such a manner that it releases a mechanism which causes the springs to be released, and hence the springs are able to release the armature, which rises smartly and in its turn releases the printing mechanism. Either a weight or a motor is used for making the movements of the mechanism.

In the operation of producing type by this instrument the type-wheel is carried round continuously by the mechanism to which it is attached by a friction disk and ratchet drive. An axle carrying four cams is normally at rest, but it is thrown into gear with the mechanism when the armature rises, makes one complete revolution, and comes to rest ready for the next signal. In its revolution one of its cams engages with the correct wheel and moves it, and moves it over to ensure that the second cam engages with the correct wheel and moves it; the second cam lifts the paper against the type-wheel and prints the letter; the third moves forward the paper tape one space to be ready for the printing stroke of the next signal; and the fourth cam operates on the cores of the electromagnet. This complete operation occupies about one-twelfth of a second. It is of course necessary that two instruments working together should have the same speed. This is obtained by causing one of them to send a signal every second, from one particular key, while the operator at the other station adjusts his speed until he receives the same signal after short-circuiting his electromagnet for ten revolutions. Both type-wheels are then set to zero by the lever provided for that purpose, and released by the current from the letter-blank key; then all subsequent signals will be recorded similarly at the sending and receiving stations. When the two instruments get out of phase, the sender is stopped by the receiver sending a few signals, after which both type-wheels are again set to zero and correspondence continued. This system of telegraphic printing is, therefore, capable of a very high speed, and avoiding the necessity for the rapidly acting electric escapement, which, however skilfully planned and executed, is always liable to failure when used of thirty words per minute or less in usage, can be perfect accuracy and certainty have been attained, and in actual practice it has proved to be decidedly superior to all previous type-printing telegraphs, not only in speed and accuracy, but in less liability to mechanical derangement from wear and tear than from accident. It involves many novel features; the receiving electromagnet is of peculiar construction and remarkable efficiency and the transmitting apparatus has a contrivance to prevent uninterrupted communication. Each letter is produced by the operation of two pairs of type-wheels, and the combination of letters is produced by the combination of the type-wheels. It is further provided with a system of correctors, by which it is possible to stop or alter any letter or words, and even to strike out any letter or words. It is further provided with a system of correctors, by which it is possible to stop or alter any letter or words, and even to strike out any letter or words.

In the Murray system the messages are first prepared in the form of perforations on paper, and are then transmitted by the perforator. The telegraphing machines equipped with typewriter keyboards are used for the preparation of the messages, two or three keyboards being employed at each end of the telegraph lines on which the Murray system is used. The messages in the form of perforated tape are then passed through an automatic transmitter, something like a Wheatstone transmitter, at a speed of about a minute. At the receiving station, electric mechanical mechanisms record the signals once more as perforations in a paper strip forming an exact replica of the transmitting tape. This received perforated tape is then used to control what is known as a Sturt or automatic typewriter. It is provided with a strip of tape perforations into letters and prints the messages in Roman type in page form. This printer is purely mechanical, and its speed is very high. An experimental printer constructed about the middle of 1908 by the British Post Office, operated successfully at the rate of 210 words (1260 letters) per minute. The usual working speed is from 100 to 120 words per minute. The Murray automatic system was designed specially for dealing with heavy traffic on long lines. As it uses the Baudot telegraph alphabet it has an advantage in theory over the Wheatstone using Morse alphabet in regard to the speed that can be obtained on a long telegraph line. The system is not regarded as suitable for short telegraph lines or moderate traffic, printing telegraphs of the multiplex principle being considered more or less realized in practice. The Murray automatic system is not regarded as suitable for short telegraph lines or moderate traffic, printing telegraphs of the multiplex principle being considered more or less realized in practice. The Murray automatic system is not regarded as suitable for short telegraph lines or moderate traffic, printing telegraphs of the multiplex principle being considered more or less realized in practice. The Murray automatic system is not regarded as suitable for short telegraph lines or moderate traffic, printing telegraphs of the multiplex principle being considered more or less realized in practice.

The Creed system is a development of the Morse-Wheatstone system, and provides a keyboard perforator which punches Morse letters or figures on a paper strip by depressing type-writer keys. The slips are passed through an ordinary Wheatstone transmitter and actuate Wheatstone receiving apparatus which in turn controls a  "Creed receiving perforator," the messages are reproduced thereon by means of perforations, which can be passed on to any other Wheatstone circuit or can be run through a "Creed printer," which is a pneumatic machine netting the several messages of identical perforations upon a tape which is gummed to the telegraph form. The speed of the receiving perforator ranges from 20 to 150 words per minute.

In the Rowland multiple method of telegraphic working, the transmitter consists of a mechanical keyboard provided with a series of levers, which effect certain combinations of positive and negative currents on the keyboard. These are transformed into sine currents over the line and operates a motor at the distant end of the line, both machines running in synchronism. At the receiving station there is provided with gearing which rotates four combining commutators and four type-wheels, which prints the letters on the band of paper. There are four transmitters and four receivers, which are operated independently by means of an adaptation of the multiplex system of working, and each circuit is provided with a number of segments set apart for its own use. Each transmitter is therefore able to
transmit a separate series of positive and negative currents in different combinations; these are distributed, by suitably arranged distributors and relays at the receiving end of the line, into their respective receivers. The combination of the currents causes a receiving instrument so to group the received combination of positive and negative currents that they operate polarized relays in the same manner as does the combination of the operation of the levers on the transmitter. Since each letter is represented by a specific combination of positive and negative currents, it is possible, by means of the combinations, to close a local circuit whenever the current causes it to be pressed against the periphery of the type-wheel at the time when the letter required is opposite. The paper is also caused to advance automatically for each letter, start a fresh line, and also to completely erase the last message.

Telegraph.—Instruments such as the telegraph and teletypewriter are apparatus for transmitting a facsimile of handwriting inscribed on a paper at one end of a line, the reproduction being made automatically at the other end of the line at the same time that the message is being written.

A successful apparatus for effecting this was devised by Cowper and was known as the writing telegraph. The telegraph is on a similar principle to the Cowper apparatus, the motion of the transcribing stylus being transferred to a system of levers into two component rectilinear motions, which are used to control and vary the currents in two distinct electrical circuits, of which the two are connected in series. A magnetic mechanism in the receiver, the two component motions are reproduced and by their combined action on a second system of levers the receiving pen is caused to duplicate the motions of the stylus. This motion is transmitted through the pencil to the roller so that the pencil serves to cut resistance in or out of the two line circuits which are connected to the rollers, and thus two independent variable resistances are obtained. These receiving resistances are placed in a strong electromagnet, excited by a local current, which has in its circuit two annular air gaps, across which the magnetic field is practically uniform and constant. In these annular spaces there are placed two light coils of fine copper wire, capable of being moved vertically, and connected in such a manner as to be traversed by the two variable line currents from the transmitter.

These coils are drawn down, by the magnetic action of the field on the light coils, into the annular spaces, against the pull of the springs, more or less strongly, according to the strengths of the two line currents. Each coil is attached to a shaft by a bell crank arrangement, and to these shafts there is secured a system of levers similar to that at the transmitter carrying the receiving pencil at the junction. The shafts are turned by the pull of the magnet upon the coils, and the motions of the transmitting pencil are thus reproduced.

The Korn telephotographic apparatus is based on the principle of an apparatus devised by Shelved Bidwell in 1881 for the electrical transmission of pictures to a distance, in which he converted to electrical resistance which selenium undergoes when acted upon by light. In the Korn apparatus the light from a Nernst electric lamp is allowed to strike upon a point in the form of a pencil on a picture, which is wound on a glass cylinder in the shape of a transparent photographic film. A totally reflecting prism placed inside the glass cylinder projects the light which penetrates the film upon a selenium cell situated at the end of the cylinder. An illumination of variable intensity (according to the deeper or lighter shades of the portion of the picture on which the light falls) thus takes place on the selenium cell. As the glass cylinder, driven by a motor, revolves upon its axis while also advancing (by means of a screw thread on the axis), all portions of the picture are successively brought under the beam or pencil of light and cause a beam of varying intensity to fall on the selenium cell. The varying illumination of the selenium thus produced, the resistance of the latter, and therefore the intensity of the current sent through the line to the receiving station by the battery, will be altered accordingly. At the receiving station the film is revolved synchronously with the transmitting cylinder—is covered with a photographic film or paper, upon a point of which a pencil of light from a Nernst lamp is concentrated. Before reaching the paper the light passes through perforations in two iron plates, which are, in fact, the pole pieces of a strong electromagnet; between these is an aluminium shutter which is attached to two parallel wires or thin strips of copper. In this way no current passes through the perforations and no light passes, but when a current traverses the wires they are depressed by electromagnetic action, carrying the shutter with them, and a quantity of light proportional to the current traversing the wire is admitted through the perforation. The intensity of this "light-relay" is the intensity of the light acting at any moment upon the sensitized paper is made proportional to the illumination of the selenium cell at the transmitting station. In other words, of the selenium transmitter a selenium cell similar to that at the transmitting station is arranged at the receiving apparatus, and exposed to precisely similar variations of light, the arrangement being such that the lag of this cell counters the lag of the transmitting cell. The synchronous revolutions of the transmitting cylinders are effected by making one cylinder rotate slightly faster than the other; after each revolution the cylinder which is accelerated is arrested for a moment by means of a special relay until the difference of speed is accurately compensated for. This device was originally adopted in the Arlincourt copying telegraph.

Submarine Telegraphy. For working long submarine cables the submarine wire ordinarily employed was recently ordered to be replaced by the selenium telewriter. This instrument is so designed that signals can only be used, as the retarding effect of the electrostatic capacity of the cable is so marked that signals fail to be recorded except at a very slow speed of working. The transmitted signals or electric impulses, which on a land line are sharply defined when received, become attenuated and prolonged in the case of a long cable, and are unable to actuate the comparatively heavy moving parts of which the land line instruments are formed. Other patterns of apparatus are therefore necessary.

The arrangement of the apparatus for working some of the most recent cables is shown in Fig. 30. The cable is supposed to be worked duplex; but, if S, Cb, C, and AC are removed and the key connected directly with Cb, the arrangement for simplex working is obtained. The apparatus consists of a sending battery B, a transmitting key K, a slide of selenium C, a condenser C, an artificial cable AC, the receiving instruments I and G, and one or more resistances R for adjusting the leakage currents. The key K is positively operated by the penultimate relay, and the receiving relay and condenser Cb are shown; one only is absolutely necessary, but it is convenient to have the galvanometer ready, so that in case of accident to the sender it may be at once switched into circuit by the switch S. When one of the levers of K is depressed, the condenser C and the cable, and the condenser Cb and the artificial cable, are simultaneously charged in series; but, if the capacity of Cb bears the same ratio to the capacity of C that the capacity of the cable does to the capacity of the artificial cable, and if the other adjustments are properly made, no charge will be communicated to Cb. After a very short interval of time, the length of which depends on the inductance and capacity of the cable, the condenser Cb is charged to a potential corresponding to the capacity of Cb, and Cb at the other end begin to be charged from the cable, and since the charge of Cb passes through the receiving instrument I or G the signal is received. The charging of Cb at the receiving end will take place, no matter in which direction the current is flowing, and the condensers, consequently the incoming signals are not affected by those which are being transmitted from that end. In actual practice the receiving instrument is so sensitive that the difference of potential between the two coatings of the condenser Cb produced by the incoming signal is only a very small fraction of the potential of the battery B. When the key is released the condensers and cables at one end return to zero directly, whereas if the key is depressed and released several times in rapid succession the cable is divided into sections of varying potential, which travel rapidly towards the receiving end, and indicate their arrival there by means of the instrument I. The entire system of the apparatus is explained in Fig. 30. It will be seen that any light or dark spot on the cable is transmitted as a corresponding light or dark spot on the printed copy. All cables of any great length are worked by reverse currents. A modification (known as the code cable) of the ordinary single needle alphabet is used; that is to say, currents in one direction indicate dots and in the other direction dashes.

The general principle on which the instruments for working long submarine cables are based is that of making the moving parts very light and perfectly free to follow the comparatively slow rise and fall of the electric impulses or waves. The simplest form of receiving instrument (formerly much used) is known as the "mirror." In this instrument a small and very light mirror, about 1 inch in diameter, is carried on a small magnetic needle fixed to its back, and is arranged within a galvanometer coil so that the influence of the latter causes the mirror (through the attraction of the magnetic needle) to be turned through a small angle in one direction or the other according to the direction of the current through the coil. A ray of light from a lamp is thrown on the mirror, whence it is reflected upon a white
siphon recorder| TELEGRAPH

moving slip of paper by a wavy line of ink-marks very close together. The interpretation of the signals is according to the Morse code,—the dot and dash being represented by deflections of the line of dots to one side or other of the centre line of the paper. A very much simpler form of siphon recorder, constructed by Dr Muirhead, is now in general use. The magnet between the poles of which the rectangular signal coil moves is built up of a number of thin flat horseshoe-shaped permanent magnets of a special quality of steel, and is provided with adjustable pole pieces. The signal coil is suspended by fibres and is mounted together with a fixed soft iron core on a brass plate affixed to a rack, with which a pinion operated by a milled head screw engages. To the brass plate is attached an arm carrying the bridge piece. A wire or fibre carrying the aluminium siphon cradle is stretched across this bridge piece, and on it is also mounted the small electromagnet, forming part of the "vibrator" arrangement with its hinged armature, to which one end of the stretched wire carrying the siphon is fastened. The ink-box is made adjustable, being carried by an arm attached to a pillar provided with a rack with which a pinion operated by a milled head screw engages. The motor is usually supported on a platform at the back of the instrument, its driving-wheel being connected to the shaft of the paper roller by means of a spirally wound steel band. In what is known as the "hybrid" form of recorder the permanent magnets are provided with windings of insulated copper wire; the object of these windings is to provide a means of "refreshing" the magnets by means of a strong current temporarily sent through the coils when required, as it has been found that, owing to magnetic leakage and other causes, the magnets tend to lose their power, especially in hot climates. Instruments of the siphon recorder type have been made to work both with and without electrification of the ink. In the latter case, which is the standard practice, mechanical vibration of the siphon is substituted in the place of electrification of the ink, so as to eliminate the effect of atmospheric conditions which frequently caused discontinuity in the flow of ink.

Fig. 32.—Muirhead's Siphon Recorder.

or similar undertakings, and to obviate this it is necessary to form the "earth" for the cable a few miles out at sea and make connexion thereto by an insulated return wire, which is enclosed in the same sheathing as the core of the main cable.

The heavier cores, with the consequent advance in speed of working attainable, have necessitated the introduction of automatic sending, the instruments adopted being in general a modification of the Wheatstone transmitter adapted to the form of cable signals, while the regularity of transmission thus secured has caused its introduction even on circuits where the speed cannot exceed that of the ordinary operator's hand signalling.

**Fig. 31.—Lord Kelvin's early Siphon Recorder.**

The spark recorder in some respects foreshadowed the more perfect instrument—the siphon recorder—which was introduced some years later. Its action was as follows. To an indicator, suitably supported, a to-and-fro motion was given by the electromagnetic actions due to the electric currents constituting the signals. The indicator was connected with a Ruhmkorff coil or other equivalent apparatus, designed to cause a continual succession of sparks to pass between the indicator and a metal plate situated beneath it and having a plane surface parallel to its line of motion. Over the surface of the plate and between it and the indicator there was passed, at a regularly uniform speed, in a direction perpendicular to the line of motion, a current capable of being acted on physically by the sparks, through either their chemical action, their heat, or their perforating force. The record of the signals given by this instrument was an undulating line of fine perforations or spots, and the character and succession of the undulations were used to interpret the signals desired to be sent.

In the original form of the siphon recorder (fig. 31), for which Lord Kelvin obtained his first patent in 1867, the indicator consisted of a light rectangular signal-coil of fine wire, suspended between the poles of two powerful electromagnets M, M so as to be free to move about its longer axis, which is vertical, and so joined that the current could pass through the cable pass through it. A fine glass siphon tube is suspended with freedom to move in only one degree, and is connected with the signal-coil and moves with it. The short leg of the siphon tube dips into an insulated ink-bottle, so that the ink it contains becomes electrified, while the long leg has its open end at a very small distance from a brass table, placed with its surface parallel to the plane in which the mouth of the leg moves, and over which a slip of paper may be passed at a uniform rate, as in the spark recorder. The ink is electrified by a small induction electrical machine E placed on the top of the instrument; this causes it to fall in very minute drops from the open end of the siphon tube upon the brass table or the paper slip passing over it. When therefore the signal-coil moves in obedience to the electric signal-currents passed through it, the motion communicated to the siphon is recorded on the
The automatic curb sender was originally designed by Lord Kelvin for the purpose of reducing the effect of mechanical retardation in long cables. In ordinary hand-sending the end of the cable is put to one or the other pole of the battery and to earth alternately, the relative time of the signal is determined by the earth depending to a great extent on the operator. By the automatic curb sender the cable is put to one or the other pole of the battery and then to the reverse pole for definite proportionate times during the poles of a laminated magnet, so that the motions of the two are similar. This magnet is excited by an alternating current, and the current induced in the second coil is after rectification sent through an ordinary siphon recorder. As the direction and intensity of this induced current are a function of the position of the second coil in its field, and as this position is determined by its mechanical connexion with the recorder coil, it is evident that, by a suitable choice of the electrical elements of the second coil and its alternating field, the indications on the siphon recorder can be magnified to any reasonable extent.

By means of a "magnetic shunt" Brown succeeded in increasing the working speed of long submarine cables to the extent of 10 to 15 per cent. The magnetic shunt (which is connected across the receiving instrument) consists of a low resistance coil of some 2000 turns of insulated copper wire, enclosed in a laminated iron circuit, and connected at intervals to a heavy terminal so that equal increments of inductance may be obtained. The use of the iron core renders it possible to produce a high inductive effect with a low resistance coil, and thus obtain the necessary slow time constant which is due the success of this type of magnetic shunt on cable signals. The shunts usually employed with the drum relay (referred to above) have each a resistance of about 30 ohms and an inductance of 20, 30 and 40 henrys respectively. The explanation of the action of the shunt is that all slowly varying currents affect the coil of the receiving instrument and its shunt in inverse proportion to their respective resistances; whereas with the comparatively rapid variations of current used in signalling the coil is forced at the beginning of each element of

**FIG. 33.**—Facsimile of Siphon Recorder Message.

Each signal is thus charged first positively and then negatively, or *vice versa*, for each signal. Owing to the difficulty of maintaining perfect balance on duplicated cables, curb sending is not now used, but the signals are transmitted by means of an apparatus similar to the Wheatstone automatic transmitter used on land lines and differing from the latter only in regard to the alphabet employed; the signals from the transmitter actuate a relay having heavy armatures which in turn transmit the signals to the cable. The practice of this apparatus is exhibited in the signal sent to the receiver. By this method of transmission of signals by means of the number of letters per word is really between eight and nine; and this forms a considerable factor in lowering the earning capacity of a cable.

A relay capable of working at the end of a long cable has long been desideratum. The difficulty experienced is that of securing a good electrical contact under the very slight pressure obtainable from an instrument excited by attenuated arrival-currents. In an instrument invented by S. G. Brown (Brit. Pat. 1434 of 1869) it is sought to overcome this difficulty by causing the point of a contact-arm, representing the siphon in the ordinary form of recorder, to traverse the cylindrical surface of a rapidly rotating drum. This surface is divided into two parallel halves by a short insulating space on which the arm normally rests, so that the separate conducting surfaces are provided, with either of which the arm makes contact in its excursions in one direction or the other from the central position of the drum; and it is apparent a definite rate of speed that the combination of this relay with a special form of curb sender allows of the re-transmission of signals to a second cable at a speed not less than the speed of the siphon recorder in the usual way. The special form of curb sender mentioned, termed the "Interpolator," has been devised so as to secure the correct re-transmission of any given number of consecutive elements of a letter which are of the same sign, for when signals are received at the end of a long cable the relay arm will not return to its zero position between consecutive elements of the same sign, but will remain on the respective contact surface during the whole time of transmission of such elements. The instrument consists of two arms, the form of which regulates the components of the curved surface, the cam being for the dot elements and the other to the dash elements. The letters are so arranged that the cam is driven back by the return signal. This arrangement thus enables the signal to the relay to be such as to produce a relay current equal to the reversed current, so that the negative elements of the signal are first transmitted corresponding to the duration of contact of the relay arm with the side controlling that particular element. If the modification of the apparatus is retained of the device, however, the operations of the transmitting half of the instrument may be inserted on a paper slip, which can be inserted in the usual way into an automatic transmitter, so as to send either cable or Morse signals.

**FIG. 34.**—Taylor and Dearlove's Interpolator with Brown's Improvements.

A slip as received on recorder, using ordinary relays for translating on to second cable; B, slip as received on recorder, when interpolator is used at intermediate station, for sending on to second cable; C (four cells through a line, KR = 3-6), signals with recorder under ordinary conditions; D, all conditions the same as in C, but magnifying relay inserted between the end of the line and the recorder.

A signal to take *more*, and at the end of the element *less* of the total arrival current from the cable than would traverse it if the shunts were non-inductive.

For duplex working a "magnetic bridge" is used. This consists of a low resistance coil of copper wire enclosed in a laminated iron circuit similar to the magnetic shunt already described. The coil, however, is arranged so that the sending current enters an adjustable mid-point in the coil and passes through the two halves of the winding to the ends connected to the cable and artificial line respectively. The receiving instrument is joined up across these ends in the usual manner. The action of this bridge resembles the magnetic shunt in its effect on the received signals, as the direction of the winding is the same throughout its length, and thus the full inductive action is produced for carrying purposes. To the sending currents, however, the bridge offers only apparent ohmic resistance due to the fact that the current entering the mid-point of the winding flows through the two halves or arms in opposite direction, and, owing to the winding being on the same iron core, the mutual inductive effect of the two arms on one another neutralizes the self-induction to the sending currents. The average total inductive value of these bridges to received signals is about 40 henrys, and the coil is so arranged that the arms contain three sections or blocks of winding each, two of which are joined up to strap connections, and the
third divided into small subdivisions to any terminals of which the cross circuit connections may be affixed. By this arrangement of the coil winding, similar sections can be thrown in or out of circuit with both arms, and also so combined that any amount of inductance suitable to every class of cable may be obtained. The bridge is provided with three sets of silver points, but only one gives a true or several turns of the winding between each stud to permit of the arms being thrown slightly out of balance as a rough compensation for the differences in the coil line. An additional "fine" adjustment in one of the arms by which the small daily balance variations may be corrected. As with other duplex systems it is possible to obtain several approximately correct adjustments with the bridge and its accessories, and only one gives a true balance, and careful experiment is required to make sure that this is obtained. The advantage of using the magnetic bridge duplex method is that the maximum current is sent to line or of cable, and the receiving system benefits accordingly. (H. R. K.)

COMMERCIAL ASPECTS

TELEGRAPH

The earliest practical trial of electrical telegraphy was made in 1837 on the London and North Western Railway, and the first public line under the patent of Wheatstone and Cooke was laid from Paddington to Slough on the Great Western Railway in 1843. At first the use of the telegraph was almost entirely confined to railways. The Electric Telegraph Company, formed to undertake the business of transmitting telegrams, was incorporated in 1846. For some time it restricted its operations to constructing and maintaining railway telegraphs and was not commercially successful. Its tariff was 7s. for 20 words within a radius of 50 miles, 12s. 6d. within 100 miles, 1s. if exceeding 100 miles. After about five years great improvements were made in the working of the telegraphs and the industry began to make progress. Telegraphic money orders were established in 1850; a cable was laid between Dover and Calais, and in November 1851 the stock exchanges of London and Paris were able for the first time to compare prices during business hours of the same day; numerous companies were formed, some of which were independent of the railways, and keen competition led to considerable reductions of wires and reduction of tariffs, with the result that a large increase in the volume of business took place. In the period from 1855 to 1868 the number of messages carried annually by all the telegraph companies of the United Kingdom increased from 1,017,529 to 5,781,989, and an average annual increase of 16.36 per cent. During this period the Electric Telegraph Company's average receipts per message fell from 48.1d. to 25.0d., or just over half, while the number of messages increased nearly fourfold. The working expenses were reduced in a progressively larger ratio, e.g. in 1859 the average expenses per message were only 22d.; in the last quarter of 1868 they were 18.0d. per message or only 51 per cent. of the receipts. Much dissatisfaction was felt because the larger towns where competition had been most keen were unduly benefited to the neglect of smaller towns where the business was comparatively less profitable, but it must be remembered that the telegraph lines followed the railways and that many towns were not served owing to their opposition to the railways.

In 1856 the Edinburgh Chamber of Commerce began an agitation for the purchase by the government of the telegraphs, and a similar agitation in Great Britain joined forces with this agitation, which was strongly supported by the Press. In 1865 the Postmaster-General (Lord Stanley) commissioned Mr F. T. Scudamore, second secretary to the Post Office, to inquire and report whether the electric telegraph service could be beneficially worked on the Post Office, and whether it would entail any very large expenditure on the Post Office beyond the purchase of the rights. At that time the total number of places supplied with telegraphic communication by all the companies collectively, including railway stations, was 2,500, whereas the number of places having postal communications was over 10,000. Under the then existing telegraphic tariff the charge in Great Britain was a shilling for a twenty-word message over a distance not exceeding 100 miles; 1s. 6d. for a like message over distances from 100 to 200 miles; 2s. when exceeding 500 miles. For a message between Great Britain and Ireland the charge ranged from 3s. to 6s.; to Jersey or Guernsey it was 7s. 8d. There were also extra charges under contingent regulations of great complexity, which commonly added 50 per cent. to the primary charge, and frequently doubled it. In conclusion of the foregoing the author of the bill for the acquisition of the telegraphic systems, reported that the charges made by the telegraph companies were too high and tended to check the growth of telegraphy; that there were frequent delays of messages; that many important districts were unprovided with facilities; that in many places the telegraph office was inconveniently remote from the centre of business and was open for too small a portion of the day; that little or no improvement could be expected so long as the working of the telegraphs was conducted by commercial companies striving churlily to earn a dividend and engage in wasteful competition with each other; that the growth of telegraphy had been greatly stimulated in Belgium and Switzerland by the annexation of the telegraphs to the Post Offices of those countries and the consequent adoption of a low scale of charges; that in Great Britain like results would follow the adoption of like means, and that the association of the telegraphs with the Post Office would produce great advantage to the public and ultimately a large revenue to the state.

In support of these views he reported that in Belgium in 1863 a reduction of 50 per cent. in the charge had been followed by an increase of 50 per cent. in the number of telegrams, and that in 1856 a reduction of 50 per cent. in the charge had been followed by an increase of 85 per cent. in the traffic; and similar statistics pointing to increase of business consequent on reduction of rates were produced in regard to France, Switzerland and Prussia. The relative backwardness of telegraphy in Great Britain was attributed to high charges made by the companies and to restricted facilities. Some of the complaints against the companies, however, were exaggerated, and the estimates formed of the possibilities of reduction of tariffs and rates were optimistic. The basis for these estimates was the experience of other countries, which, however, did not justify the expectation that a large increase of business consequent on reduction of rates could be obtained without serious diminution of profit. The Belgian state telegraphs were started in 1850 and were at first very profitable, but for the years 1866–7 they yielded an average profit of only 2.5 per cent., and subsequently failed to earn operating expenses, the reasons for the steady decline of the profits being the opening of relatively unprofitable lines and offices, increases in wages, and a diminution in the value of the state patents, which had constituted the most profitable part of the whole business. The Belgian government endeavoured by reducing rates and increasing facilities to stimulate inland telegraphy in the hope of thereby increasing the profits of the department. But these expectations were not realized. Upwards of 100 telegraph offices in Belgium despatched on the average less than one telegram per day, and some offices despatched less than one a month. Similar experience was adduced by the working of the state telegraphs in Switzerland and in France. The profits when earned were derived mainly from foreign messages and the differences between foreign countries, while the receipts from inland messages did not always cover expenses. In 1868 there were in France over 300 telegraph offices whose average receipts did not exceed 8 francs per annum. In that year the Swiss government reduced the rate for inland telegrams by one-half, and the traffic immediately doubled, but the cost of carrying on the service increased in a larger ratio.

The experience of the telegraph companies in the United Kingdom, moreover, showed that a uniform rate, irrespective of distance, of 1s. 20 words, addressed free, was not remunerative in the then state of telegraphy, which made it necessary for messages to be re-transmitted at intervals of about 300 miles. In 1861 the United Kingdom Telegraph Company began a competition with the other companies on the basis of a 1s. rate, and the old-established companies were forced to adopt this rate between all points served by the United Kingdom.
Company; but after a trial of four years it was found that a uniform rate irrespective of distance had not justified itself, and that for any but very short distances the tariff was "utterly unremunerative" notwithstanding a very large increase in volume of business. Even the London District Telegraph Company, which was formed in 1859 for the purpose of transmitting telegraph messages between points in metropolitan England, found that a low uniform rate was not financially practicable. The company began with a tariff of 4d. per ro words; it soon increased the rate to 6d. for 15 words with an additional porterage charge for delivery beyond a certain distance, and in 1866 the tariff was raised to 1s. The company had 123 m. of line and 83 offices, and in 1865 conveyed over 316,000 messages, but it was not financially successful. Both the telegraph companies and the railway companies had incurred heavy commercial risks in developing the telegraph services of the country and only moderate profits were earned. It cannot justly be said that the companies made large profits while neglecting to develop the services adequately, but it is true that they were not able commercially to comply with many of the demands made upon them by the public. Until speculation took place in anticipation of government purchase, the market prices of the telegraph securities were mostly below par. The stock of the Electric and International Company, the return on which had reached 10 per cent. per annum, however, was valued at about 14 years' purchase of the annual profits. Very little new capital was invested in the telegraph companies about 1865 because of the natural reluctance of the companies to extend the system under their control so long as a proposal for their acquisition by the state was under consideration. In 1868 the length of electric telegraph lines belonging to the companies was 16,643 m., and of those belonging to the railway companies 4872 m., or a total of 21,515. With regard to the statement that the companies had installed competitive systems and had expended capital needlessly, it was found by the Post Office authorities that in 1865 less than 3000 m. of telegraph lines, and 350 offices out of a total of over 2000, were redundant. The telegraph companies proposed to effect an amalgamation so as to enable the services to be consolidated and extended, and they proposed to submit to various conditions for the protection of the public, such as maximum rates and limitation of dividends, with the provision that new issues of capital should be offered by auction, but public opinion was averse to the proposal. By 1868 both political parties in the House of Commons had committed themselves to the policy of state purchase of the telegraphs.

After much negotiation the basis finally agreed upon between the telegraph companies was 20 years' purchase of the profits of the year ended 30th June 1868. The Chancellor of the Exchequer described the terms as "very liberal but not more liberal than they should be under the circumstances," and stated that Mr Scudamore had estimated that £6,000,000 was the maximum price which the government would have to pay, and that the Postmaster-General would obtain from the telegraphs a net annual revenue of £293,000 at least. In addition to the undertakings of the telegraph companies the government had to purchase the reversionary rights of the railway companies which arose out of the circumstance that the telegraph companies for the most part had erected their poles and wires along the permanent way of the railways under leases which in 1868 had still many years to run. The price awarded to the six telegraph companies was £5,733,000. A further £1,000,000 was paid for the Jersey, Guernsey, Isle of Man and other undertakings, and about £9,500,000 was paid to the railway companies for their reversionary rights, the cost of which had been estimated at £700,000.

The government acquired the perpetual and exclusive way-leaves for telegraph lines over the railways, but the monopoly of the Postmaster-General does not apply to those parts of wires which are required for the protection of life on railways. The telegraphs were transferred to the Post Office on the 5th of February 1870. During the following three years the government spent £5,000,000 in making good the depreciation suffered by the plant in the transition years of 1868 and 1869, for which allowance had been made in the purchase price, and about £1,700,000 was expended on new plant. During that period 8000 m. of posts, 46,000 m. of wire and about 200 m. of underground pipes were added. The cost of these works had been underestimated, and the report of the Select Committee of the Post Office (Telegraph Department), 1876, states that "the committee have not received any full and satisfactory explanation of the great differences between the estimated expenditure of 1869 and the actual expenditure incurred up to 1876."

The excess expenditure caused the Post Office during two or three years to make temporary application of Savings Banks' balances to telegraph expenditure, an expedient which was disapproved of by both the Treasury and the House of Commons. Probably no more arduous task was ever thrown upon a public department than that imposed on the Post Office by the transfer. The reforms which it was to bring about were eagerly and impatiently demanded by the public. This great operation had to be effected without interrupting the public service, and the department had immediately to reduce and to simplify the charges for transmission throughout the kingdom. It had to extend the hours of business at all the offices; it had to extend the wires from railway stations lying outside of town populations to post offices in the centre of those populations and throughout the country; it had to extend the wires to towns into rural districts previously devoid of telegraphic communication; it had to effect a complete severance of commercial and domestic telegraphy from that of mere railway traffic, and in order to effect this severance it had to provide the railways with some 6000 m. of wires in substitution for those of which they had been joint users. It had further to provide at low charges for the distribution of news to the Press; it had to facilitate the transmission of money orders by telegram; finally, it had to amalgamate into one staff bodies of men who had formerly worked as rivals upon opposite plans and with different instruments, and to combine the amalgamated telegraph staff with that of the postal service. So zealously was the work of improvement pursued that within little more than six years of the transfer the aggregate extent of road wires in the United Kingdom was already 63,000 m. and that of railway wires 45,000, in all 108,000 m. The number of instruments in the telegraph offices was 12,000. At that date the superintending and managing staffs of the Post Office comprised 500 persons, the staff of the old companies with only about one-third of the traffic having been 534 persons.

The first appropriation was by 1871 for the increase of messages that would result from the reduction of rates were fully realized. The number of messages increased from about 6,500,000 in 1869 to nearly 10,000,000 in 1871 and to 20,000,000 in 1875, but the expectations as to net revenue were not justified by the results. In 1869 Mr Scudamore estimated the operating expenses at 51 to 56 per cent. of the gross revenue. In 1870-1 they were 57 per cent. and in 1871-2, 78 per cent. Since 1873 the capital account has been closed with a total expenditure of £10,867,044, and all subsequent expenditure for extensions, purchase of sites and erection of buildings has been charged against revenue.

There are several reasons for the unsatisfactory financial results apart from the high price paid for the acquisition of the telegraphs. The unprofitable extension of the telegraphs has largely contributed to the loss. Moreover, since 1861 the wages and salaries of the telegraph employees have been increased on several occasions in consequence of political pressure brought to bear on members of parliament; and notwithstanding the protest of the government the House of Commons in 1883 carried a resolution that the minimum rate for inland telegrams should be reduced to 6d. This involved a large extension of wires to cope with increased traffic. The reduced rate took effect as from the 1st of October 1883.

Another reason assigned by the committee appointed by the Treasury in 1875 to investigate the causes of the increased cost of the telegraphic service since the acquisition of the telegraphs by the state is the loss on the business of transmitting Press
messages, which has been estimated as at least £300,000 a year. A further cause has been competition offered by the telephone service, but against this the Post Office has received royalties from telephone companies and revenue from trunk telephone lines. These amounted in 1887 to £26,170 and £131,932 respectively; in 1897 to £85,289 and £113,294, and in 1897 to £240,333 and £479,639 respectively.

The following table shows the financial results of the business in the year immediately following the purchase of the telegraphs by the state, in the two years preceding and the two years following the introduction of the 6d. tariff, and in the seven financial years from 1900-1907:

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Messages</th>
<th>Gross Receipts</th>
<th>Total Expenditure</th>
<th>Percentage of Total Expenditure to Gross Receipts</th>
<th>Net Revenue or Deficiency</th>
<th>Net Revenue after deducting the cost of Sites, Buildings and Telegraph Extension</th>
<th>Interest on Stock created for Purchase of Telegraphs</th>
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<tr>
<td>1870-71</td>
<td>9,850,177</td>
<td>£801,262</td>
<td>£462,762</td>
<td>57.75</td>
<td>£338,500</td>
<td>£342,618</td>
<td>£214,500</td>
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<td>1883-84</td>
<td>32,843,120</td>
<td>1,789,223</td>
<td>1,808,920</td>
<td>101.10</td>
<td>19,697</td>
<td>330,355</td>
<td>326,417</td>
</tr>
<tr>
<td>1884-85</td>
<td>33,278,459</td>
<td>1,784,414</td>
<td>1,820,764</td>
<td>102.03</td>
<td>36,350</td>
<td>374,217</td>
<td>326,417</td>
</tr>
<tr>
<td>1885-86</td>
<td>39,146,283</td>
<td>1,787,264</td>
<td>1,832,401</td>
<td>102.52</td>
<td>45,452</td>
<td>399,575</td>
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<td>1886-87</td>
<td>50,350,639</td>
<td>1,881,159</td>
<td>2,032,632</td>
<td>107.70</td>
<td>145,473</td>
<td>433,484</td>
<td>326,417</td>
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<tr>
<td>1900-01</td>
<td>89,576,961</td>
<td>3,459,353</td>
<td>3,796,994</td>
<td>118.26</td>
<td>661,881</td>
<td>534,727</td>
<td>298,860</td>
</tr>
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<td>1901-02</td>
<td>90,430,041</td>
<td>3,570,046</td>
<td>4,221,927</td>
<td>116.16</td>
<td>601,714</td>
<td>530,760</td>
<td>298,860</td>
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<tr>
<td>1902-03</td>
<td>92,471,000</td>
<td>3,723,866</td>
<td>4,325,577</td>
<td>119.65</td>
<td>937,783</td>
<td>536,108</td>
<td>278,483</td>
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<tr>
<td>1903-04</td>
<td>99,997,000</td>
<td>3,736,115</td>
<td>4,693,898</td>
<td>125.44</td>
<td>919,436</td>
<td>575,436</td>
<td>271,691</td>
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<tr>
<td>1904-05</td>
<td>88,969,000</td>
<td>3,920,023</td>
<td>4,839,459</td>
<td>123.45</td>
<td>1,091,742</td>
<td>536,435</td>
<td>271,691</td>
</tr>
<tr>
<td>1905-06</td>
<td>93,478,000</td>
<td>4,154,386</td>
<td>4,892,199</td>
<td>117.85</td>
<td>740,819</td>
<td>556,539</td>
<td>271,691</td>
</tr>
<tr>
<td>1906-07</td>
<td>94,393,000</td>
<td>4,359,230</td>
<td>5,021,285</td>
<td>114.02</td>
<td>625,055</td>
<td>571,982</td>
<td>271,691</td>
</tr>
</tbody>
</table>

\[\text{5th February 1870.—Transfer of telegraphs to the state.} \]
\[\text{\dag 1st October 1885.—Introduction of sixpenny tariff.} \]

**Submarine Telegraphs.**—The first commercially successful cable was that laid across the straits of Dover from the South Foreland to Sangatte by T. R. Crampton in 1851, and two years later, after several futile attempts, another was laid between Port Patrick in the south of Scotland and Donaghadee in Ireland. This was followed by various other cables between England and the neighbouring countries, and their success naturally revived the idea which had been suggested in 1845 of establishing telegraphic communication between England and America, though this enterprise, on account of the distance and the greater depth of water, was of a much more formidable character. On the American side Cyrus W. Field acquired a concession which had been granted to F. N. Gisborne for a land line connecting St John's, Newfoundland, and Cape Ray, in the Gulf of St Lawrence, and proceeded himself to get control of the points on the American coast most suitable as landing places for a cable. On the British side the question of constructing an Atlantic cable was engaging the attention of the Magnetic Telegraph Company and its engineer Mr (afterwards Sir) Charles Bright. Visiting England in 1856, Field entered into an agreement with Bright and with John Watkins Brett, who with his brother Jacob had proposed the constructing of an Atlantic cable eleven years previously, with the object of forming a company for establishing and working electric telegraphic communication between Newfoundland and Ireland. The Atlantic Telegraph Company was duly registered in 1856, with a capital of £530,000, the great bulk of which was subscribed in England. The manufacture of the cable, begun early in the following year, was finished in June, and before the end of July it was stowed partly in the American ship "Niagara" and partly in the British ship "Agamemnon," both being war-ships lent for the purpose by their respective governments. The shore end was landed in Valentia Harbour on the 5th of August, and next morning paying out was started by the "Niagara," to which the laying of the first half had been entrusted. For the first few days the operation proceeded satisfactorily, though slowly, but on the afternoon of the 11th, when 380 m. had been laid, the cable snapped, owing to a mistake in the manipulation of the brake, and the ships returned to Plymouth with what remained. Next year, 700 m. of new cable having been made, the attempt was renewed, with the same ships, but on this occasion it was decided to begin paying out in mid-ocean, the two vessels, after splicing together the ends of the cable they had on board, sailing away from each other in opposite directions. They left Plymouth on the 10th of June, but owing to a terrific storm it was not till the 25th that they met at the rendezvous. A splice having been made they started on the 26th, but the cable broke almost immediately. Another splice was made, to be followed, after the "Agamemnon" had paid out about 40 m., by another break. Again the ships returned to the rendezvous and made another splice, and again there was a break after the "Agamemnon" had paid out 146 m., and then the "Agamemnon," after again returning to the meeting-place in the vain hope that the "Niagara" might have returned there also, made for Queenstown, where she found her consort had arrived nearly a week previously.

Although a good deal of cable had been lost, enough remained to connect the British and American shores, and accordingly it was determined to make another attempt immediately. To this end the ships sailed from Queenstown on the 17th of July, and having spliced the cable in mid-ocean, started to pay it out on the 29th. The "Niagara" landed her end in Trinity Bay, Newfoundland, on the 5th of August, while on the same day the "Agamemnon," landed hers at Valentia. The electrical condition of the cable was then excellent, but unfortunately the electrician in charge, Wildman Whitehouse, conceived the wrong idea that it should be worked by currents of high potential. For nearly a week futile attempts were made to send messages by his methods, and then a return was made to the weak currents and the mirror galvanometers of Sir William Thomson (Lord Kelvin) which had been employed for testing purposes.
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while the cable was being laid. In this way communication was established from both sides on the 16th of August, but it did not continue long, for the insulation had been ruined by Whitehouse's treatment, and after the 20th of October no signals could be got through.

The next attempt at laying an Atlantic cable was made in 1865, the necessary capital being again raised in England. It was then thought that the work should be done by a single ship, and the plan was accordingly named the "Great Eastern." It was chartered by the Telegraph Company, and the undertaking was entrusted to Captain Panne Farnham, a member of the Atlantic Telegraph Company. The cable was laid between Great Britain and the United States.

In 1866, the Atlantic Telegraph Company laid the first transatlantic cable, which was successful. The cable was laid between the United States and England, with a length of 7,700 miles. The cable was made of copper, covered with rubber, and had a thickness of 0.25 inches. The cable was laid at a speed of 10 miles per hour, and the work was completed in 63 days.

The laying of the transatlantic cable was a major engineering achievement of the time. The cable was made of copper, covered with rubber, and had a thickness of 0.25 inches. The cable was laid at a speed of 10 miles per hour, and the work was completed in 63 days.

In 1867, the Atlantic Telegraph Company was reconstituted as the Anglo-American Telegraph Company, with a capital of $600,000 and a sufficient cable was ordered. The cable was again employed, and leaving the west-coast of Ireland on the 13th of July, it reached Trinity Bay on the 9th of August, without serious mishap. It was then steamed eastwards again, and on the 13th of August made its first attempt to recover the lost cable. This, like many subsequent ones, was a failure, but finally it succeeded on the 2nd of September, and having made a splice completed the laying of the cable on the 8th of September. These two cables did not have a very long life, that of 1865 breaking down in 1877 and that of 1866 in 1872, but by the latter of these dates four other cables had been laid across the Atlantic, including one from Brest to Dublin, Messrs. Piron, Pannier, and others. The first cable of submarine cable, according to Mr. Charles Bright in 1887, that by that date 157,000 miles of submarine cable had been laid, while ten years later it was computed that 162,000 nautical miles of cable were in existence, representing a capital of $400,000,000, 75 per cent. of which had been provided by the United Kingdom. Among the men of business it was undoubtedly Sir John Pender (1815-1866) who contributed most to the development of this colossal industry, and to his unfailing faith in their ultimate realization must be ascribed the completion of the first successful Atlantic cables.

The submarine cables of the world now have a length exceeding 200,000 nautical miles, and most of them have been manufactured on the Thames.

The monopoly conferred upon the Postmaster-General by the Telegraph Act 1869 was subsequently extended to telephony and wireless telegraphy, but it does not extend to submarine telegraphy. The submarine telegraphs are mainly controlled by companies, the amount of issued capital of the existing British telegraph companies (twenty-four in number) being £30,447,101, but a certain number of lines are in government hands. On the 31st of March 1889 the undertaking of the Submarine Telegraph Company was purchased by the government. France and Great Britain jointly acquired the cables between Calais and Dover, Boulogne and Folkestone, Dieppe and Beachy Head, Havre and Beachy Head, Piron, near Coutances, and Vieux Chateaux (St. Heliers, Jersey).

Belgium and Great Britain became joint-proprietors of the cables between Ramsgate and Ostend and Dover and Die la Panne (near Furnes). The two cables to Holland and one of the cables to Germany were already the property of Great Britain, and the German Union Company's cable to Germany was purchased by the German government. The offices of the Submarine Company in London, Dover, Ramsgate, East Dean and Jersey were purchased by the Post Office, as well as the cable ship; and the staff, 370 in number, was taken over by the government. The capital amount laid out by Great Britain was £67,163, and on 1st April 1890 the new business was begun with a uniform rate to France, Germany, Holland and Belgium of 2d. a word, with a minimum of 101.

In 1890 Liverpool was placed in direct telegraphic communication with Hamburg and Havre, and London with Rome. The following year, an additional cable was laid a single strand, in Norfolk, to Borkum, in Germany, at the joint expense of the British and German governments. Direct telegraphic commu-
analogous to the action of the state in the cases referred to is the action taken by municipal authorities with the authority of the legislature in competing with or superseding private companies for the supply of electric light, gas, water, tramways and other public services. The service which the government and the colonies desire is one which neither the Eastern Telegraph Company nor any other private enterprise is prepared to undertake on terms which can be considered in comparison with the terms upon which it can be provided by the associated governments.

In November 1899 a committee was appointed by the Colonial Office for the further examination of the scheme, and towards the end of 1900 a tender was accepted for the manufacture and laying of a submarine cable between the Island of Vancouver and Queensland and New Zealand for the sum of £1,795,000, the work to be completed by the 31st of December 1901. A board was constituted to supervise the construction and working of the cable, composed of representatives of the several governments, with offices at Westminster. Under the Pacific Cable Act 1901 the capital sum of £2,000,000 was provided in the following proportions:

United Kingdom, $1,518ths with 3 representatives including the chairman.
Canada, $1,518ths with 2 representatives.
Australia, $1,618ths with 2 representatives.
New Zealand, 2,18ths with 1 representative.

In these proportions the respective contributing governments are responsible for the losses made in the working of the undertaking, and the total length of the cable was to be paid for cable repairs and reserve and a fixed payment to the National Debt Commissioners of $77,544 as sinking fund to amortise capital expenditure in fifty years. The deficiency on the working for the year ended 31st March 1907 was $54,924, and the approximate number of messages transmitted during the year was 96,783 with 1,126,940 words. There was in addition a considerable inter-colonial traffic between Australia, New Zealand and the Fiji.

Since the early days of international telegraphy, conferences of representatives of government telegraph departments and companies have been held from time to time (Paris 1865, Vienna 1868, Rome 1871 and 1878, St. Petersburg 1875, London 1879, Berlin 1885, Paris 1891, Buda Pesth 1896, London 1903). In 1898 the International Bureau of Telegraphic Administrations was constituted at Berne, and a convention was formulated by which a central office was appointed to collect and publish information and generally to promote the interests of international telegraphy. International service regulations have been drawn up which possess equal authority with the convention and constitute what may be regarded as the law relating to international telegraphy. The total lengths of the telegraphs throughout the world in 1907 were 1,015,894 m. aerial, and 11,454 m. underground, and the total lengths of submarine cables of the world were 39,072 nautical miles under government administration and 104,735 nautical miles under the administration of private companies.

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Part II.—Wireless Telegraphy

The early attempts to achieve electric telegraphy involved the use of a complete metallic circuit, but K. A. Steinheil of Munich, however, acting on a suggestion given by Gauss, made in 1838 the important discovery that half of the circuit might be formed of the conducting earth, and so discovered the use of the earth return, since then an essential feature of nearly every telegraphic circuit. Encouraged by this success, he even made the further suggestion that the remaining metallic portion of the circuit might perhaps some day be abolished and a system of wireless telegraphy established.

Morse showed, by experiments made in 1842 on a canal at Washington, that it was possible to interrupt the metallic electric circuit in two places and yet retain power of electric communication (see Fahie, loc. cit., p. 10). His plan, which has been imitated by numerous other experimentalists, was as follows:—On each side of the canal, at a considerable distance apart, metal plates ε and η (fig. 25) were sunk in the water; the pair on one side were connected by a battery B, and the pair on the other by a galvanometer or telegraphic receiver R. Under these circumstances a small portion of the current from the battery is shunted through the galvanometer circuit, and can be used to make electric signals. Morse and Gale, who assisted him, found, however, that the distance of the plates ε and η, as well as the length of the water between them, had to be at least three or four times the width of the canal to obtain successful results. Numerous investigators followed in Morse's footsteps. James Bowman Lindsay of Dundee, between 1845 and 1854, invented and even patented Morse's method, and practically put the plan into operation for experimental purposes across the river Tay. J. W. Wilkins in 1849, and H. Highton in experiments described in 1872, also revived the same suggestion for wireless telegraphy.

The invention of the magneto-telephone put into the hands of experimenters a new instrument of extraordinary sensitiveness for the detection of feeble interrupted, or alternating, currents, and by its aid J. Trowbridge in 1880, in the United States, made a very elaborate investigation of the propagation of electric currents through the earth, either soil or water (see "The Earth as a Conductor of Electricity," Amer. Acad. Arts and Sci., 1880). He found, as others have done, that if a battery, dynamo or induction coil has its terminals connected to the earth at two distant places, a system of electric currents flows between these points through the crust of the earth. If the current is interrupted or alternating, and if a telephone receiver has its terminals connected to a separate metallic circuit joined by earth plates at two other places to the earth, not on the same equipotential surface of the first circuit, sounds will be heard in the telephone due to a current passing through it. Hence, by inserting a break-and-make key in the circuit of the battery, coil or dynamo, the uniform noise or hum in the telephone can be cut up into periods of long and short noises, which can be made to yield the signals of the Morse alphabet. In this manner Trowbridge showed that signalling might be carried on over considerable distances by electric conduction through the earth or water between places not metallically connected. He also repeated the suggestion which Lindsay had already made that it might be possible to signal in this manner by conduction currents through the Atlantic Ocean from the United States to Europe. He and others also suggested the applicability of the method to the inter-communication of ships at sea. He proposed that one ship should be provided with the means of making an interrupted current in a circuit formed partly of an insulated metallic wire connected with the sea at both ends by plates, and partly of the unlimited ocean. Such an arrangement would distribute a...
system of flow lines of current through the sea, and these might be detected by any other ships furnished with two plates dipping into the sea at stem and stern, and connected by a wire having a telephone in its circuit, provided that the two plates were not placed on the same equipotential surface of the original current flow lines. Experiments of this kind were actually tried by Graham Bell in 1882, with boats on the Potomac river, and signals were detected at a distance of a mile and a half.

At a later date, 1891, Trowbridge discussed another method of effecting communication at a distance, viz., by means of magnetic induction between two separate and completely insulated circuits. If a primary circuit, consisting of a large coil of wire P (fig. 36), has in circuit a battery B and an interrupter or current reverser, signals can be given by breaking up the continuous hum in the telephone into long and short periods. This method of communication by magnetic induction through space establishes, therefore, a second method of wireless telegraphy which is quite independent of and different from that due to conduction through earth or water.

Sir W. H. Preece, who took up the subject about the same time as Prof. Trowbridge, obtained improved practical results by combining together methods of induction and conduction. His first publication of results was in 1882 (Brit. Assoc. Report), when he drew attention to the considerable distance over which inductive effects occurred between parallel wires forming portions of two telephonic and telegraphic circuits. Following on this he made an interesting series of experiments on telephonic and telegraphic circuits, insisting on the need of separating the primary and secondary circuits as far as possible from each other. Heaviside and Smullin devised an improved method which unites both conduction and induction as the means of affecting one circuit by a current in another. In 1892, on the Bristol Channel, he established communication between Willenborough Point and Penarth, at a point 5.5 miles apart, by placing at these positions insulated single-wire telegraphy circuits, earthed at both ends and laid as far as possible parallel to each other, the distance between them being 3-3 m. The shore wire was 1267 yds. long, and that on the island 600 yds. An interrupted current having a frequency of about 400 was used in the primary circuit, and a telephone was employed as a receiver in the secondary circuit. Other experiments in inductive telegraphy were made by Preece, aided by the officers of the British Postal Telegraph Service, in Glamorganshire in 1887; at Loch Na Keal, in the Hebrides, in 1888; and at Frodsham, on the Dee, in 1894. (See Jour. Inst. Elec. Eng., 27, p. 869.) In 1889 experiments were made at Menai Straits to put the lighthouse at the Skerries into communication with the coastguard station at Cemlyn. A wire 750 yds. in length was erected along the Skerries, and on the mainland one of 33 m. long, starting from a point opposite the Skerries, to Cemlyn. Each line terminated in an earth plate placed in the sea.

The average perpendicularly distance between the two lines, which are roughly parallel, is 2-8 m. Telephonic speech between these two circuits was found possible and good, the telephone receiving any wires in the circuits by means of mutual induction, and no doubt partly by conduction. On the question of how far the effects are due to conduction between the earth plates, and how far to true electromagnetic induction, authorities differ, some being of opinion that the two effects are in operation together. A similar installation of inductive telephony, in which telephone currents in one line were made to create others in a nearly parallel and distant line, was established in 1899 between Rathlin Island on the north coast of Ireland and the mainland. The shortest distance between the two points was 10 miles, and by various experiments in the water, it was found that conduction was the only factor. The two lines were laid between an island and the mainland parallel wire circuits earthed at each end, good telephonic communication over an average distance of 6½ m. was established between these independent circuits.

The difficulty of connecting lightships and isolated lighthouses to the mainland by submarine cables, owing to the destructive action of the tides and waves on rocky coasts on the shore ends, led many inventors to look for a way out of the difficulty by the adoption of some form of inductive or conductive telegraphy not necessitating a continuous cable. Wiloughby Smith, of the telegraphic company, explains how a submarine cable, laid with wires that are not connected to any land, can be telephonic communication. He showed an improved method which depends upon conduction through sea water. (See Jour. Inst. Elec. Eng., 27, p. 538.) It may be explained as follows:—Suppose a battery on shore to have one pole earthed and the other connected to an insulated submarine cable, the distant end of which was also earthed; if now a galvanometer is inserted anywhere in the cable, a current will be found flowing through the cable and returning by various paths through the sea. If we suppose the cable interrupted at any place, and both sides of the gap earthed by connexion to plates, then the same conditions will still hold. Communication was established by this method in the year 1895 with the lighthouse on the Fastnet. A cable is carried out from the mainland at Crookhaven for 7 m., and the outer end earthed by connexion with a copper mushroom anchor. Another earthed cable starts from a similar anchor about 100 ft. away near the shore line of the Fastnet rock, crosses the rock, and is again earthed in the sea at the distant end. If a battery on the mainland is connected through a key with the shore end of the main cable, and a speaking galvanometer is in circuit with the short cable crossing the Fastnet rock, then closing or opening the battery connexion will create a deflection of the galvanometer. A very ingenious call-bell arrangement was devised, capable of responding only to regularly reversed battery currents, but not

1See Fahie, History of Wireless Telegraphy, p. 1701 also 5th Report (1897) of the Royal Commission on Electrical Communication with Lightships and Lighthouses.
to stray "earth currents," and very good signalling was established between the mainland and the rock. Owing to the rough seas sweeping over the Fastnet, the conditions are such that any ordinary submarine cable would be broken by the wearing action of the waves at the rock boundary in a very short time. Another circuit in this department of research was arranged by C. A. Stevenson, who in 1892 advocated the use of the inductive system pure and simple for communication between the mainland and isolated lighthouses or islands. He proposed to employ two large flat coils of wire laid horizontally on the ground, that on the mainland having in circuit a battery, interrupter and key, and that on the island a telephone. His proposals had special reference to the necessity for connecting a lighthouse on Muckle Flugga, in the Shetlands, and the mainland, but were not carried into effect. Professor E. Rathenau of Berlin made many experiments in 1894 in which, by means of a conductive system of wireless telegraphy, he signalled through 3 m. of water.

Sir Oliver Lodge in 1898 theoretically examined the inductive system of space telegraphy. (See Jour. Inst. Elec. Eng., 27, p. 799.) He advocated and put in practice experimentally a system by which the primary and secondary circuits were "turned" or synchronized by including condensers in the circuits. He proved that when so synchronized the circuits are inductively respondent to each other with much less power expenditure in the primary circuit than without the syntonizing. He also considered the question of another coil and an ordinary electric bell by the accumulated effect of the properly tuned inductive impulses falling on the secondary circuit. A very ingenious call-bell or annunciator for use with inductive or conductive systems of wireless telegraphy was invented and described in 1898 by S. Evershed, and has been practically adopted at Lavernock and Flat Holme. (Id., 27, p. 532.)

In addition to the systems of wireless or space telegraphy depending upon conduction through earth or water, and the inductive system based upon the power of a magnetic field to produce this conduction, there have been certain attempts to utilize what may best be described as electrostatic induction. In 1885 Edison, in conjunction with Gilliland, Phelps, and W. Smith, worked out a system of communicating between railway stations and moving trains. At each signalling station was erected an insulated metallic surface facing and near to the ordinary telegraph wires. On one or more of the carriages of the trains were placed also insulated metallic sheets, which were in connexion through a telephone and the secondary circuit by an induction coil with the earth or rails. In the apparatus used by this arrangement it was shown that an ordinary electric bell could be actuated by the accumulation of the electric potential of the earth and the cable. At the telephone used was Edison's chalk cylinder or electromotograph type of telephone. Hence, when the coil at one fixed station was in action it generated high frequency alternating currents, which were propagated across the air gap between the ordinary telegraph wires and the metallic surfaces attached to one secondary terminal of the induction coil, and conveyed along the ordinary telegraph wires between station and moving train. Thus, in the case of one station and one moving rail circuit, when, for example, the parts of the earth, the parts of the ordinary telegraph wires at the side of the track, and partly of the circuits of the telephone receiver at one place and the secondary of the induction coil at the other, two air gaps existing in this circuit. The electromotive force of the coil is, however, great enough to create in these air gaps displacement currents which are of magnitude sufficient to be equivalent to the conduction current required to actuate a telephone. This current may be taken to be of the order of two or three micro-amperes. The signals were sent by cutting up the continuous hum in the telephone into long and short periods in accordance with the Morse code, and thus the key of the primary circuit was actuated and the key of the telegraph. This system was put into practical operation in 1887 on the Lehigh Valley railroad in the United States, and worked well, but was abandoned because it apparently fulfilled no real public want. Edison also patented (U.S.A. Pat. Spec., No. 465971, 14th May 1885) a plan for establishing at distant places two insulated elevated plates. One of these was to be connected to the earth through a telephone receiver, and the other through the secondary circuit of an induction coil in the primary circuit of which was a key. The idea was that variations of the primary current would create electromotive force in the secondary circuit which would act through the air condenser formed by the two plates. It has sometimes been claimed that Edison's proposed elevated plates anticipated the subsequent invention by Marconi of the aerial wire or antenna, but it is particularly to be noticed that Edison employed no spark gap or means for creating electrical high frequency oscillations in these wires. There is no evidence that this plan of Edison's was practically operative as a system of telegraphy.

A very similar system of wireless telegraphy was patented by Professor A. E. Dolbear in 1886 (U.S.A. Pat. Spec., No. 350290), in which he proposed to employ two batteries at two places to affect the potential of the earth at those places. At the sending station one battery was to have its positive pole connected to the earth and its negative pole to an insulated condenser. In circuit with this battery was placed the secondary circuit of an induction coil, the primary circuit of which contained a telephone transmitter or microphone interrupter. At the receiving station a telephone receiver was placed in the circuit with another insulated battery, the negative terminal of which was to be in connexion with the earth. There is no evidence, however, that the method proposed could or did effect the transmission of speech or signals between stations separated by any distance. Many other more or less imperfect devices—such as those of Mahlon Loomis, put forward in 1872 and 1877, and Kitsee in 1895—for wireless telegraphy were not within the region of practically realizable schemes.

Space or Radio-Telegraphy by Hertzian Waves.—Up to 1895 or 1896 the suggestions for wireless telegraphy which had been publicly announced or tried could thus be classified under three or four divisions, based respectively upon electrical conduction through the soil or sea, magnetic induction through space, combinations of the two foregoing, and, lastly, electrostatic induction. All these older methods have, however, been thrown into the background and rendered antiquated by inventions which have grown out of Hertz's scientific investigations on the production of electric waves. Before the classical researches of Hertz in 1886 and 1887, many observers had noticed curious effects due to electric sparks produced at a distance which were commonly ascribed to ordinary electrostatic or electro-magnetic induction. Thus Joseph Henry (Scientific Writings, vol. i. p. 203) noticed that a single electric spark about an inch long thrown on to a circuit of wire in an upper room could magnetize steel needles included in a parallel circuit of wire placed in a cellar 30 ft. below with two floors intervening. Some curious distance-phenomena connected with electric sparks were observed in 1875 by Edison (who referred them to a supposed new "aetheric force"), and confirmed by Beard, S. P. Thompson, E. J. Houston and others. D. E. Hughes made some remarkable observations and experiments in 1886 and 1887; he showed that he could transmit electric waves, not describe them till some twenty years afterwards. He discovered a fact subsequently rediscovered by others, that a tube of metallic filings, loosely packed, was sensitive to electric sparks made in its vicinity, its electrical resistance being reduced, and he was able to detect effects on such a tube connected to a battery and telephone at a distance of 500 yds. These distance effects were not understood at the time, or else were referred simply to ordinary induction. Hertz, however, made known in 1887 the experimental proofs that the discharge


of a condenser produces an electric spark which under proper conditions creates an effect propagated out into space as an electric wave. He employed as a detector of this wave a simple, nearly closed circuit of wire called a Hertz resonator, but it was subsequently discovered that the metallic microphone of D. E. Hughes was a far more sensitive detector. The peculiar action of electric sparks and waves in reducing the resistance of discontinuous conductors was rediscovered and investigated by Calzecchi Onesti,1 by Brantly,2 Dawson Turner,3 Minchin, Lodge,4 and many others. Brantly was the first to investigate and describe in 1890 the fact that an electric spark at a distance had the power of changing loose aggregations of metallic powders from poor to good electric conductors, and he also found that in some cases the reverse action was produced. Lodge particularly studied the action of electric waves in reducing the resistance of the contact between two metallic surfaces such as a plate and a point, or two balls, and named the device a 'coherer.' He constructed one form of his coherer of a glass tube a few inches long filled with iron borings or brass filings, having contact plates or pins at the end. When such a tube is inserted in series with a single voltaic cell and galvanometer it is found that the resistance of the tube is nearly infinite, provided the filings are not too tightly squeezed. On creating an electric spark or wave in the neighbourhood of the tube the resistance suddenly falls to a few ohms and the cell sends a current through it. By shaking or tapping the tube the current is extinguished. In 1894 he described a simple apparatus of this kind in which the tapping back of the tube of filings was effected automatically. He ascribed the reduction of resistance of the mass to a welding or cohering action taking place between the metallic particles, hence the name 'coherer.' But, as Brantly showed, it is not universally true that the action of an electric wave is to reduce the resistance of a tube of powdered metal or cause the particles to cohere. In some cases, such as that of peroxide of lead, an increase of resistance takes place.

Between 1894 and 1896 G. Marconi gave great attention to the improvement of devices for the detection of electric waves.

Marconi. He made his sensitive tube, or improved coherer, as follows:—A glass tube having an internal diameter of about 4 millimetres has sealed into it two silver plugs By means of platinum wires WW (fig. 37); the opposed faces of these plugs are perfectly smooth, and are placed within a millimetre of each other. The interspace is filled with a very small quantity of nickel and silver filings, about 95 per cent. nickel and 5 per cent. silver, sufficient to fill loosely about half the cavity between the plugs, which fit tightly into the tube. The tube is then exhausted of its air, and attached to a bone or glass rod as a holder. This form of electric wave detector proved itself to be far more certain in operation and sensitive made, but no one had overcome the practical difficulties or actually shown how to do it.

G. Marconi, however, made the important discovery that if his sensitive tube or coherer had one terminal attached to a metal plate lying on the earth, or buried in it, and the other to an insulated plate elevated at a height above the ground, it could detect the presence of very feeble electric waves of a certain kind originating at a great distance. In conjunction with the above receiver he employed a transmitter, which consisted of a large induction or spark coil S having its spark balls placed a few millimetres apart; one of these balls was connected to an earth plate E and the other to a plate or wire insulated at the upper end and elevated above the surface of the earth. In the primary circuit of the induction coil I he placed an ordinary signalling key K, and when this was pressed for a longer or shorter time a torrent of electric sparks passed between the balls, alternately charging and discharging the elevated conductor A1 and creating electrical oscillations (see ELECTRO-KINETICS) in the wire. This elevated conductor is now called the antenna, aerial wire, or air wire. At the receiving station Marconi connected a single voltaic cell B1 and a sensitive telegraphic relay R in series with his tube of metallic filings C, and interposed certain little coils called choking coils. The relay was employed to actuate through a local battery B2 an ordinary Morse printing telegraphic instrument M. One end of the sensitive tube was then connected to the earth and the other end to an antenna or insulated elevated conductor A2. Assuming the transmitting and receiving apparatus to be set up at distant stations (see fig. 38), the insulated wires or plates being upheld by masts, its operation is as follows:—When the key in the primary circuit of the induction coil is pressed the transmitting antenna wire is alternately charged to a high potential and discharged with the production of high frequency oscillations in it. This process creates in the space around electric waves or periodic changes in electric and magnetic force round the antenna wire. The antenna wire, connected to one spark ball of the induction coil, must be considered to form with the earth, connected to the other spark ball, a condenser. Before the spark happens lines of electrostatic force stretch from one to the other in curved lines. When the discharge takes place the ends of the lines of electric force abutting on the wire run down it and are detached in the form of semi-loops of electric force which move outwards with their ends on the surface of the earth. As they travel they are accompanied by lines of magnetic force, which expand outwards in ever-widening circles. The magnetic and electric forces are directed alternately in one direction and the other, and at distances which are called multiples of a wave length the force is in the same direction at the same time, but in the case of damped waves has not quite the same intensity. The force at any one point also varies cyclically, that is, is varying at any one point

1 Nuovo cimento, series iii. vol. xviii.
2 Comptes rendus, vols. cxi., cxxii.; see also The Electrician, xl. 1891, 166, 235, 333 and 397; xli. 487; xlii. 46 and 527; and lilii. 277.
3 Report Brit. Assoc., 1892.
4 Lodge, Signalling through Space without Wires, 3rd ed., p. 73, 1892.
6 Figures 38, 39, 41, 42, 44, 45, 46, 47, 48 and 49 are drawn from Professor J. A. Fleming's Electric Wave Telegraphy, by permission of Longmans Green & Co.
7 For a more complete account of the nature of an electric wave the reader is referred to Hertz's Electric Waves, and to the article ELECTRIC WAVE. See also The Principles of Electric Wave Telegraphy, by J. A. Fleming.
and varying from point to point. This periodic distribution in time and space constitutes an electric wave proceeding outward in all directions from the sending antenna. If we consider the lines of magnetic force in the neighbourhood of the receiving antenna wire we shall see that they move across it, and thus create in it an electric current which acts upon the coherer or other sensitive device associated with it.

**Marconi’s System of Wireless Telegraphy.**—Marconi’s system of electrical transmission consists therefore in setting up at the transmitting station the devices just described for sending out groups of damped electric waves of the above kind in long or short trains corresponding to the dash or dot signals of the Morse code. He placed in the primary circuit of the induction coil a longer or shorter time. This produced in the antenna, by the effect of the electric waves. At the receiving station he connected, as stated, one end of the sensitive tube to earth and the other to the antenna, and improved and applied a device of Popoff for automatically tapping the tube after each electric impact had rendered it conductive. He caused the relay in series with the sensitive tube to set in action not only a telegraphic instrument but also the electromagnetic tapper, which was arranged so as to administer light blows on the under side of the sensitive tube when the latter became conductive. The effect was to print a dash or dot on a strip of telegraphic paper, according as the incident electric wave lasted a longer or shorter time. In addition there was produced a slight spark from the contacts of the relay and tapper. He thus produced in 1896 for the first time an operative apparatus of electric wave telegraphy. Its simplicity and compactness recommended it immediately for communication between ship and shore and for intermarine communication generally. Marconi’s earliest experiments with this apparatus were made in Italy. In 1896 he came to England and gave demonstrations to the British postal telegraph department and other officials. These experiments were made on Salisbury Plain and others in the Bristol Channel between Lavernock and Flat Holm and Bream Down in 1897. Early in 1898 permanent stations were established between Alum Bay and Bournemouth, a distance of 143 m., where successful results were obtained. Later the Bournemouth station was removed to Poole Harbour, and the Alum Bay station to Niton in the Isle of Wight, the distance being thus increased to 20 m. In December 1898 communication was established by the Marconi method between the East Goodwin lightship and the South Foreland lighthouse, and this installation was maintained for upwards of a year, during which it was the means of saving both life and property. In March 1899 communication was effected by his system between England (South Foreland lighthouse) and France (Wimereux, near Boulogne), a distance of 30 m. He kept up the communication for 20,000 words, in all weathers, and found that ordinary commercial messages could be transmitted at the rate of 15 to 20 words a minute. In January 1901 he established communication by his new system between Cornuta and Niton in the Isle of Wight, a distance of 200 m. A full account of the development of his system was given by him in an article published in the Fortnightly Review for June 1902; see also a paper by him in the Journal of Inst. Elec. Eng., Dec., 1901, p. 727. About this time he introduced various improvements into the receiving apparatus. Instead of inserting the sensitive tube between the receiving antenna and the earth, he inserted the primary coil of a peculiar form of oscillation transformer and connected the terminals of the tube to the secondary circuit of the transformer. Lodge had previously suggested the use of transformed oscillations for acting on the coherer (see British Patent Spec., No. 11575 of 1897), but it is not every form of oscillation transformer which is suitable for this purpose.

Marconi’s successes and the demonstrations he had given of the thoroughly practical character of his system of telegraphy led to investigations in every part of the world. In Belgium many workers were under the same field of labour, whilst theorists began to study carefully the nature of the physical phenomena involved. It was seen that the effect of the incident electric waves was to produce a certain amount of electric oscillations, or in other words, high frequency alternating electric currents, such that whilst the potential variations were a maximum at the top or insulated end of the antenna, at some other point there was zero and the potential variation was zero and the current amplitude a maximum. Hence devices for detecting the oscillations in the antenna are merely very sensitive forms of ammeter and voltmeter.

We now consider the transmitting apparatus. The first stage of the transmitting part, one essential element is the antenna, aerial, or air wire, which may take a variety of forms. It may consist of a single plain or stranded copper wire upheld at the top by an insulator from a mast, chimney or building. The wire may have at the upper end a plate called a "capacity area." electrically equivalent to an extension of the wire, or part of the wire may be bent over and carried horizontally. In many cases multiple antennae are used consisting of many wires arranged in cone or umbrella-rib fashion, or a metal roof or metallic chimney may be employed (see fig. 39). In any case the antenna serves as one surface of a condenser, the other surface of which is the earth. This condenser is charged electrically and then suddenly discharged and violent electrical oscillations are set up in it, that is to say, electricity rushes to and fro between the antenna and the earth. This creates rapid variations in electric and magnetic force round the antenna and detaches energy from it in the form of an electric wave. The antenna has at one moment a static electrical charge distributed upon it, and lines of electric force stretch from it to the surrounding earth. At the next instant it is the seat of an electric current and is surrounded by closed lines of magnetic force. These static and kinetic conditions succeed each other rapidly, and the result is to detach or throw off from the antenna semi-loops of electric force, which move outwards in all directions and are accompanied by expanding circular lines of magnetic force. The whole process is exactly analogous to the operation by which a violin string or organ pipe creates an air or sound wave. The violin string is first drawn on one side. This strain corresponds to the electrical charging of the antenna. The string is then suddenly released. This corresponds to the electrical discharge of the antenna, and the subsequent string vibrations to the electrical vibrations. These communicate their energy to the surrounding air, and this energy is conveyed away in the form of air waves.

There are three ways in which the antenna may be charged:—

(i) It may be separated from the earth by a pair of spark balls which are connected respectively to the terminals of an induction coil or transformer, or other high tension generator. If these spark balls are set at the right distance, then when the potential difference accumulates the antenna will be charged and at some stage suddenly discharged by the discharge leaping across the spark gap. This was Marconi’s original method, and the plan is still used under the name of the direct method of excitation or the plain antenna.

(ii) The antenna may have oscillations excited in it inductively. F. Braun suggested in 1898 that the oscillatory discharge of a Leyden jar should be sent through the primary coil of a transformer and the secondary coil should be interposed between the antenna and the earth connexion. Marconi’s practical utility to this idea by tuning the two circuits together, and the arrangement now employed is as follows:—A suitable condenser C, or battery of Leyden jars, has one coating connected to one spark ball and the other through a coil of one turn with the other spark ball of a discharging S. These spark balls are connected either to the secondary circuit of an induction coil 1, or to that of an alternating current transformer having a secondary voltage of 20,000 to 100,000 volts. Over the coil of one turn is wound a secondary circuit of many turns of many wires connected to the earth through a variable inductance and the other end to an antenna or radiating wire A (see fig. 40). These two circuits are so adjusted that the closed oscillation circuit, consisting of the condenser, primary coil

1 See German Patent of F. Braun, No. 111578 of 1898, or British Specification, No. 1805 of 1899.

2 See British Pat. Spec., G. Marconi, No. 7777 of 1900.
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and spark gap, has the same natural time period of oscillation as the open circuit consisting of the antenna, secondary coil, and adjustable inductance. When this is the case, if discharges are made across the spark gap oscillations are excited in the closed circuit, and these induce other syntonie oscillations in the antenna circuit. J. A. Fleming devised an arrangement in which a multiple transformation takes place, two oscillation circuits being interlinked inductively, and the last one acting inductively on the open or antenna circuit. J. S. Stone similarly devised a multiple inductive oscillation circuit with the object of forcing on the antenna circuit a single oscillation of definite frequency. In the case of the inductive mode of exciting the oscillations an important quantity is the coefficient of coupling of the two oscillation circuits. If \( L_1 \) and \( L_2 \) are the inductances of any two circuits which have a coefficient of mutual inductance \( M \), then \( M/\sqrt{(L_1L_2)} \) is called the coefficient of coupling of the circuits and is generally expressed as a percentage. Two circuits are said to be closely coupled if the coefficient of coupling is near unity and to be loosely coupled if it is very small. It can be shown that if two circuits, both having capacity \( C \) and inductance \( L \), are coupled together inductively, then, when oscillations are set up in one circuit, oscillations of two periods are excited in the other differing in frequency from each other and from the natural frequency of the circuit if the two circuits are in tune so that the numerical product of capacity and inductance of each circuit is the same or \( CL_1 = CL_2 + CL \), and if \( k \) is the coefficient of coupling then the natural frequency of each circuit is \( n = 1 + k^2 \) and \( n = n/\sqrt{(1 + k)} \). Since in all cases of

wave motion the wave-length \( \lambda \) is connected with the frequency \( n \) and the velocity of propagation \( v \) by the relation \( v = \lambda n \); it follows that from such an inductively coupled tuned antenna electric waves of two wave-lengths are sent out having lengths \( \lambda_1 \) and \( \lambda_2 \) such that \( \lambda_1 = \lambda \sqrt{(1 - k)} \) and \( \lambda_2 = \lambda \sqrt{(1 + k)} \), where \( \lambda \) is the natural wave-length. It is seen that as the coupling \( k \) becomes small these two wave-lengths coalesce into one single wave-length. Hence there are advantages in employing a very loose coupling.

(iii) The antenna may be direct-coupled to the closed oscillatory circuit in the manner suggested by F. Braun, A. Slaby and O. Lodge. In this case a closed condenser circuit is formed with a battery of Leyden jars, an inductance coil and a spark gap, and oscillations are excited in it by discharges created across the spark gap by an induction coil or transformer. One end of the inductance coil is connected to the earth, and some other point on the closed condenser circuit to an antenna of appropriate length. When oscillations are created in the closed circuit syntonie oscillations are created which are increased considerably, and are propagated from the earth. In many cases additional condensers or inductance coils are inserted in various places so that the arrangement is somewhat disguised, but by far the larger part of the electric wave wireless telegraphy in 1907 was effected by transmitters having antennae either inductively or directly coupled to a closed condenser circuit containing a spark gap.

In practical wireless telegraphy the antenna generally a collection of wires in fan shape upheld from one or more masts or wooden towers. Sometimes the prolongations of these wires are carried horizontally or dipped down so as to form an umbrella antenna (fig. 42). The lower ends of these wires are connected through the secondary coil of an oscillation transformer to an earth plate, or to a large conductor placed on or near the earth called a "balancing capacity." If the direct coupling is adopted then the lower end of the antenna is connected directly to the earth. The main capacity in this last circuit consists of a battery of Leyden jars or of Leyden plates immersed in oil or some form of air condenser, and the inductance coil or primary circuit of the oscillation transformer consists of a few turns of highly insulated wire wound on a frame and immersed in oil. The oscillations are controlled either by a key inserted in the primary circuit of the exciting induction coil or transformer, or by a key cutting in and out of the primary condensers or throwing inductance in and out of the closed oscillation circuit. In one of these ways the oscillations can be created or stopped at pleasure in the radiating antenna, and hence groups of electric waves thrown off at will.

Production of Electric Waves of Large Amplitude.—In creating powerful electric waves for communication over long distances it is necessary to employ an alternating current transformer (see Transformers) supplied with alternating currents from a low frequency alternator D driven by an engine to charge the condenser (fig. 43). The transformer \( T_1 \) has its secondary or high-pressure terminals connected to spark balls \( S_1 \), which are also connected by a circuit consisting of a large glass plate condenser \( C_1 \) and the primary circuit of an air-core transformer \( T_2 \), called an oscillation transformer. The secondary circuit of this last is either connected between an aerial \( A \) and the earth \( E \), or it may be again in turn connected to a second pair of spark balls \( S_2 \) and these again to a second condenser \( C_2 \), oscillation transformer \( T_3 \), and the aerial \( A \). In order to produce electric oscillations in the system, the first or alternating current transformer must charge the condenser connected to its secondary terminals, but must not produce a permanent electric arc between the balls. Various devices have been suggested for extinguishing the arc and yet allowing the condenser oscillatory discharge to take place. Tesla effected this purpose by placing the spark balls transversely in a powerful magnetic field. Elihu Thomson blows on the spark balls with a powerful jet of air. Marconi causes the spark balls to move rapidly past each other or causes a studded disk to move between the spark balls. J. A. Fleming devised a method which has practical advantages in both preventing the arc and permitting the oscillatory currents to be controlled so as to make electric wave signals. He inserts in the primary circuit of the alternating

1 See J. S. Stone, U.S.A. Pat. Spec., Nos. 714756 and 714831.
adjust the frequency so that it has the value of the normal time period of the circuit formed of the condenser and transformer secondary circuit, and thus it is possible to obtain complete oscillatory discharges free from any mixture with alternating current arc. In this manner the condenser discharge can be started or stopped at pleasure, and long and short discharges made in accordance with the signals of the Morse alphabet by manipulating the short-circuiting key of one of the choking coils (see British Patent Spec., Nos. 18865, 20576 and 22126 of 1900, and 3451 of 1901).

In the case of transmitters constructed as above described, in which the effective agent in producing the electric waves radiated is the sudden discharge of a condenser, it should be noticed that what is really sent out is a train of damped or decaying electric waves. When electric oscillations are set up in an open or closed electric circuit having capacity and inductance, and left to themselves, they die away in amplitude, either because they dissipate their energy as heat in overcoming the resistance of the circuit, or because they radiate it by imparting wave motion to the surrounding ether. In both cases the amplitude of the oscillations decreases more or less rapidly. Such a sequence of decreasing electric oscillations and corresponding set of waves is called a damped train. In the case of the plain or directly excited antenna the oscillations are highly damped, and each wave probably only consists of most of a dozen oscillations. The reason for this is that the capacity of a simple antenna is very small—it may be something of the order of 0-0002 of a microfarad—and hence the energy stored up in it even under a high voltage is also small. Accordingly this energy is rapidly dissipated and but few oscillations can take place. If, however, the antenna is inductively or directly coupled to a condenser circuit of large capacity then the amount of energy which can be stored up before discharge takes place is very much greater, and hence can be drawn upon to create prolonged or slightly damped trains of waves. Allusion is made below to recent work on the production of undamped trains of electric waves.

Receiving Arrangements.—Before explaining the advantages of such oscillatory trains it will be necessary to consider the usual forms of the receiving apparatus. This consists of a receiving antenna similar to the sending antenna, and in any wireless telegraph station it is usual to make the one and the same antenna do duty as a receiver or sender by switching it over from one apparatus to the other. The electric waves coming through space from the sending station strike against the receiving antenna and set up in it high frequency alternating electrromotive forces. To detect these currents some device has to be inserted in the antenna circuit or else inductively connected with it which is sensitive to high frequency currents. The devices used for this purpose may be divided into two classes: (i) potential operated detectors, and (ii) current operated detectors. The oldest of the class (i) is that generically known as a coherer, the construction of which we have already described. The ordinary forms of metallic filings coherer of the Brany type require tapping to bring them back to the high resistance or sensitive condition. Lodge arranged a mechanical taper for the purpose which continually administered the small blow to the tube sufficient to keep the filings in a sensitive condition. Popoff employed an electromagnetic taper, in fact the mechanism of an electric bell with the gong removed, for this purpose. Marconi, by giving great attention to the details, improved the electromagnetic taper and, combining it with his improved form of sensitive tube, made a telegraphic instrument as follows: the small glass tube, containing nickel and silver filings between two silver plugs, was attached to a bone holder, and under this was arranged a small electromagnet having a vibrating armature like an electric bell carrying on it a stem and hammer. This hammer is arranged so that when the armature vibrates it gives little blows to the underside of the tube and shatters the fillings. By means of several adjusting screws the force and frequency of these blows can be exactly regulated. In series with the tube is placed a single voltaic cell and a telegraphic relay, and Marconi added certain coils placed across the spark contacts of the relay to prevent the local sparks affecting the coherer. The relay itself served to actuate a Morse printing telegraph by means of a local battery. This receiving apparatus, with the exception of the Morse printer, was contained in a sheet-iron box, so as to exclude it from the action of the sparks of the neighbouring transmitter. In the course of experiments Marconi connected the sensitive tube in between the receiving antenna and the earth plate, but, as already mentioned, in subsequent forms of apparatus he introduced the primary coil of a peculiar form of oscillation transformer into the antenna circuit and connected the ends of the sensitive tube to the terminals of the secondary circuit of this "jigger" (fig. 44). In later improvements the secondary circuit of this jigger was interrupted by a small condenser, and the terminals of the relay and local cell were connected to the plates of the condenser, whilst the sensitive tube was attached to the other end of the secondary circuit. Also another condenser was added in parallel with the sensitive tube.

With this apparatus some of Marconi's earliest successes, such as telegraphing across the English Channel, were achieved, and telegraphic communication at the rate of fifteen words or so a minute established between the East Goodwin lightship and the South Foreland lighthouse, also between the Isle of Wight and the Lizard in Cornwall. It was found to be peculiarly adapted for communication between ships at sea and between ship and shore, and a system of regular supermarine communication was put into operation by two limited companies, Marconi's Wireless Telegraph Company and the Marconi International Marine Communication Company. Stations were established on various coast positions and ships supplied with the above-described apparatus to communicate with each other and with these stations. By the end of 1901 this radio-telegraphy had been established by Marconi and his associates on a secure industrial basis.

Various Forms of Wave Detectors or Receivers.—The numerous adjustments required by the taper and the inertia of the apparatus prompted inventors to seek a self-restoring coherer which should not need tapping. Castelli, a petty officer in the Italian navy, found that, if a small drop of mercury was contained in a glass tube between a plug of iron and carbon, with certain adjustments, the arrangement was non-conductive to the current from a single cell but became conductive when electric oscillations passed through it. Hence the following appliance was worked out by Lieutenant Solarj and officers in the Italian navy. The tube provided with certain screw adjustments had a glass bulb, a cell and a telephone placed in series with it, and one end of the tube was connected to the earth and the other end to a receiving antenna. It was then found that when electric waves fell on the antenna a sound was heard in the telephone as each wave train passed over it, so that if the wave trains endured for a longer or shorter time the sound in the telephone was of corresponding duration. In this manner it was possible to hear a flash of light on the horizon in the telephone. This method of receiving soon came to be known as the telephonic method. Lodge, Muirhead and Robinson also devised a self-restoring coherer as follows:—A small steel wheel with a sharp edge was kept revolving by a clockwork so that its edge continually cut through a globule of mercury covered with paraffin oil. The oil film prevented

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1 See "Electrical Review," 1902, 51, p. 968.
3 See *British Pat. Spec.*, Lodge and others, No. 13521 of 1902.
A third class of electric wave detector depends upon the power of electric oscillations to annul the electrolytic polarization of a sensitive cell, and it is a very simple device. A vessel of nitric acid are placed a large platinum plate and a platinum electrode of very small surface such that produced when an electric wave passes through the electrolytic cell so that the fine wire is the anode or positive pole, then the small surface will be polarized or covered with a film of electrolytically dissolved material, which increase the resistance of the electrolytic cell. If, however, one electrode of this cell is connected to the earth and the other remains antenae, then electric waves allowed to fall on the antenna, the oscillations passing through the electric cell will remove the polarization and temporarily decrease the resistance of the cell. This may be detected by putting a telephone in series with the electrolytic cell, and then on the impact of the electric waves a sound is heard in the telephone due to the sudden increase in the current through it. Such receivers were devised by R. A. Fessenden,\(^12\) and it is known as electrolytic detectors.

Discussions have taken place as to the theory of the operations in them, in which some have advocated a thermal explanation and others a chemical explanation. To V. Lessing, Ann. der Phys., 1904, 15, p. 193, and J. E. Ives, Electrical World of New York, December 1904.

A third class of wave detector comprises the thermal detectors which operate in virtue of the fact that electric oscillations create heat in a fine wire through which they pass. One form such a detector takes is the bolometer. If a loop of very fine platinum wire, prepared by the Wollaston process, is included in an exhausted glass bulb like an incandescent lamp, then when electric oscillations are sent through it its resistance is increased. This increase may be made evident by making the loop of wire arm of a Wheatstone bridge and arranging the circuits that the oscillations pass through the fine wire. H. Rubens and Ritter in 1890 (Wied. Ann., 1890, 40, p. 56) employed an arrangement as follows: Four fine platinum or gold wires were joined in lozenge shape, and two of these sets of R and S were connected up with two resistances P and Q to form a bridge with a galvanometer G and battery B. To one of these sets of fine wires an antenna A and earth connexion E is added (fig. 47) and when electric waves fall on A they excite oscillations in the fine wire resistance R and increase the resistance, and so upset the balance of the bridge and cause the galvanometer to deflect. Such a bolometer is known as a resistance bridge. A similar instrument has been used by C. Tisson (Comptes rendus, 1904, 137, p. 846) and others as a receiver in electric wave telegraphy.

Fessenden employed a simple fine loop of Wollaston platinum wire in series with a telephone and shunted voltaic cell, so that when electric oscillations passed through the fine wire its resistance was increased and the current through the telephone suddenly diminished. A. A. Popoff, U.S.A. Pat. Spec., No. 706742 and No. 706744 of 1902. I. Klemencic devised a form of thermal receiver depending on thermo-electricity. A pair of fine wires of platinum and constantan are twisted together in the middle, and one pair of these wires are connected to a galvanometer. If then oscillations are sent through the other pair heat is produced at the junction and the galvanometer indicates a thermo-electric current (Wied. Ann., 1904, 45, p. 75). Another thermo-receiver was made vastly more sensitive by W. Duddell (Phil. Mag., 1904, 8, p. 91). He passed the oscillations to be detected through a fine wire or strip of gold leaf, and over this, but just not touching, suspended a loop of bismuth-antimony wire, and the loop was adapted to move in a very strong magnetic field, and when one junction was heated by radiation and convection from the heating wire the loop was deflected.

teled regularly traversed by a current and detected in the field. Its deflection was observed by an atherometer.

Another form of thermolectric receiver has been devised by J. A. Fleming (Phil. Mag., December 1906) as follows:—It consists of two glass vessels like test tubes one inside the other, the space between the two being exhausted and then filled with four copper strips having platinum wires at their ends sealed through the glass. In the inner space between the test tubes one pair of these platinum wires are connected to a galvanometer, and when electric oscillations are sent through the fine wire they cause a deflection of this galvanometer (fig. 48). The thermal detectors are especially useful for the purpose of giving a very sensitive indication of the number of oscillations passing through the hot wire. On the other hand, the coherer or loose contact detectors are chiefly affected by the initial value of the electromotive force acting on the junction during the train of oscillations, and the magnetic detectors by the initial value; the current. and also to a considerable extent by the number of oscillations during the train. Hence the coherer type of detectors are called integral current detectors, whilst thermal are called integral current detectors, the current detectors depending entirely or to some extent upon the magnitude of oscillations of current, and is to say, upon the number of oscillations forming a train.

The fifth type of wave detector depends upon the peculiar property of rarefied gases or vapours which under some circumstances possess a unidirectional conductivity. Thus J. A. Fleming invented in 1904 a detector which can detect an oscillating current of electricity. The apparatus was as follows: A small carbon filament incandescent lamp has a platinum plate or cylinder placed in it surrounding or close to the filament. This plate is supported by a platinum wire sealed through the glass. Fleming discovered that if the filament is made incandescent by the current from an insulated battery there is a unidirectional conductivity of the rarefied gas between the hot filament and the metal plate, such that if the negative terminal of the filament is connected outside the lamp a current flows through the vacuum space. This phenomenon is connected with the fact that incandescent bodies, especially in rarefied gases, throw off or emit electrons or gaseous negative ions.

The first use of this device was first used by Fleming as a receiver for wireless telegraph purposes in 1904 as follows:—In between the receiving antenna and the earth is placed the primary coil of an oscillation transformer; the secondary circuit of this transformer consists of a galvanometer in series with it, and the two together are joined between the external negative terminal of the carbon filament of the above-described lamp and the insulated platinum plate. When this is the case oscillations set up in the antenna will cause a continuous current to flow through the galvanometer, the lamp acting as a valve to stop all those electric oscillations in one direction and only permit the opposite one to pass (fig. 49). Weinhold discovered that the same effect could be produced by using instead of a carbon filament a platinum wire coated with the oxides of calcium or barium, which when incandescent have the property of copiously emitting negative ions. Another form of the detector depends upon the property of rarefied gases and vapours. A highly insulated tube contains a little mercury, which is used as a negative electrode, and the tube also has sealed through the glass a platinum wire carrying a hot iron plate as an anode. A current conducted from an electric battery is passed through the tube, and can be used to filter off all those oscillations in a train which pass in one direction and make them readable on an ordinary galvanometer. In addition to the above gaseous rectifiers of oscillations it has been found that some crystals, such as carboborundum (carbide of silicon), hessite, anastase and many others possess a unidirectional conductivity and enable us to rectify trains of oscillations into continuous currents which can affect a telephone.

Also several contacts, such as that of galena (sulphide of lead) and plumbago, and molybdenite and copper possess similar powers, and can be used as detectors in radio-telegraphy. See G. W. Pierce, The Physical Review, July 1907, March 1909, on crystal rectifiers for electric oscillations.

**Syntonic Electric Wave Telegraphy.**—If a simple receiving antenna as above described is set up with an oscillation-detecting device attached to it, we find that it responds to incident electric waves of almost any frequency or damping provided that the magnetic force of the wave is perpendicular to the antenna, and of sufficient intensity. This arrangement is called a non-syntonic receiver. On the other hand, if a closed oscillation circuit is constructed having capacity and considerable inductance, then oscillations can be set up in it by very small periodic electromotive forces provided these have a frequency exactly agreeing with that of the condenser circuit. This last circuit has a natural frequency of its own which is numerically measured by $\frac{1}{2\pi}\sqrt{CL}$, where $C$ is the capacity of the condenser and $L$ is the inductance of the circuit. The problem of syntonic electric wave telegraphy is then to construct a transmitter and a receiver of such kind that the receiver will be affected by the waves emitted by the corresponding or syntonic transmitter, but not by waves of any other wavelength or by irregular electric impulses due to atmospheric electricity. It was found that to achieve this result the transmitter must be so constructed as to send out prolonged trains of slightly damped waves. Electric-radiative circuits like thermal radiators are divided into two broad classes, good radiators and bad radiators. The good electric radiators may be compared with good thermal radiators, such as a vessel coated with lamp black on the outside, and the bad electric radiators to poor thermal radiators, such as a silver vessel highly polished on its exterior. When electric oscillations are set up in these two classes of electric radiators, the first class send out a highly damped wave train and the second a feeble damped wave train provided that they have sufficient capacity or energy storage and low resistance. A radiator of this last class can be constructed by connecting inductively or directly an antenna of suitable capacity and inductance to a nearly closed electric circuit consisting of a condenser of large capacity, a spark gap and an inductance of low resistance. When oscillations are excited in this last circuit they communicate to the antenna provided this last circuit is joined or sympathized to the closed circuit, and the radiating antenna has thus a large store of energy to draw upon and can therefore radiate prolonged trains of electric waves. The above statements, though correct as far as they go, are an imperfect account of the nature of the radiation from a coupled antenna, but a mathematical treatment is required for a fuller explanation.

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wave trains; but, although other patentees have suggested the same plan, the author is not aware that any such success has attended the practice. In Marconi's practice, the principal problem of isolation in connexion with wireless telegraphy stations was given by Anders Bull (Electrician, 1901, 46, p. 573). Very briefly stated, his method consists in sending out syntonized wave trains at certain irregular but assigned intervals of time to constitute the simplest signal equivalent to a dot in the Morse code, and a sequence of such trains, say three following one another, to constitute the dash in that code. The apparatus is very complicated and can only be understood by reference to very detailed diagrams. (See Principles of Electric Wave Telegraphy, by J. A. Fleming, 1906, sect. 13, chap. VIII.) By means of the Anders Bull system several messages can be sent simultaneously from different transmitters and received independently and simultaneously upon corresponding receivers, while no ordinary non-electric or other receiver is able to obscure the messages being sent to the Anders Bull receivers or to interpret those that may be picked up. Although complicated the apparatus seems to work fairly well.

**Practical Electric Wave Telegraphy.**—At this stage it may be convenient to outline the progress of electric wave telegraphy since 1899. Marconi's success in bridging the English Channel at Easter in 1899 with electric waves and establishing practical wireless telegraphy between ships and the shore by this means drew public attention to the value of the new means of communication. Many investigators were thus attracted into this field of research and invention. In Germany A. Slaby and F. Braun were the most active. Slaby paid considerable attention to the study of the phenomena connected with the production of the oscillations in the antenna. He showed that in a simple Marconi antenna the variations of the potential are maximum at the insulated top and a minimum at the base, whereas the present methods of development we find that in 1898 Professor F. Braun showed that oscillations suitable for the purposes of electric wave creation in wireless telegraphy could be set up in a circuit consisting of a Leyden jar or jars, a spark gap and an inductive circuit, and communicated to an antenna either by inductive or direct action. The apparatus is shown in fig. 50. When the methods for effecting this had been worked out practically it finally led to the inventions of Slaby, Braun and others being united into a system called the Telefunken system, which, as regards the transmitter, consisted in forming a closed oscillation circuit comprising a condenser, spark gap and inductance which at one point was attached either directly or through a condenser to the earth or to an equivalent balancing capacity, and at some other point to a suitably tuned antenna. The receiving arrangements comprised also an open or antenna circuit connected directly with a closing out or inductance circuit, but in place of the spark gap in the transmitter an electrolytic receiver was inserted, having in connexion with it as indicator a voltaic cell and telephone. In this manner the signals are read by ear. In the same way the arrangements finally elaborated by Lodge and Muirhead consisted of a direct coupled antenna and nearly closed condenser circuit, and a similar receiving circuit containing as a detector the steel wheel revolving on oily mercury which actuated a siphon recorder writing signals on paper tape. Arrangements not very different in general principle were put into practice in the United States by Possendieck and de Forest and others.

Hence it will be seen that the difference between various forms of the so-called spark systems of wireless telegraphy is not very

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The success so far achieved in isolating electric wave telegraphic stations has been based upon the principles of electric resonance and the fact that electric oscillations can be set up in a circuit having capacity and considerable inductance by feeble electromagnetic impulses, provided they are of exactly the natural frequency of the said circuit. We may illustrate the matter as follows: A heavy pendulum possesses inertia and the property of being displaced from a position of rest but tending to return to it. These mechanical qualities correspond to inductance and capacity in electric circuits. Such a pendulum can be set in vigorous vibration even by feeble puffs of air directed against it, provided these are administered exactly in time with the natural period of vibration of the pendulum.

Although inventors had more or less clearly grasped these principles they were first embodied in practice in 1900 by G. Marconi in an operative system of syntonic wireless telegraphy. His transmitter consists of a nearly closed oscillating circuit comprising a condenser or battery of Leyden jars, a spark gap, and the primary coil of an oscillation transformer consisting of one turn of thick wire wound on a wooden frame. Over this primary is wound a secondary circuit of five to ten turns which has one end connected to the earth through a variable inductance coil and the other end to an antenna. The two circuits are sympathized so that the closed or condenser circuit and the open or antenna circuit are adjusted to have, when separate, the same natural electrical time of vibration. The receiving arrangement consists of an antenna which is connected to earth through the primary coil of an oscillation transformer and a variable inductance. The secondary circuit of this transformer is cut in the middle and has a condenser inserted in it, and its ends are connected to the sensitive metallic filaments of a coherer as shown in fig. 50. This receiver therefore, like the transmitter, consists of an open and a closed electric oscillation circuit inductively connected together; also the two circuits of the receiver must be sympathized or tuned both to each other and to those of the transmitter. When this is done we have a syntonic system which is not easily affected by electric waves of other than the right period or approximating thereto. Marconi exhibited in October 1900 this apparatus in action, and showed that two or more receivers of different tunings could be connected to the same antenna and made to respond separately and simultaneously to the action of separate but tuned transmitters. A. Slaby in Berlin shortly afterwards made a similar exhibition of syntonic electric wave telegraphy. O. Lodge had previously described in 1897 a syntonic system of electric wave telegraphy, but it had not been publicly seen in operation prior to the exhibitions of Marconi and Slaby. Lodge was, however, fully aware that it was necessary for syntonic telegraphy to provide a radiator capable of emitting sustained trains of waves. His proposed radiator and absorber consisted of two wing-shaped plates of copper, the transmitter plates being interrupted in the centre by a spark gap, and the receiver plates by an inductive coil from the ends of which connections were made to a coherer. At a later date a syntonic system comprising, as above stated, an antenna directly coupled to a resonant closed condenser, was put into operation by Lodge and Muirhead, and much the same methods have been followed in the system known as the Telefunken system employed in Germany.

A method of telegraphic telephony proposed by A. Blondel (Comptes rendus, 1900, 130, p. 1383) consisted in creating a syntonized gap between the frequency of the oscillations in the sender and receiver circuits but between the groups of oscillations constituting the
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great. All of them make use of Marconi’s antenna in some form both at the transmitting and receiving ends and make use of an earth connexion, or its equivalent in the form of a balancing capacity or large surface having capacity with respect to the earth, which merely means that they insert a condenser of large capacity in the same way as they couple the transmitting antenna directly or inductively to a capacity-inductive circuit serving as a storage of energy, and all of them create thereby electromagnetic oscillations of the same type moving over the earth’s surface with the magnetic force of the wave parallel to it. At the receiving station the differences in these systems depend chiefly upon variation in the actual form of the oscillation detector used, whether it be a loose contact or a thermal, electrolytic or magnetic detector.

In July and August 1899 the Marconi system of wireless telegraphy was tried for the first time during British naval manœuvres, and the two cruisers, “Junio” and “Europe,” were fitted with the new means of communication. The important results obtained showed that a weapon of great power had been provided for assisting naval warfare. From and after that time the British Admiralty and the navies of other countries began to give great attention to the development of electric wave telegraphy.

Transatlantic Wireless Telegraphy.—Having found that the principles of resonance could be successfully applied so as to isolate wireless telegraph receivers, Marconi turned his attention to the accomplishment of his great ambition, viz. Transatlantic wireless telegraphy, which he was able to immediately increase the speed of transmission without difficulty by electric waves from the Isle of Wight to the Lizard, viz. 200 m., and he considered that the time had come for a serious attempt to be made to communicate across the Atlantic. A site for a first Transatlantic electric wave power station was secured at Poldhu, near Mullion in south Cornwall, by the Marconi Company, and plans arranged for an installation. Up to that time an induction coil known as a 10-inch coil had sufficed for spark production, but it was evident that much more power would be required to send electric waves across the Atlan-tic. At St. John’s in Newfoundland he erected a temporary transmitting electrode and a condenser, and at Cape Breton these high tension transmitters were used to charge condensers and set up powerful oscillations in a multiple antenna. The special electrical engineering arrangements employed at the outset for this first electric wave power station required to create the oscillations of the desired power were designed for Marconi by J. A. Fleming, but the arrangements were subsequently altered and improved by Marconi, one of the most important additions being a form of high-speed rotating disk discharger devised by Marconi, which he was able to immediately increase the speed of transmission. The first antenna employed consisted of 50 bare copper wires 200 ft. long, arranged in fan-shape and upheld between two masts. Subsequently this antenna was enlarged, and four wooden lattice towers were built, 215 ft. high and 200 ft. apart, sustaining a conical antenna comprised of 400 wires (see G. Marconi, Proc. Roy. Inst., 1902, 17, p. 208). This transmitting plant was completed in December 1901, and Marconi then crossed the Atlantic to Newfoundland and began to make experiments to ascertain if he could detect the waves emitted by it. At St. John’s in Newfoundland he erected a temporary receiving antenna consisting of a wire 400 ft. long upheld by a box kite, and, employing a sensitive coherer and telephone as a receiver, he was able, on December 12, 1901, to hear “S” signals on the Morse code, consisting of three dots, which he had arranged should be sent out from Poldhu at stated hours, according to a preconcerted programme, so as to leave no doubt they were electric wave signals sent across the Atlantic and not accidental atmospheric electric disturbances. This result created a great sensation, and proved that Transatlantic electric telegraphy was quite feasible and not inhibited by distance, or by the earth’s curvature, even over a very great circle 3000 m. in length. In a repetition of this experiment at the end of February 1902 Marconi, on board the s.s. “Philadelphia,” received wireless messages printed on the ordinary Morse tape at a distance of 1557 m. from the sending station at Poldhu, and also received the letter “S” at a distance of 2009 m. from the same place. In the course of this voyage he noticed that the signals were received better during the night than the daytime, legible messages being received on a Morse printer only 700 m. by day but 1500 by night.

The appliances in the Poldhu station were subsequently enlarged and improved by Marconi, and corresponding power stations erected at Cape Cod, Massachusetts, U.S.A., and at Cape Breton in Nova Scotia. In 1902 Marconi was able to transmit a large number of messages across the Atlantic, receiving them by means of his magnetic detector. In the same year numerous experiments were tried with the assistance of an Italian battleship, the “Carlo Alberto,” lent by the Italian government, and messages were transmitted from Poldhu to Kronstadt, to Spezia, and also to Sydney in Nova Scotia. In 1903 having been raised whether the powerful electric waves sent out from these stations would not interfere with the ordinary ship to shore communication, special demonstrations were made by Marconi before the writer, and later before British naval officers, to demonstrate that this was not the case. In 1904 a regular system of communication of press news and private messages from the Poldhu and Cape Breton stations to Atlantic liners in mid-Atlantic was inaugurated, and daily newspapers were thenceforth printed on board these vessels, news being supplied to them daily by electric wave telegraphy. By the middle of 1905 a very large number of vessels had been equipped with the Marconi short distance and long distance wireless telegraph apparatus for intercommunication and reception of messages from power stations on both sides of the Atlantic, and the chief navies of the world had adopted the apparatus. In 1904, during the Russo-Japanese war, war news was transmitted for The Times by wireless telegraphy, the enormous importance of which in naval strategy was abundantly demonstrated.

As the power station at Poldhu was then fully occupied with the transmission of a substantial number of messages, and the Marconi Company began to erect another large power station to Marconi’s designs, at Clifden in Connemara on the west coast of Ireland. This station was intended for the Transatlantic service in correspondence with a similar station at Glace Bay in Nova Scotia. It was completed in the summer of 1907, and on the 17th of October 1907 press messages and private messages were sent across the Atlantic in both directions. The station was opened shortly afterwards for public service, on the rates being greatly below that then current for the cable service.

The service was, however, interrupted in August 1909 by a fire, which destroyed part of the Glace Bay station, but was re-established in April 1910.

Meanwhile other competitors were not idle. The inventions of Slaby, Braun and others were put into practice by a German wireless telegraph company, and very much work done in erecting land stations and equipping ships. In France the scientific study of the subject was advanced by the work of Blondel, Tissot, Ducretet and others, and systems called wireless telegraphy were put into operation. In the United States the most active workers and patentees at this period were R. A. Fessenden, Lee de Forest, J. S. Stone, H. Shoemaker and a few others. In England, in addition to the Marconi Company, the Lodge-Muirhead Syndicate was formed to operate the inventions of Sir Oliver Lodge and Dr Muirhead.

Directive Telegraphy.—A problem of great importance in connexion with electric wave telegraphy is that of limiting the radiation to certain directions. A vertical transmitting antenna sends out its waves equally in all directions, and these can be equally detected by a suitable syphon or other receiver at all points on the circumference of a circle described round the transmitter. This, however, is a disadvantage. What is required is some means for localizing and directing a beam of radiation. The first attempts involved the use of mirrors. Hertz had shown that the electric radiation from an oscillator

could be reflected and converged by cylindrical parabolic mirrors. He operated with electric waves two or three feet in wave-length. Experiments precisely analogous to optical ones can be performed with somewhat shorter waves. Marconi in his first British patent (No. 12059 of 1896) brought forward the idea of focusing a beam of diverging electric waves by parabolic mirrors on a distant station by means of parabolic mirrors, and tried this method successfully on Salisbury Plain up to a distance of about a couple of miles. As, however, the wave-length necessary to cover any considerable distance must be at least 200 or 300 ft., it becomes impracticable to employ mirrors for reflection. The process of reflection in the case of a wave motion involves the condition that the wave-length shall be small compared with the dimensions of the mirror, and hence the attempt to reflect and converge electric waves 1000 ft. in length by any mirrors which can be practically constructed would be like attempting optical experiments with mirrors one-hundred-thousandth of an inch in diameter.

Another closely connected problem is that of locating or ascertaining the direction of the sending station. To deal with the latter question first, one of the earliest suggestions was that of J. S. Stone (U.S.A. Pat. Spec., Nos. 716134 and 716135, also reissue No. 12148), who proposed to place two receiving antennae at a distance of half a wave-length apart. If these were widely on to the direction of the sending station on the shorter side, phase would be produced in the wave, but if they were in line with it then the oscillations would be in opposite phases. It was then proposed to arrange a detector so that it was affected by the algebraic sum of the two oscillations, and by swivelling round the double receiving antennae to locate the direction of the sending station by finding out where the detector gave the best signal. Even if the proposal had been practicable with waves 1000 or 2000 ft. in length, which it is not, it is essentially based upon the supposition that the damping of the waves is negligible. A proposal was made by L. Poulsen (Eng. Pat. Spec., No. 771858) to employ a receiving antenna consisting of vertical wires held in a frame which could be swivelled round into various positions and used to locate the position of the sending station by ascertaining the position in which the frame must be placed to create in it the maximum oscillatory current. Other inventors had professed to find a solution of the problem by the use of looped receiving antennae or antennae inclined in various directions.

G. Marconi, however, gave in 1906 the first really practical solution of the problem by the use of bent transmitting and receiving antennae. He showed that if an antenna was constructed with a short part of its length vertical and the greater part horizontal, or if the lower end of the vertical part be earthed, and if oscillations were created in it, electric waves were sent out most powerfully in the plane of the antenna, or in any direction other than that of a perpendicular to the free end pointed. Also he showed that if such an antenna had its horizontal part swivelled round into various directions the current created in a distant receiver antenna varied with the azimuth, and when plotted out in the form of a polar curve gave a curve of a peculiar figure-of-8 shape. The mathematical theory of this antenna was given by J. A. Fleming (Proc. Roy. Soc., May 1906, also Phil. Mag., December 1906). Marconi also showed that if such a bent receiving antenna was used the greatest oscillations were created in it when its insulated end pointed directly away from the sending station. In this manner he was able to provide means for locating inaccessible sending stations. F. Braun gave an interesting solution of the problem of directive telegraphy. In his method three vertical antennae are employed, placed at equal distances, and oscillations are created in the three with a certain relative difference of phase. The radiations interfere in an optical sense of the word, and in some directions reinforce each other and in other directions neutralize each other, so making the resultant very small in some directions than others. Very valuable work in devising forms of apparatus and directive telegraphy has been done by MM. Bellini and Tochi, who have devised instruments, called radioinometers, for projecting radiation in required directions and locating the azimuth of a transmitting station.

**Improvements in the Production of Continuous Trains of Electric Waves.**—All the above-described apparatus employed in connexion with wireless telegraph transmitters, in which the oscillatory discharge of a condenser is used to create oscillations in an antenna, labours under the disadvantage that the time occupied by the oscillations is a very small fraction of the total time of actuation. Thus, for instance, when using an induction line, an induction line is not sufficiently formed for a long-time current; it is not generally convenient to make more than 50 discharges from a condenser, and each of these may create a train of oscillations consisting of, say, 20 to 50 waves. Supposing, then, that these waves are 1000 ft. in wave-length, the frequency of the oscillations would be 1,000,000 per second, and accordingly 50 of these waves would be emitted in 1/20,000th part of a second; and if there are 50 groups of waves per second, the total time occupied by the oscillations in a second would only be 1/400th part of a second. In other words, the intervals of silence are nearly 400 times as long as the intervals of activity. It very soon, therefore, becomes clear to inventors that a very great advantage would be gained if some means could be discovered of creating high frequency oscillations which were not intermittent but continuous. The condenser method of making oscillations is analogous to the production of air vibrations by twanging a harp string at short intervals. What is required, however, is something analogous to an organ pipe which produces a continuous sound.

A method of producing these oscillations devised by Valdemar Poulsen is based upon the employment of what is called a musical or telephone arc. In a telephone arc, Poulsen, it is said, had the carbon arc had its carbon electrodes connected by a condenser in series with an inductance, then under certain conditions oscillations were excited in this condenser circuit which appeared to be continuous and unaffected by the Maxwellian term. Poulsen proved that the carbon arc is in an atmosphere of hydrogen, coal-gas or some other non-oxidizing gas, and at the same time arranging it in a strong magnetic field in such a way that he was able to produce an apparatus which created continuous trains of oscillations suitable for the purposes of wireless telegraphy. The so-called musical arc of Duddell has been the subject of considerable investigation, and physicists are agreed that in the telephone arc the vibrations of the oscillations of production of the oscillations. It appears, however, to depend upon the fact that an electric arc is not like a solid conductor. Increase in the voltage acting upon a solid conductor increases the current through it, but in the case of the electric arc an increase in current is accompanied by a fall in the difference of potential of the carbons, within certain limits, and the arc has therefore been said to possess a negative resistance.

Poulsen's method of producing continuous or undamped electrical waves has been applied by him in radio-telegraphy. The electric arc is formed between cooled copper (positive) and carbon (negative) electrodes in an atmosphere of hydrogen or coal-gas. In recent apparatus, to enable it to be used on board ship, a hydrogenous spirit is used which is fed drop by drop into the chamber in which the arc is worked. Across the arc is a transverse or radial magnetic field, which produces a bending of the electric lines of force, consisting of a condenser and inductance. The antenna is connected either directly or indirectly with the circuit. At the receiving end are a similar antenna and resonant circuit, and a telephone is connected across one part of the latter through an automatic interrupting device called by Poulsen a "ticker." To send signals the continuous or nearly continuous train of waves must be cut up into Morse signals by a key, and these are then heard as audible signals in the telephone. An important modification of this method enables not only audible signals but articulated words to be transmitted, and gives thus a system of wireless telephony.

*Note: References and footnotes are not included in the natural text.*
TELEMACHUS—TELEMARK

employed for the production of the continuous trains of waves a high frequency alternator of his own invention (see The Electricalian, 1904, 52, p. 497, or German Pat. Spec., No. 149350).

1 The Electricalian, 1904, 52, p. 497.


3 J. A. Fleming, Phil. Mag., 1905 [6], 9, p. 758.

4 ibid., 1906, 9, p. 128.


6 G. Marconi, ib., 1902, 70, p. 344.

at the same time it has taken a position of the greatest importance in connexion with naval strategy and communication between ships and ships and the shore in time of peace. It is now generally recognized that Hertzian wave telegraphy, or radio-telegraphy, as it is sometimes called, has a special field of operations of its own, and that the anticipations which were at one time entertained of its great impact on the world. It would specifically annihilate all telegraphy conducted with wires which have been dispersed by experience. Nevertheless, transoceanic wireless telegraphy over long distances, such as those across the Atlantic and Pacific oceans, is a matter to be reckoned with in the future, but it remains to be seen whether the present means are sufficient to render possible communication to the antipodes. The fact that it has become necessary to introduce regulations for its control by national legislation and international conferences in the supremely important position which it has taken in the short interval of one decade as a means of communicating human intelligence from place to place over the surface of the globe. An important International Conference on radiotelegraphy was held in Berlin in 1906, and as a result of its deliberations international regulations have been adopted by the chief Powers of the world. The decisions of the Conference were ratified for Great Britain by the British government on July 1, 1908.


TELEMACHUS, in Greek legend (Odyssey i.–iv., xv.–xxiv.), Hyginus, Fab. 127), son of Odysseus and Penelope. When he reached manhood, he visited Pylos and Sparta to make inquiries about his father, who had been absent for nearly twenty years. On his return, he found that Odysseus had reached home before him. Then father and son, aided by Eumaeus and Philoetius, slew or drove out the suitors of Penelope (see Odyssey). According to later tradition, Telemachus became the husband of Circe and by her the father of Latinus and of a daughter Roma, afterwards the wife of Aeaeus. In another story, he married a daughter of Circe, named Cassipheon; having slain his mother-in-law in a quarrel, he was himself killed by his wife. This is the only notice of the death of Telemachus. The foundation of Clusium in Etruria was attributed to him.

TELEMARK, or THELEMARK, a district of southern Norway, wholly comprised in the amt (county) of Bratsberg. It covers the lake-brands and the small mountains of the country, having its highest point in the Gaustafjel (2600 ft.), and contains several large and beautiful lakes, as Nordsfjø, Bandaksvand, Tinsjø, Mjøsvand, and Toksvåg. The two
first are connected by the Bandaks canal, a fine engineering work giving access from the port of Skien to Dalen at the head of Bandaksvand. From Dalen, which may be reached by road from the railway at Kongberg (58 miles) a driving road much frequented by travellers winds north-west. It traverses a precipitous wooded gorge, its course in parts hewn out of the rock, and skirts the Bøtte and Grungedal lakes, follows the Flaathyl river, passes the Vafos and Little Rjukanfos (waterfalls), and Lake Voxtli, and culminates at Haukellidsaeter, a station grandly situated among the fields at a height of 3085 ft. It rises to the watershed (3715 ft.) and then, leaving the district, descends abruptly with a remarkable winding course to Røldal (58 miles from Dalen), and soon divides, one branch surmounting the Horrebrækleike pass and continuing to Odde, the other traversing the beautiful Bratlandsdal. On the Kongberg-Dalen road is Hitterdal, with a good specimen of the Stavekirke or medieval timber-built church. A divergence from this route may be made by way of Tinsjø to Fosso, where the Maan river forms a fine fall (Rjukanfos) of 415 ft.

**TELEOLOGY** (Gr. τέλος, end), in philosophy and theology, strictly that branch of study which considers "final causes" as real principles of explanation, i.e. which explains things as existing solely as pre-requisites of the results which they produce. More commonly the term is applied to the doctrine that everything, even the whole being has been planned on a definite design, or at least that it tends towards some end. The term has been used very loosely, and its meaning has changed considerably. The root idea arises from the analogy of the acts of human beings which are observed to have certain purposes: hence it was natural to assume that the whole sum of existence with its amazing complexity and its orderly progress can be explained only on the assumption of a similar plan devised by a conscious agent. Such a view is essential to any theistic view of the universe which postulates God as the Creator, omniscient and all-good. The modern theory of evolution, on the other hand, has reintroduced a scientific teleology, another type. This is discussed, from the biologist's point of view, in the article ZOOLOGY. Teleology, in this narrower sense, as the study of the adaptation of organic structures to the service of the organisms in which they occur, was completely revolutionized by Darwinism and the research founded on it.

**TELEOSTOMES**, members of the third sub-class of the class Fishes, being all the fishes in which the skull is invested with membrane bones, viz., the Crossopterygians, the Dipnoans, the Ganoids, and the Teleostomes. They may be further defined as fishes with an ossified or cartilaginous skull, there is much in any one jaw, gills inserted on the gill-arches, a single gill-opening on one side (exceptionally fused with its fellow on the ventral side), an opercle formed of one or several bones, the body usually covered with scales or bony plates, an air-bladder or lung, at least in the primitive forms, and without copulatory paired organs or "claspers."

The term which designates this sub-class has been adopted by Sir R. Owen, E. D. Cope, and E. Woodward in a less comprehensive sense, the Dipneusti being regarded by them as constituting a separate sub-class, and its inventor, C. L. Bonaparte (1838) had proposed it in a more restricted sense. The sturgeons, lophobanchias and plectognaths being excluded. T. Gill (1872) was the first to use it in the acceptation taken in the present article. Whether the Ostracophores should be included among the Teleostomes, as recently proposed by C. T. Regan, is still open to doubt. The sub-class is here divided into four orders, but it is difficult to decide whether, in an ascending series, the Crossopterygians or the Ganoids should be placed first. From the point of view of the evolution of the paired fins, accepting the lateral fin-fold theory as the better supported by the evidence, it is much to say in favour of regarding the Chondrosteans the Ganoids as the more primitive form. From another point of view the condition of the air-bladder in the existing Crossopterygians appears to represent the earliest form assumed by this important organ, which it seems rational to conclude was originally evolved as an accessory breathing organ and later became transformed into a hydrostatic apparatus (Ganoids and Teleostomes) on the one hand, into a true lung (Dipnoans and Batrachians) on the other. Guided by the second consideration, assuming that the air-bladder of the fossil Crossopterygians corresponded to the type known in their recent representatives, and also in deference to palaeontological chronology, whatever it be worth in the present state of our knowledge, we shall begin the series with the Crossopterygians, which pass into the Dipnoans, and then take up the Ganoids, which lead up very gradually to the Teleostees, the dominant group at the present day. But we do not deny the force of the arguments adduced by Regan in attempting to show that the paired fins of the Chondrosteans Ganoids are a nearer approach to the primitive condition than are those of the Teleostees. Not until some day we shall become acquainted with still older Teleostomes, which we may expect to establish the connexion between the two types which in Palaeozoic times have evolved on parallel lines.

**Order I.—CROSSOPTERYGII**

Paired fins, at least the pectoral, lobate, having an endo-skeletal armature, less fingers with dermal rays. Mandibular arch suspended from the upper segment of the hyoid arch (hyostylid skull), Splenial bone present. No supraopercular bone. A pair of large jugular plates, sometimes with small lateral plates and an opercle of a separate type. No or few gills. Cartilaginous membrane between the mandibular rami. Heart with a contractile, multivalvular comus arteriosus; intestine with a spiral valve; air-bladder with pneumatic duct communicating with the ventral side of the gills. Absence of the mouth.

Maxillary bone large, toothed, bordering the mouth. Bones of the upper surface of the skull mostly paired. Pectoral arch with both clavicle (so-called infra-clavicle) and clavithrum. Ventral fins inserted far back. With few exceptions (family of Coelacanthidae, dorsal and caudal fins of Polypterusidae) the dermal rays of the unpaired fins more numerous than their endo-skeletal supports, a primitive character also found in the lower Ganoids, but disappearing in the higher.

**Suborder I.—OSTEOLEPIDA**

(Including the Haplistia, Rhipidistia and Actinistia.) Pectoral fins obtusely or acutely lobate, articulating with the pectoral girdle by a single basal endo-skeletal element. Nostrils on the lower side of the snout. Two dorsal fins.

**Families:** Osteolepidae, Rhizodontidae, Holoptyridae, Coelacanthidae.

The scales may be rhombic and thickly coated with ganoine (Osteolepidae) or cycloid. The vertebral axis is strongly heteroceratal in the Osteolepidae. The arch is intermediate between the heteroceratal and the diphyceratal types in the other families; usually acerate, sometimes with ring-like rays (family of Rhizodontidae). In the Holoptyridae the pectoral fin is extremely similar to that of the Dipneusti of the family Dipteridae, which they resemble closely in form and scaling. Their teeth are remarkable for their complicated structure, resembling those of the Lower Carboniferous. The Lower Carboniferous and Permian era for the most part belong to the family Dipteridae. The Osteolepidae were mostly moderate-sized fishes, the largest (Megalechis) measuring about 4 ft. in length.

These Crossopterygians first appear in the Lower Devonian, are abundant in the Upper Devonian, Carboniferous and Permian; in later periods they are represented only by the more specialized Coelacanthidae, which appear in the Lower Carboniferous, and persist as late as the Upper Chalk.

**Suborder II.—CLADISTIA**


A single family: Polypterusidae.

The existing Crossopterygians which form this sub-order differ very considerably from the extinct Osteolepida, perhaps quite as much as these differ from the Dipneusti. The ventral fins are not lobate, the vertebral column is well ossified and its termination is of the diphyceratal type. Spiracles, covered by bony valves, are present at the upper branch of the gill-opening. The dorsal fin is among fishes, being formed of detached rays consisting of a spine-like fulcrum scale supporting the fringes of the ray; these rays have been regarded, erroneously, as representing so many distinct fins, or "fles." The scales are bony, rhombic and thickly coated with ganoine.

The Polypterusidae are confined to tropical Africa and the Nile, and represented by two genera: Polypterus and Calamichthys, the former moderately elongate and provided with ventral fins, the
latter serpentine form and devoid of ventrals. We now know ten species of Polystomus, from the Nile, Congo, the rivers of South Africa, and the Suckshel of Calico mishtis, which inhabits West Africa from the Niger delta to the Chiloango. The largest species of Polystomus reach a length of nearly 10 feet. The eyes are large, lacks a supraneurary, and the gill very similar to the gills of larval salmonids. The air-bladder acts as an accessory breathing organ, although these fishes are not known ever to leave the water. The development is stated by the late Mr. D. G. C. Haeckel, as occurring without a larval stage. Both eggs of Dipnoii, but the results of the study of the material collected by him shortly before his death have not yet been published.

ORDER II.—DINPEUSTI

Often called Dipnii, a term proposed for this order by J. Müller in 1845, but which had already been used for the Batraciihns (P. Leuckart, 1821) before the discovery of Lepidodes. The substitute Dinpeusti (E. Haeckel, 1866) is, therefore, preferable. Paired fins lobate, or reduced to a jointed endo-skeletal axis. Upper segment of the mandibular arch confluent with the skull (autostylic skull). Praemaxillary and maxillary bones absent, dentary absent or small and toothless; teeth on the palato- or ganoid bones, sometimes also on the vomers. No supraocipital bone. Heart trilocular, with a contractile, multivalvar conus arteriosus; intestine with a spiral valve; air-bladder transformed into a single or double lung, opening at the glottis opening of the gill caverns. The cranial roof-bones include median as well as paired plates, which cannot easily be homologized with those of other Teleostomi. These plates, in general, are small and, and, coated with ganoine, appear on the surface of the head, whilst in the later forms they are reduced in number as well as in the degree of ossification, and have sunk below the skin. Pectoral and pelvic fins are absent, except for an elongate pelvic bone. Vertebrae acrocentric. Dermal rays of vertical fins much more numerous than their supports, which correspond in number to the neural and haemal spines. The lower side of the mouth is armed with the pectoral within the mouth. Scales cycloid (almost quadratic in Segensodus, a genus of Ceratodontidae).

Families: Dipnteridae, Ctenodontoideae, Uronemidae, Ceratodontoideae.

The Dipnii are heterocercal and have two dorsal fins, as in the Crossopterygian Holopscidae; in the other families the dorsal fin is elongate and single, and extends to the extremity of the tail, which is heterocercal or barbourian; these features, which are entirely Palaeozoic, ranging from the Devonian to the Permian, the dental plates nearly always exhibit more or less clearly the points of the separate denticles of which, as shown by the development of Neoceratodus, they were originally composed, but vormerine teeth, such as exist in the Ceratodontoideae and Dipnii, do not appear to have existed. The Dipnii have a gill-bar, without well-defined gill compartments, which has become much reduced or disappeared entirely in the other members of this order. The two first families had well-developed gular plates.

In the Ceratodontoideae, which first appeared in the Trias and have persisted to the present day, the skull is more feebly ossified than in the earlier forms, and this may well be looked upon as a degeneration, since the horny plates in Trias species, such as Trias ichthyops, which is entirely Palaeozoic, ranging from the Devonian to the Permian, the dental plates nearly always exhibit more or less clearly the points of the separate denticles of which, as shown by the development of Neoceratodus, they were originally composed, but vormerine teeth, such as exist in the Ceratodontoideae and Dipnii, do not appear to have existed. The Dipnii have a gill-bar, without well-defined gill compartments, which has become much reduced or disappeared entirely in the other members of this order. The two first families had well-developed gular plates.

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The Ceratodontoideae, the body is much or less celled, the scales are thinner, the paired fins are reduced to slender styleform appendages, sometimes with a small tuft of cartilaginous rays bearing fine dermal rays, and the lung is paired. The development is even more Batrachian-like than that of Neoceratodus, and the length of the hind limb. The lung is absent, but the eggs are deposited in nests in the water and the male keeps guard over the eggs and young. The food is both animal and vegetable. As a rule, as a tuberculate bone, the teeth of Dipnoi burrows in the mud of drying marshes and, surrounded by a cocoon formed of hardened mucus secreted by glands of the skin, it spends weeks or months in a dormant condition, breathing air, until by its body burrowing out of its shell the contents of the cocoon have been often been brought over to Europe, and when soaked in water, the Protopterus is released in a most lively condition. Three species of Protopterus are known from different parts of Africa. One species being P. ammodytes, an inhabitant of West Africa, from the Senegal to the Niger, and Lake Chad. Of Lepidosiren only one species is known, L. paradoxa, living in the Amazon and Paragua bay.

Great uncertainty, and much difference of opinion among palaeichthyologists, still prevail as to the position in the system of a group of Devonian fishes, of which Coccosteus and Dinichthys are the best-known. L. Spence (1819) placed them with the Coccosteidae, but Woodward (1848) under the name of Placoderms; they were removed from their vicinity by the Woodwardian improve his paper, and Woodwardianed them to a group which he proposed to call Archordia. This view was based mainly on the assumption that the skull was autostylous and that maxillary bones were not developed, and also on the resemblance, previously noticed by T. H. Huxley and others, between the dermal mechanism of the Archordia as something quite different from the jaws and teeth of other vertebrates, and revert to the view of E. C. McCoy in placing the Archordia in a group Placodermata, which inserted Archordia as a co-ordinate in rank with such divisions as Cyromystom and Piscidae.

In the present state of our knowledge it is perhaps best to leave the Archordia with or near the Dipnoi. They are thus defined by Woodward:—"Fishes with both head and trunk armoured, in the more specialized genera the shield of the abdominal region articulating with the head-guard in ginglymoid facettes (Gr. ginglymos, a hinge) which admit of free motion, and even regard the dental mechanism of the Archordia as something quite different from the jaws and teeth of other vertebrates, and revert to the view of E. C. McCoy in placing the Archordia in a group Placodermata, which inserted Archordia as a co-ordinate in rank with such divisions as Cyromystom and Piscidae."

Some of the species of Dinichthys reached a great size, the head sometimes measuring a metre across.

ORDER III.—GANOIDI

Paired fins not lobate. Mandibular arch suspended from the upper segment of the hyoid arch (hyoscylic skull). Splenial bone present. No supraocipital bone. Unpaired fins often with fulcra. Heart with a contractile, multivalvar conus arteriosus; intestine with a spiral valve; air-bladder with pneumatic duct commencing with the dorsal side of the oesophagus.

ORDER II CHONDROSTEI

Pectoral arch with both clavicle and cleithrum. Vertical fins inserted for back support, hence developed endo-skeletal rays (baselets); dermal rays of the dorsal and anal fins more numerous than their endo-skeletal supports. Heterocercal. Vertebrae acrocentric. Most species have a barbamentum, and the system is divided as follows.

Families: Palaeoniscidae, Plagocentridae, Cetorhynchinae, Belonocentridae, Polyodontidae, Acipenseridae.

In the three first families (Devonian to Jurassic), the mouth is toothed, pectoral maxillary bones are present, and the maxillaries are large, the border of the submaxillary lobe is solid, the sub-maxillaries are present, and the body is covered with rhamphoid, typically ganoid bony scales. In the fourth family (Trias to Liassic), the snout is much elongate, and longitudinal series of scutes extend along the back, and the anterior of the vertebrae is developed posteriorly. In the fifth family (Jurassic to Recent), the sub-maxillaries are absent, but the maxillary bone was well developed, though small; the membrane bones of the skull were paired;
branchiostegal rays were present; scales were absent, except on the ventral side.

In the modern Polyodontidae and Acipenseridae, whose first representatives appear in the Eocene, praemaxillaries are absent and the mouth is edentulous (Acipenseridae) or beset with minute teeth (Polyodontidae), the membrane bones of the skull are more irregular and comprise azYGous elements, branchiostegal rays are absent, and the body is naked or covered with small ossifications and longitudinal series of bony scutes, whilst the caudal fin is scaled exactly as in the Palaeoniscidae. Barbed are absent in the Polyodontidae.

In the Polyodontidae, represented by one species, the paddle-fish (Polyodon spathula), the membrane bones of the skull are much more irregular and comprise azYGous elements, branchiostegal rays are absent, and the body is naked or covered with small ossifications and longitudinal series of bony scutes, whilst the caudal fin is scaled exactly as in the Palaeoniscidae. Barbed are absent in the Polyodontidae.

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TELEOSTOMES

America. The Galaxiidae are mostly fresh-water fishes and have a wide distribution in the southern hemisphere (southern parts of South America, New Zealand, South Australia and Tasmania, Cape of Good Hope) and species identical in South America, the Falkland Islands, New Zealand and Tasmania. Their distribution has been regarded as affording support to the theory of an Antarctic continent in Tertiary times. However, the species spend part of their life, and even breed, in the sea, whilst others may be regarded as having become recently adapted to fresh water, so that the argument derived from their range is not so clear. The only true freshwater fishes are the Clariidae, which are exclusively fresh-water fishes. The Cyprinodontidae are partly brackish, partly fresh-water fishes, whilst the Scopelidae, which are traced back to the Chalk, are all marine, many being inhabitants of great depths.

SUB-ORDER VI.—HETEROMI

Air-bladder without duct. Opercle well developed, pectoral bones separating the frontals from the supraopercular. Pectoral arch suspended from the supraopercular or the epiotic, the post-temporal small and simple or replaced by a ligament; no mesocoracid bone. Ventral fins abdominal, if present.

Families: Dercetidae, Halosaridae, Lipogeniidae, Notacanthidae, Fierasferidae.

Closely related to the Plagiopriidae, but separated chiefly on account of the close air-bladder. Mostly deep-sea fishes, some of which appear as early as the Cretaceous period. The genus Fierasfer comprises small degraded fishes commensal of Holothurians and bivalve molluscs.

SUB-ORDER VII.—SELENICHYES

Air-bladder without duct. Opercle well developed. Pectoral arch solidly attached to the skull; no mesocoracid bone. Fins without spines. Ventral fins abdominal, with very numerous (15 to 17) rays.

A very aberrant type, of uncertain affinities. Its only representative is the opah, Lampris lupus, a large pelagic fish of wide distribution.

SUB-ORDER VIII.—THORACOSTEI

Embracing the Hemibranchii and Lophobranchii, but excluding the Hypostomoides (Pegasidae), which investigates the F. E. Jungersen show to be aberrant tail-checked Acanthopterygians.

Air-bladder without duct. Pectoral arch suspended from the skull; no mesocoracid bone. Ventral fins abdominal, if present. Branchial arches more or less reduced.

Families: Gastrosteidae, Aulorhynchidae, Protosyngnathidae, Aulosomata, Symmoriidae, Synagathidae. The two latter families constitute the division Lophobranchii, in which the gill-laneces are enlarged and form rounded lobes.

See articles SEA-HORSE, STICKLEBACK, and PIPE-FISHES.

SUB-ORDER IX.—PERSECOSES

Air-bladder, if present, without duct. Pectoral bones separated by the supraopercular, prootic and exoccipital separated by the enlarged opisthopterygian. Pectoral arch suspended from the skull; no mesocoracid bone. Ventral fins, if present, abdominal, or at least with the pelvic bones not solidly attached to the clavicular arch.

Families: Scombresocidae, Ammodytidae, Atherinidae, Mugilidae, Polynemidae, Chiasmodontidae, Sphyraenidae, Tetraonuridae, Stromateidae, Icosteididae, Ophichthidae, Anabantidae.

This series of families connects the Hoplopterygii with the Acanthop- erygi. The Percenees are mostly marine, but the last two families are exclusively fresh-water. Some are inhabitants of great depths, others are pelagic, like the flying-fish (Exocoetus).

SUB-ORDER X.—ANACANTHINI

Air-bladder without duct. Pectoral bones separated by the supraopercular; prootic and exoccipital separated by the enlarged opisthopterygian. Pectoral arch suspended from the skull; no mesocoracid bone. Ventral fins below or in front of the pectorals, the pelvic bones solidly attached to the clavicular symphyses and only loosely attached to it by ligament. Fins without spines.

Families: Macruridae, Gadidae, Muraenolepididae.

Nearly all the families are marine. The Macruridae are among the most characteristic fishes of the great depths. The Gadidae include some of the most valuable food-fishes.

SUB-ORDER XI.—ACANTHOPERYGI

Air-bladder usually without duct. Opercle well developed; supraopercular in contact with the frontals. Pectoral arch suspended from the skull; no mesocoracid bone. Ventral fins thoracic or jugular, more or less firmly attached to the clavicular arch. Gill-opening usually large, in front of the base of the pectoral fin.

The character from which this sub-order, the most comprehensive of the whole class, derives its name, viz., the presence of non-articulated, spiny rays in the dorsal and anal fins, is by no means universal, exceptions to the rule being numerous.

Division I. Beryciformes.—Families: Berycidae, Monocentridae, Polyodontidae.

The most primitive of the Acanthoperygiids, already well represented in the Chalk. A duct has been observed to be sometimes present between the body-bladder and the digestive tract. All marine, several benthic.


The Percidae, Centrarchidae, Toxodontidae, Nandidae, Osphromenidae, Embiotocidae, and Cichlidae are fresh-water fishes, the others are all or nearly all marine. Aiptopus, which is included among the Scorpidae, is one of the few Acanthoperygiid fishes known to have existed as early as the Cretaceous period. See articles CICHLIDS, MILLET, MURREY COD, PARROT-FISHES, PERCH, PIKE-PERCH, SHARKHEAD, WRASSE.

Division III. Scombriformes.—Families: Carangidae, Rachycentridae, Lophidae, Histiophoridae, Xiphiidae, Luvoridae, Coryphaenidae, Bramidae.

Marine fishes, several being pelagic and among the largest Teleostei and swiftest swimmers. See articles HALE-TAIL, MACKEREL, PEARL-FISH, SWORD-FISH, TUNA.

Division IV. Zeoformes.—Families: Zeidae, Amphistegidae, Pleuronectidae.

Division V. Kirtiformes.—A single family, Kirtidae, with a single genus and species from the Indian and Pacific oceans.

Division VI. Gobiiformes.—A single family, Gobiidae.

Division VII. Discophagidae.—A single family, Echeneididae.

The remarkable remoras attach themselves by means of a cephalic disk to boats or to sharks, turtles, ceteaceans, and other large swimming animals. They form an isolated group, and have no real affinity with the Scombridae, with which they have long been associated.

Division VIII. Scorpiformes.—Families: Scorpaenidae, Hexagrammidae, Conephoridae, Rhamphocottidae, Cottidae, Cylopotheridae, Platyccephalidae, Holphichthyidae, Agonidae, Pegasidae, Tridacnidae, Dactylopteridae.

The "Mail-check" Acanthoperygiids include a great variety of forms, mostly living in the sea, the best known being referred to the articles FLYING-FISH, GURNARD, LUMP-SUCKER, and MILLER'S-THUMB.

Division IX. Jujuridae.—Families: Trachinidae, Percophidae, Leptocephalidae, Nototontidae, Uranoscopidae, Trichodontidae, Centrarchidae, Gobioidei, Blediidae, Batrachidae, Pimelodidae, Zoarcidae, Congroaididae, Ophididae, Podatellidae.

Nearly all marine, some deep-water. Macrus americus, whichプロジェクトing to the Atlantic, measures 5 ft. and is the largest known deep-sea Teleostean. The other members of this division are mostly small, Anarrhichas being another exception. The weever (Trachinus) are dangerous stinging fishes.

Division X. Tainiosomi.—Families: Trachypteridae, Lophidiidae.

Deep-sea or pelagic fishes, some attaining a large size.

SUB-ORDER XII.—OPISHTHOMI

Air-bladder without duct. Opercle well developed, hidden under the skin; supraopercular in contact with the frontals. Pectoral arch separated from the vertebral column, far behind the skull; no mesocoracid bone. Vertical fins with spines. Ventral fins absent.

Bel-shaped fishes standing in the same relation to the Acanthoperygi as do the Apodes to the Malacopterygii. The single family, Mastacembelidae, is possibly derived from the Blenniidae.

Fresh and brackish waters of southern Asia and tropical Africa.

SUB-ORDER XIII.—PEDICULATI

Air-bladder without duct. Opercle well developed, hidden under the skin; supraopercular in contact with the frontals. Pectoral arch suspended from the vertebral column, far behind the skull; no mesocoracid bone. Gill-opening reduced to a foramen situated in or near the axil more or less posterior to the base of the pectoral fin. Body naked or covered with spines or bony tubercles.

Connected with the Acanthoperygiid Juggedaries through the Batra- chidae.

Families: Lophidae, Ceratiidae, Antennariidae, Gigantactinidae, Malthidae.

Nearly aberrant marine fishes, many benthidal. The best known are the flying-frog or angler, Lophius, and the Antennarius, which lives in coral groves or is carried about in mid-ocean among the Sargassum weeds.
TELEPATHY

Sub-order XIV.—PECTOGRAPHTHI

Air-bladder without duct. Opercular bones more or less reduced; supraoccipital in contact with the frontals; maxillary and premaxillary bones often firmly united. Pectoral arch suspended from the skull. No ribs. Ventral fins thoracic and much reduced if present; the pelvic fins, if present, more or less co-ossified. Gill-opening much reduced. Body covered with more or less ossaceous scales, bony scutes, or spines, or naked.

A highly aberrant group, closely connected with the Actoantherygii through the Actanthuridae.

Division I. Scleroderomi.—Families: Triacanthidae, Triodontidae, Balistidae, Ostraciidae, Ostracodermata.

Division II. Gymnomontes.—Families: Tetrodonidae, Diodonidae, Mollidae.

The Plectognaths are all marine; the recently discovered Triacanthidae, Himantura, remarkable for its long, tube-like snout from the Gulf of Manaos, is the only form of this sub-order which is confined to the deep sea. Although so highly specialized, several forms, such as Ostracion (the coffer-fish), Tetradon and Diodon, were already represented in the upper Eocene. See FILE-FISH, GLOBE-FISH and SUN-FISH.

For bibliographical references to the Teleostomi, see Ichthyology.

(G. A. B.)

TELEPATHY (Gr. τελεόν, far, πάθος, feelings), or Thought Transference, the conveyance of thoughts and feelings from mind to mind, usually inaudibly and unperceived by the sender or the percipient, is a mental function in the animal and human organism, which has been the subject of scientific investigation from time immemorial. Although the word "telepathy" was first suggested by F. W. H. Myers in 1882, the suggestion had long before been made that the transmission of ideas, images and sensations could be brought about by other than the normally operative motor and sensory apparatus of the body. More than one writer has explained wraiths at the moment of death, clairvoyance and the phenomena of spiritualism by the theory of "brain waves."

But it was not until the advent of the Society for Psychological Research that the hypothesis attracted much notice or was based by carefully collected evidence. Accepted by the society the term is a mere designation and implies no hypothesis as to "action at a distance" or the operation of any force not recognized by physical science.

The earliest recorded systematic experiments in thought transference were made in 1871 by the Rev. P. H. and Mrs. Newnham, and were continued for a period of some eight months with marked success; subsequent attempts showed no results of an evidential nature. A few years later the attention of the British Association was called to the subject by Prof. W. F. Barrett, and from 1881 onwards many experiments were made in which the S.P.R. of pedal opinion, in B the problem of "willing game" was at one time exceedingly popular; the successes, however, depended largely, if not entirely, upon muscle-reading, and usually ceased when there was no contact between agent (the sender of the idea) and percipient (the receiver).

The systematic investigation has followed two main lines: (A) experiments on persons, often in the hypnotic state, in which the aim was to transfer selected images, &c., and compare the guesses with the results which chance would give; (B) the collection and examination of records of phenomena such as apparitions at the moment of death and other spontaneous cases in which there is a correspondence between the psychical states of two individuals, usually remote in space from one another. The problems raised by the two cases are entirely different: (1) in A there is seldom any hallucinatory element (see HALLUCINATIONS), in B, though not essential, it is present in a high percentage of cases; (2) what is transferred is in A an image kept before the mind, in B the phantom of the dying person when that person has prima facie neither endeavoured to transfer this image nor, it may be, even thought of the percipient; (3) the desideratum in A has usually been to exclude the possibility of coincidence of certain facts, in B the problem is to show that coincidence will not account for the facts; for, whereas in A the relation of successes to failures is known, in B it is difficult to get statistics and to be sure that an abnormal number of successful cases do not figure in a census. Side by side with direct experimentation, the S.P.R. collected first-hand records of apparitions at or within twelve hours of the moment of death. These, together with a discussion of the experimental evidence, were issued in 1885 under the title of Phantasms of the Living. In order to provide a statistical basis for discussion of coincidental apparitions, a census of hallucinations was undertaken by Edmund Gurney, and replies were obtained from over 5000 persons. A defect of the collection in Phantasms is that the progressive deterioration of evidence with age is neglected. No narratives are regarded as evidential by the society unless they were reduced to writing less than three years after the event or are based on notes made at the time.

The second systematic attempt to collect material was the so-called hallucination inaugurated at the congress of experimental psychology of 1886, and entrusted to Professor Henry Sidgwick. The total number of persons who made returns was 17,000, of whom 1684 asserted that they had once or oftener experienced an hallucination. Analysis of the answers showed that in 350 cases the apparition was recognized; the probability that any person will die on a given day is roughly 1 in 19,000: if therefore chance alone operated, one apparition in 19,000 would coincide with a death; after making all allowances for error, the census committee found that 30 of the 350 recognized apparitions coincided with a death—in other words, that the coincidence would not be greater than chance coincidence would give. The committee reported that between deaths and apparitions of dying persons there exists a connexion which is not due to chance alone.

The experimental evidence for telepathy is made up partly of the results of trials where direct transference of thoughts, images or sensations was attempted, partly of successes in hypnotization at a distance; dreams (q.e.) also provide some material; and in a small but important class of cases, transitional between wraiths and ordinary experimental cases, the agent has caused his phantasm to appear to the percipient.

Among the chief experimenters may be mentioned Prof. M. Dessor, Mr Guthrie, Sir Oliver Lodge and Prof. Sidgwick. In experiments conducted by the latter and Mrs Sidgwick at Brighton with numbers as the objects to be guessed, 617 trials were made with the agent and percipients in the same room: the numbers were between ten and ninety, and ninety successes were recorded, the probable total, if chance alone had operated, being eight. In a later series, conducted by Mrs Sidgwick, a similarly high proportion of successes was recorded; but when agent and percipients were in different rooms the results were not always what chance would give. These results were criticised by Prof. Lehmann and others, but were not seriously shaken: it was pointed out that the failure of experiments at a distance might be due to psychological causes rather than to the fact that the increase of distance eliminated the possibility of communication by normal means. In subsequent experiments, however, the successes in no series of any length were so far above chance as to give substantial support to a belief in telepathy.

Experiments in hypnotization at a distance provide some of the most conclusive evidence for telepathy. In 1885 trials were made both by Dr Janet and by Prof. Richet with the same subject. Out of twenty-five experiments the former held that nineteen were complete successes; Prof. Richet secured two successes and four partial successes in nine trials. The most striking point was that the hypnotic trance always coincided with or followed at an interval the attempt to hypnotize the patient; this is a feature of much importance in considering the possibility of coincidence or of auto-suggestion.

It is usually impossible to prove that a dying person has been thinking of the percipient; much less can we show that there was any idea of causing his phantasm to appear. There are, however, a small number of cases in which apparitions, of the agent or some other person, prima facie telepathic, have been produced experimentally. A singularly interesting instance is recorded by Wesermann, who tried the experiment in the early part of the 19th century; he wished to make the phantasm of a lady appear to a lieutenant, who was residing some miles away; at the time of the experiment he was, owing to an unforeseen visit, not alone, and his visitor is said to have seen the apparition also. More recently, in cases recorded in Phantasms
and the Census, the figure of the agent himself has been seen by the percipient. The so-called, reciprocal cases are evidentially of much importance. Each of the two persons concerned appears to receive a telepathic impulse from the other, so that each receives information about the other, or sees his phantasm. Occasionally telepathic impressions from animals to human beings are reported, but the facts are usually far from well established. Telepathic communication has also been suggested as the explanation of the simultaneous movements of large flocks of birds.

Various theories have been put forward to account for telepathy, but they only agree in the total lack of an experimental basis. Broadly speaking, they are divisible into physical and psychical. Sir W. Crookes suggests that transmission is effected by means of waves of smaller magnitude and greater frequency than those which constitute X-rays. Undulations starting from nervous centres are adopted as the explanation by Prof. Flournoy and others. But Myers and others regard the case against a physical explanation as complete. The main difficulty in the way of it is that the strength of the impulse does not seem, in the spontaneous cases, to vary with the distance, as by all physical laws it should. On the other hand, a curious phenomenon has been noted in experiments; if the percipient gaze at an arrow with its head turned to the right, there is a tendency, disproportionately strong if we suppose that chance alone operates, for the arrow to be seen reversed. This fact is, however, more important in all probability for the light which it throws on the mechanism of hallucinations (q.v.) than on that of transmission. Telepathy is often invoked as an explanation of the facts of mediumship (see Medium, and Possession); but it seems insufficient to explain them unless we assume for the medium a far greater power of reading other people’s minds than experimental evidence has so far shown to exist.

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TELEPHONE

(Cr. 174, far, and φως, voice), voice. Telephony is the art of reproducing sounds at a distance from their source, and a telephone is the instrument employed in sending or receiving such sounds. The term “telephony” was first used by Philipp Reis of Friedrichsdorf, in a lecture delivered before the Physical Society of Frankfort in 1851. But, although this lecture and Reis’s subsequent work received considerable notice, little progress was made until the subject was taken up between 1874 and 1876 by Alexander Graham Bell, a native of Edinburgh, then resident in Boston, Mass., U.S.A. Bell, like Reis, employed electricity for the reproduction of sounds; but he attacked the problem in a totally different manner. This will be better understood if we consider shortly on what the chief characteristics of sound depend.

The sensation of sound is produced by rapid fluctuation in the pressure of the atmosphere on the tympanum of the ear. If the fluctuations are irregular and non-periodic, the sound is called a noise; if they are cyclic and follow a regular and sufficiently rapid periodic law, the sound is a musical sound. The present subject is important to notice the three characteristics of a musical sound, namely, pitch, loudness and quality. The pitch of a musical sound depends on the number of cycles passed through by the fluctuations of the pressure per unit of time; the loudness depends on the amount or the amplitude of the fluctuation in each cycle; the quality depends on the form or the nature of the fluctuation in each cycle. The necessary condition for a successful system of telephony is the ability to reproduce these characteristics.

In 1831 Wheatstone by his “magic lyre” experiment showed that, when the sounding-boards of two musical instruments are connected together by a rod of pine wood, a tune played on one will be faithfully reproduced by the other. This only answers, however, for telephoning musical sounds to short distances. Another and somewhat similar example is furnished by what has been variously designated as the “string,” “toy,” “lovers,” and “mechanical” telephone. Two disks of thin metal, or two stretched membranes, each furnished with a mouthpiece, are connected together by a thin string or wire attached at each end to the centres of the membranes. A good example may be made with two cylindrical tin cups; the bottoms form the membranes and the cups the mouthpieces. When the connecting string is held taut and sounds, such as those of ordinary speech, are produced in front of one of the membranes, pulses corresponding to the fluctuations of the atmospheric pressure are transmitted along the string and communicated to the other membrane, which in its turn communicates them to the air, thus reproducing the sound.

In both these examples all the three characteristics—pitch, relative intensity, and quality—of sound are reproduced.

In July 1837 Dr C. G. Page of Salem, Mass., drew attention to the sound given out by an electromagnet at the instant when the electric circuit is closed or broken, and in October of the same year he discussed, in a short article entitled “Galvanic Music,” the musical note produced by rapidly revolving the armature of an electromagnet so that the poles were alternately brought close to it. These experiments were subsequently made by a great number of investigators.

Page’s discovery is of considerable importance in connexion with the theory of action of various forms of telephone, and was a very important feature in the early attempts by Reis to transmit music and speech. On the 26th of August 1854 there appeared in L’Illustration (Paris) an interesting article by Charles Bourseul on the electric transmission of speech. The writer recommended the use of a flexible plate at the source of sound, which would vibrate in response to the varying pressure of the air, and thus open and close an electric circuit, and of a similar plate at the receiving station, which would be acted on electromagnetically and thus give out as many pulsations as there are breaks in the current. These suggestions were to some extent an anticipation of the work of Reis; but the conditions to be fulfilled before the sounds given out at the receiving station can be similar in pitch, quality and relative intensity to those produced at the transmitting station are not stated, and do not seem to have been appreciated.

In Reis’s lecture an apparatus was described which has given rise to much discussion on the priority in the invention of the telephone. The instrument was described in over fifty publications in various countries, and was well known to physicists previous to Bell’s introduction of the electric telephone as a competitor with the electric telegraph. Reis caused a membrane to open and close an electric circuit...
Bell's object was to reproduce at a distance not only music but also human speech; but that he did not wholly succeed is clear from the following extract from his lecture:—"Hitherto it has not been possible to reproduce human speech with sufficient distinctness. The consonants are for the most part reproduced pretty distinctly, but not the vowels as yet in an equal degree." Considering the time at which he wrote, Reis seems to have understood very well the nature of the vibrations he had to reproduce, but he failed to comprehend how they could be reproduced by electricity. His fundamental idea—the interruption of the current—was a fatal mistake, which was not at the time properly understood. The suggestion of Bourseul and the experiments of Reis are founded on the idea that a succession of currents, corresponding in number to the successive undulations of the pressure on the membrane of the transmitting instrument, could reproduce at the receiving station sounds of the same character as those produced at the sending station. Neither of them seemed to recognize anything as important except pitch and amplitude, and Reis thought the amplitude was to some extent obtained by the varying length of contact in the transmitting instrument. This might possibly be true to a small extent; but, considering the small capacity of the circuits he used and the nature of his receiving instrument, it is hardly probable that the duration of contact sensibly influenced the result. The quality of the sounds was to some extent also reproduced; but, judging from the results of later telephone investigation, it is highly probable that this was due, not to the varying duration, but to the varying firmness of the contact.

The next worker at the telephone, and the one to whom the present great commercial importance of the instrument is due, was Bell. His aim was the production, by means of the undulations of pressure on a membrane caused by sound, of an electric current the strength of which should at every instant vary directly as the pressure varied. His first idea seems to have been to employ the vibrations of the current in an electric circuit, produced by moving the armature of an electromagnet included in the circuit nearer to or farther from the poles of the magnet. He proposed to make the armature vibrate of the vibrations of the atmosphere either by converting it into a suitable vibrator or by controlling its vibrations by a stretched membrane of parchment.

In the early trials the armature had the form of a hinged lever of iron, which was pressed against or released from a small part of a stretched membrane of parchment. Fig. 1 shows the arrangement. M was a membrane stretched by a ring R over the end of a tube T fixed at one side of the frame F. To the opposite side of the frame an electromagnet I was fixed with its axis in line with the tube T and between the end of the electromagnet and the membrane a hinged armature A was arranged in such a way that its motion could be controlled by the membrane. The instrument was joined in circuit with a battery and another similar instrument placed at a distance; and a continuous current was made to flow through the circuit, keeping the electromagnets energized. The experiment with this form was not successful, and, with the view of making the moving parts as light as possible, he substituted for the armature a small piece of clock spring, about the size of a sixpence, glued to the centre of the diaphragm. The magnet was mounted with its end carrying the coil opposite, and very close to, the centre of the piece of clock spring. This answer sufficiently well to prove the feasibility of the plan, and subsequent experiments were directed to the discovery of the best form and arrangement of the parts. An increase in the size of the iron disk attached to the membrane augmented both the loudness and the distinctness of the sounds, and this finally led to the adoption of a thin iron disk supported round its edge, acting as both membrane and armature (fig. 2). Again, the form of the opening or mouthpiece in front of the membrane exercised considerable influence on the efficiency of the instrument, and it was ultimately ascertained that a small central opening, with a thin air space extending across the face of the membrane, was best. It was also found that comparatively small magnets were sufficient, and that there was no particular virtue in the closed circuit and electromagnet, but that a small permanent magnet having one pole in contact with the end of the core of a short electromagnet, the coil of which was in circuit with the line, but which had no permanent current flowing through it, answered the purpose quite as well. The apparatus thus acted as both a transmitter and a receiver; indeed it is essentially the magneto-receiver which has come into universal use in practical telephony, though for transmission it was soon superseded by forms of microphonic transmitters. One of the latest forms of

A telephone transmitter and a receiver on a novel plan were patented in July 1877 by Edison, shortly after the introduction of Bell's instruments. The receiver was based on Edison's invention of a device for producing an electric current through the point of contact of certain substances in relative motion. In one form a drum, mounted on an axis and covered by a band of paper soaked in a solution of caustic potash, was turned under a spring the end of which was in contact through a platinum point with the paper. The spring was attached to the centre of a diaphragm in such a way that, when the drum was turned, the friction between the point of the spring and the paper deflected the diaphragm. The current from the line was made to pass through the spring and paper to the cylinder. Now it had been previously shown by Edison that, when a current was made to pass through an arrangement like that just described, the friction between the paper and the spring was greatly diminished. Hence, when the undulating telephonic currents were made to pass through the apparatus, the constant variation of the friction of the spring caused the deflexions of the diaphragm to vary in unison with the variation of the electric currents.\footnote{The extreme smallness of the magnets which might be successfully employed was first demonstrated by Professor Peirce of Brown University, Providence, R.I.}
currents, and sounds were given out corresponding in pitch, and also to some extent in quality, with the sounds produced at the transmitting station. A cylinder of chalk was used in some of Edison's later experiments with this receiver.

The transmitter (fig. 4), in an early form, consisted of a cell of immersion about 18 inches long and 9 inches in diameter, a bottom flat-headed screw G; on the top of G was a layer of carbon powder C, on the top of that a platinum disk D, and above that again, forming the cover of the cell, a disk of ivory B, held in position by a ring E. Resting on the centre of the ivory disk was a small piece of rubber tubing, and this was lightly pressed by the diaphragm A, which was held in place by the mouthpiece M. The varying pressure on A, while the operator was speaking into it, caused corresponding variations in the pressure on the carbon powder, and this produced similar variations in its electric resistance.

Experiments very similar to those of Edison were made by Elisha Gray of Boston, Mass., and described by him in papers communicated to the American Electrical Society in 1875 and 1878. In these experiments the electric current passed through the diaphragm to the electromotive forces, as in the Bell telephone. Sir W. Thomson (Lord Kelvin) observed in 1862 that when a condenser was charged or discharged, a sharp click is heard, and a similar observation was made by Croxton and F. Varley, who proposed to make use of it in a telegraphic receiving instrument. In Bell's instrument one plate of a condenser was a flexible diaphragm, connected with the telephone line in such a way that the varying electric potential produced by the action of the transmitting telephone caused an increased or diminished charge in the condenser. This alteration of charge caused a corresponding change in the mutual attraction of the plates of the condenser; hence the flexible plate was made to copy the vibrations of the diaphragm of the transmitter. It is obvious that this apparatus might be used either as a transmitter or as a receiver, but that the effects must under ordinary circumstances be in either case extremely feeble.

It was very early recognized—and, indeed, is mentioned in the first patents of Bell, and in a caveat filed by Elisha Gray in the United States patent office only some two hours after Bell's application for a patent—that sounds and spoken words might be transmitted to a distance by causing the vibrations of a diaphragm to vary the resistance in the circuit. Bell and Gray proposed to do this by introducing a column of liquid into the circuit, the length or the resistance of which could be varied by causing the vibrations of the diaphragm to vary the depth of immersion of a light rod fixed to it and dipping into the liquid.

On the 4th of April 1877 Émile Berliner filed a caveat in the United States patent office, in which he stated that, on the principle of the variation with pressure of the resistance at the contact of two conductors, he had made an instrument which could be used as a telephone transmitter, and that, in consequence of the mutual forces between the two parts of the current on the two sides of the point of contact, the instrument was capable of acting as a receiver. The caveat was illustrated by a sketch showing a diaphragm with a metal patch in the centre, against which a metal knob was lightly pressed by an adjusting screw. This seems to have been the first transmitter in which it was proposed to use the resistance at the contact of two conductors.

Almost simultaneously with Berliner, Edison conceived the idea of using a variable resistance transmitter. He proposed to introduce into the circuit a cell containing carbon powder, the pressure on which could be varied by the vibrations of a diaphragm. He sometimes held the carbon powder against the diaphragm in a small shallow cell (from a quarter of an inch in diameter and about an eighth of an inch deep), and sometimes he used what he described as a "fluff," that is, a little brush of silk fibre with plumbago rubbed into it. In another form the plumbago powder was worked into a button cemented together with syrup and other substances. In the specification of the patent applied for on the 21st of July 1877 he showed a sketch of an instrument which consisted of a diaphragm, with a small platinum patch in the centre for an electrode, against which a spring point, made of plumbago powder cemented together with india-rubber and varnish, was pressed by a long spring, the pressure of the carbon against the platinum being adjusted by a straining screw near the base of the spring. Subsequently he filed an application for a patent in which various forms of springs and weights assisted in maintaining the contacts and otherwise improved the instrument.

In the early part of 1878 Professor D. E. Hughes, while engaged in experiments upon a Bell telephone in an electric circuit, discovered that a peculiar noise was produced whenever hard electrodes, such as two wires, were drawn across each other, or were made to touch each other with a variable degree of firmness. Acting upon this discovery, he constructed an instrument which he called a "microphone," and which consisted essentially of two hard carbon electrodes placed in contact, with a current passing through the point of contact and a telephone included in the same circuit. One of the electrodes was attached to a sounding board capable of being vibrated by sound-waves and the other was held either by springs or weights in delicate contact with it. When the sounding board was spoken to or subjected to the action of sound-waves, the resistance of the hard electrode, due to its weight, or to the spring, or both, served to vary the pressure at the contact, and this gave rise to vibrations corresponding to the sound-waves, and it was therefore capable of being used as a speaking-telephone transmitter.

The next transmitter of note was that introduced by Francis Blake, which came into wide use in the United States of America and other countries. In it the electrodes were of platinum and carbon.

To a frame F (fig. 5) was attached a diaphragm D of thin sheet iron; in front of this was a cover M, provided with a suitable cavity for directing the sound-waves against the diaphragm. The microphone arrangement consisted of a spring S, about the thickness of an inch thick and the eighth of an inch broad, fixed at one end to a lever L, and carrying at its free extremity a brass block W. In one side of W a small disk C of carbon was inserted, resting on the hemispherical end of a small platinum pin K, about the twentieth of an inch in diameter, held in position by a similar diaphragm A. The pressure of the carbon on the platinum point could be adjusted by the screw N, which turned the lever about the flexible joint G. The electrical connections of the instrument as arranged for actual use are also illustrated in the figure. The current circuit went through S, W, C, K, A, and the primary circuit of the induction coil I to the battery B, and thence to S again. This formed a local circuit at the transmitting station. The line current was passed through the secondary of the induction coil I to the line, from that to the telephone T at the receiving station.

and then either to earth or back to the induction coil by a return line of wire.

Another type of microphone which was used in Europe much more than in the United States was the multiple-contact instrument. In this several microphonic joints were employed.

![Diagram of Blake's Transmitter](image)

**Fig. 5.—Blake's Transmitter.**

Thus, in the Crossley transmitter four hard carbon pencils were arranged in a lozenge-shaped figure, the ends of each pencil resting loosely in a small carbon block. These blocks were fastened to a diaphragm of wood. The circuit connections were such that two adjacent sides of the lozenge were in parallel and two in series. In the Ader transmitter as many as twelve carbon pencils were employed, arranged in a series of two groups with four pencils in parallel in each group. These were supported at their ends in parallel carbon bars, which were carried by a nearly horizontal wooden diaphragm. Such multiple-electrode transmitters give a loud although somewhat harsh sound, and will bear being spoken to very strongly without breaking the circuit.

A type of transmitter which has come to be invaluable in connexion with long-distance telephony, and which has practically superseded all other forms, is the granular carbon transmitter. The earliest instrument of this kind was the Hunnings transmitter, patented in 1875. This was constructed of a shallow box placed in a vertical position, with metallic front and back and insulating sides. The front face was of thin metal, and served as a diaphragm. The box was filled nearly, but not quite full, of granulated hard carbon. The current from the battery used passed from the diaphragm through the granulated carbon to the metallic back of the box. When spoken to the diaphragm vibrated, and thus set the carbon granules into vigorous vibration. The vast number of microphonic contacts present give rise to very strong electrical undulations, and hence to a loud sound.

The chief difficulty with this transmitter, and with various others of later date based upon it, has been the frequent packing of the carbon granules, which renders the instrument inoperative. The difficulty was first satisfactorily overcome in the long-distance transmitter, invented by A. C. White in the laboratory of the American Bell Telephone Company, and commonly known as the "solid back transmitter" (fig. 6).

The microphonic portion of the transmitter is contained in a thin cylindrical box or case of brass A, the inner curved surface of which is covered with an insulating layer of paper. The case is firmly fixed to a "bridge" B with its back or bottom in a vertical position. To the brass bottom of the case is attached a thin disk of polished hard carbon C, which is slightly less in diameter than the brass bottom, so that the carbon disk almost entirely covers this brass back, leaving only a slight annular space around its edge. The front or cover of the case is a similar button of hard polished carbon D, also slightly smaller in diameter than the cylindrical wall of the box. It is attached to a brass disk E, which is fastened to the centre of the diaphragm F by means of a rivet, and is capable of moving to and fro like a plunger when the diaphragm vibrates. A washer of thin flexible mica G concentric with the carbon button is carried by the brass disk, and projecting over the edge of this is held firmly against the rim of the cylindrical wall of the case by an annular brass collar H, which is screwed upon the outer curved surface of this wall. The box is thus entirely closed at the front, while the front carbon disk, which constitutes an electrode, is perfectly free to follow the motions of the diaphragm.

**Fig. 6.—Solid Back Transmitter.**

The space enclosed between the front and rear faces of the box is filled about three-quarters full of finely granulated hard carbon, which therefore lies in contact with the front and rear carbon disks of the apparatus, and also fills up the space lying between the lower edge of these disks and the curved surface of the case. The current from the battery passes from one of the carbon disks to the other through the particles of granulated carbon which fill the space between them.

The disks and granules constitute a very powerful microphone. The motions impressed upon the carbon granules are very vigorous, and this together with the particular arrangement of the parts of the instrument is effectual in overcoming the difficulty from packing which attended the use of earlier forms of granulated carbon transmitters. This instrument has almost entirely displaced all other forms of transmitter.

**Subscribers' Organization.**—The employment of the telephone as one of the great means of communication requires a definite organization of the subscribers. It is not practicable to connect each subscriber directly to all the others, hence a system of exchanges has been adopted. The territory in which a telephone administration operates is usually divided into a number of local areas, in each of which one or more exchanges are placed. An exchange is a central station to which wires are brought from the various subscribers in its neighbourhood, any two of whom can be put in telephonic communication with each other when the proper pairs of wires are joined together in the exchange.

When the subscribers in a local area exceed a certain number, or when for some other reason it is not convenient or economical to connect all the subscribers in the area to one exchange, it is usual to divide the area into a number of districts in each of which an exchange is placed, and to connect these district exchanges together by means of "junction circuits." In some cases the exchanges are connected together directly; but when the volume of traffic is not sufficient to warrant the adoption of such a course connections between two exchanges are made through junction centres to which both are connected.

A system of wires, similar to that which connects the district exchanges in an area, links together the various local areas in the territory, and sometimes the territory of one administration with that of another. These inter-area or long-distance lines, called trunk circuits in England, terminate at one exchange in each local area, and between that exchange and the various
district exchanges junction circuits are provided for the purpose of connecting subscribers to the trunk lines.

Circuit and Working Arrangements.—The method first employed for working a telephone line was extremely simple. A single line of wire, like an ordinary telegraph line, had a bell telephone included in it at each end, and the ends were put to earth. Words spoken to the telephone at one end could be heard by holding the telephone to the ear at the other. To obviate the inconvenience of placing the telephone to the mouth and the ear alternately, two telephones were commonly used at each end, joined either parallel to each other or in series. The contrivance most generally adopted for calling attention was a call-bell ringer either by a small magneto-electric machine (magneto-generator) or by a battery.

The telephone was switched out of circuit when not in use and the bell put in its place, a key being used for throwing the battery into circuit to make the signal. This arrangement is still employed, a hook being attached to the switch lever so that the mere hanging up of the telephone puts the bell in circuit. In some cases when a magneto-generator is employed for calling purposes the coil of the machine is automatically cut out of circuit when it is not in action, and is brought into circuit when the handle is turned by the operation of a central fugal spring.

At first it was usual to join the microphone transmitter in the direct circuit. It was soon found that it could only be used to advantage in this way when the total resistance of the circuit, exclusive of the microphone, was small compared with the resistance of the microphone—that is, on very short lines worked low resistance telephones. The transmitter on long and high-resistance lines worked better by joining, in the manner shown in fig. 7, the microphone, a battery and the primary of an induction coil in a local circuit, and putting the line in circuit with the secondary of the induction coil, which acted as the transmitter. The resistance of the microphone can thus be made a large fraction of the total resistance of the circuit in which it is placed; hence by using considerable currents, small variations in its resistance can be made to induce somewhat powerful currents in the wire line. The microphone of this arrangement is shown in fig. 7.

In the earliest telephone switchboards the lines were connected to vertical conducting strips, across which were placed a series of similar horizontal strips in such a manner that any horizontal could be connected to any line strip by the insertion of a plug into holes provided in the strips for the purpose. Any two lines could be connected together by connecting both to the same horizontal strip.

The next step of importance was the introduction of what was termed the "Standard board." This board was equipped with spring-jacks and announciators (calling-drops) for the subscribers' lines, and with flexible cords terminating in plugs for connecting purposes. The spring-jack used was a form of switch with two contact springs which pressed against each other, one being connected to the subscriber's line wire and the other to the announciator, which was also earthed. When a plug was inserted in the spring-jack the connexion between the springs was opened, disconnecting the calling-drop from the line. Each connecting-cord circuit had associated with it a clearing-out drop connected between the line and ground by means of which the subscriber's speaking and ringing apparatus could be brought into circuit. When a subscriber called (by turning the handle of his magneto-generator) the shutter of the announciator associated with his line was dropped. This attracted the attention of the attendant, who in response to the call inserted a plug into the spring-jack and connected the speaking apparatus to the circuit by means of the key. The telephone was now connected to the subscriber, and the operator connected the second plug to the spring-jack of the wanted subscriber, whom she rang up. When the conversation was finished either of the subscribers could release the shutter of the clearing-out drop by turning his generator handle, and the operator thus notified of the fact removed the plugs and discontinued the connexion.

The single-wire earthed circuits used in the early days of telephony were subject to serious disturbances from the induction of currents in the lines by magnetic fields and electric currents in the earth, and from the varying potential of the earth due to natural or artificial causes. The introduction of electric tramways caused an increase in the number of such disturbances of this class. It was early recognized that a complete separation of the telephone circuit from the earth would obviate the disturbing effects of the disturbing wires, and that if the outgoing and incoming branches of the circuits were parallel and kept, by transformers, at equal potential, the effect of the disturbing wire induction would likewise be removed.

These advantages led to the gradual supersession of the single-wire system until at the present day the all-metallic system is employed in the majority of cases. Since its introduction all switchboards have been arranged for metallic circuits.

Though many types of manually operated switchboards have been brought into use, differences from each other in respect of circuit and working arrangements, yet each of them is placed in one or other of three main classes according as the system of working is magneto, call-wire, or common battery. The fundamental principle of the magnetic system has been described in connexion with the "Standard board."

In a large exchange a number of operators are necessary to attend to the calls. Several single-switchboards like that described may be employed, each being in charge of a certain number of subscribers, and placed in care of an operator. In these circumstances, when, as frequently will be the case, the person calling desires to speak with a subscriber who is in communication with one or more others, many additional switchboard operations are required. In connexion with the introduction of the "multiple switchboard" this board is built up in sections of one or more operators' positions each. All the subscriber's lines are connected in order to the boards on the first, second or third operators' positions, and these connections are repeated or "multiplied" upon each succeeding similar group of positions. Each subscriber's circuit is further connected to another spring-jack directly associated with the calling-drop. These spring-jacks, known as answering jacks, are distributed along the switchboard, a certain number being terminated upon each position and placed in care of the operator assigned to that position. Hence this operation is much simplified, and in the ordinary way, can be put at the disposal of these subscribers in connexion with any subscriber whatever, without the necessity of calling upon another operator to make connexion.

Two methods of "multiplying" have been much used. In the arrangement first introduced the line wire is connected in series through the various spring-jacks, the circuit finally passing through the answering jack to the calling-drop. This arrangement is liable to give trouble, as disconnections may arise in the spring-jacks in consequence of the failure of the springs to make contact. Operating mistakes also cause interruptions to conversations, as it is impossible for an ordinary telephone to work without being connected in the circuit between two talking subscribers. To overcome these difficulties the "branching multiple" was introduced. In this case, all the being of being introduced in connexion with a subscriber, rather than that subscriber's circuit being treated as an independent branch from the main circuit. With the "branching multiple" the "self-restoring drop" was introduced. This apparatus has two coils, one of which, connected across the line, is provided for the purpose of projecting the shutter, while the other is intended for its restoration and is joined in a local circuit arranged to be closed when a plug is inserted in any one of the associated jacks.

It is necessary that the operators working at a multiple board shall be able to ascertain without entering a subscriber's circuit whether the circuit is disengaged. This requirement is usually met by means of a "test" button. Each test button is associated with a subscriber's line, and by making the circuit arrangements such that this wire is either disconnected or at earth potential when the line is not in use, and at some potential above or below earth when the circuit is engaged. With a proper arrangement of the operator's speaking set it is possible, by touching the socket of a jack with the tip of a pen or a special "test" thumble, to determine whether the circuit connected to the jack is in use or not.

Both the series and the branching methods of multiplying are recognized at the present time as standard methods, although the former is the more extensively employed because of the comparative disadvantage of the magneto system itself is dying out. There are still many magneto exchanges in existence, but when new exchanges are erected only the very smallest are equipped for magneto working, that system having been displaced by other systems. The "call-wire" system has been used to some extent, but it is now obsolete. The feature of the system was the provision of special service circuits, termed call-wires, for purposes of communication.
between the subscribers and the exchange operators. Each subscriber was given the exclusive use of a circuit in other systems, and shared a call-wire with a number of other subscribers. Each telephone set was equipped with a special key or switch by means of which the telephone could be transferred from one exclusive line to the call-wire at will. A subscriber desiring a connexion pressed the key and communicated his own number and that of the subscriber to the operator in attendance on the call-wire. Then, when the connexion was made, the originating subscriber rang up the other. At the close of a conversation the originating subscriber again entered the call-wire and requested the operator to take down the connexion. The call-wires were usually equipped with drops in order that the exchange might be called at night when the operators were not listening continuously.

One of the greatest advances made in the development of the art of telephony was the introduction of the "common battery relay system." This advance did not merely remove the primary batteries from the subscribers' stations; it removed also the magneto-generator, and at the same time it modified considerably the conditions governing the exchange operating. The calling-drop of the magneto system was displaced by a relay and a small electric incandescent lamp, and whereas in the older system the calling-drop and the answering jack were two apparatus separated by some distance, the calling-lamp and the answering jack of the newer system were placed in juxtaposition. This alteration improved the operating conditions in three ways. In the first place it increased the visibility of the signaling instrument; in the second place it brought that instrument into the position in which it could most readily catch the operator's eye; and finally it eliminated the effort involved in associating one piece of apparatus with another and in finding that other. Moreover the clearing-out drop of the cord circuit was replaced by an arrangement which included the provision of one signal to be controlled through the agency of a relay by the calling subscriber, and another to be controlled by the person wanted. These supervisory signals took the form of lamps and were placed on the keyboard in positions immediately adjacent to the associated cords. With the adoption of relays the signaling between the subscribers and the exchange became automatic, and, with the introduction of the principle of double and automatic supervision on the cord circuits, it became possible for the operators to tell at any instant the state of the connexion. As a result the time occupied by an operator per call was reduced from 50-77 seconds to 16-63 seconds.

Three fundamental common battery transmission systems have been devised and are shown in figs. 8, 9, and 10. In the Hayes system (fig. 8) a repeating coil is placed in the cord circuit, and when two subscribers are connected together the winding connected to the line of the subscriber who is talking for the time being acts as primary, and the other, which is in the line of the listening subscriber, as secondary.

The Stone system (fig. 9) is characterized by the use of impedance coils between the battery and the line wires. When one of two subscribers connected together by this arrangement talks, the variation in resistance of the subscriber transmitted into causes a variation of the pressure at the line terminals of the impedance coils, and since those terminals are common to the two circuits the variable E.M.F. operates in the line of the listening subscriber, causing the reproduction of the speech in the latter's receiver.

The Stone system, compared with that of Hayes, possesses the disadvantage that one of the conditions affecting the supply of current to any particular subscriber's circuit is the resistance of the other circuit to which it is connected for the time being. An improvement in this respect has been effected by the insertion of condensers in the cord circuits, coupled with the use of two sets of impedance coils, one set on each side of the condensers.

Dean's method (fig. 10) embodies the idea of supplying current to the transmitters over the line wires in parallel instead of round the loop circuit, as in the other systems referred to. An earth return is used. The transmitter is placed in multiple with the primary winding of an induction coil whose secondary operates in the loop circuit, and consequently when the transmitter is spoken into, a variable E.M.F. is impressed upon the circuit through the medium of the induction coil. The impedance coils shown connected between the battery and the lines and between the latter and the transmitters are joined up non-inductively as regards the transmitter circuits, but inductively as regards the secondary circuits. Figs. 11 and 12 indicate typical subscriber's and connecting-cord circuits as equipped by the Western Electric Company. At the subscriber's station when the receiver is on the hook, the circuit is through the call-bell and a condenser. The conditions permit of the circulation of the alternating currents of low periodicity, which are used for operating the bells, but in respect of the battery the circuit is open until the subscriber lifts the receiver, when the hook switch, thus released, joins the transmitter with one winding of an induction coil in series across the circuit. A current then flows and in passing round the circuit operates the line relay with the result that the calling-lamp is lighted. The operator, whose attention is thus attracted, inserts a peg in the jack, then throws over the speaking key of the cord circuit, and having ascertained particulars of the requirement places the other peg of the pair in the nearest multiple jack of the wanted subscriber, whom she proceeds to ring up. In the meantime the calling-lamp has darkened; and each subscriber's line being equipped with a cut-off relay whose function it is to disconnect the calling apparatus while the circuit is in use, the insertion of a peg is immediately followed by the disappearance of the calling signal. The supervisory lamp associated with the peg in the wanted subscriber's jack glows from the time that the peg is inserted until...
the subscriber responds, when it darkens, in which condition it remains until the subscriber restores the receiver to the hook and causes the lamp to light up again. The other supervisory lamp on the cord circuit is controlled in a similar manner by the subscriber who originated the call, and as that subscriber's telephone is off the hook when the peg is inserted, the lamp is not lighted at all until the subscriber replaces the receiver. When both lamps glow, the operator, who thereby knows that both subscribers have restored their instruments, discontinues the connexion.

A cord circuit, similar in many respects, including the method of operation, but equipped with condensers and impedance coils, in place of the repeating coil, is shown in fig. 13.

In fig. 11 a meter or counter is shown associated with the subscriber's line, the whole between 12 and 13 positive meters are shown connected to the cord circuits. The operation of these meters is controlled by the operators. The subscriber's meter is joined in multiple with the cut-off relay, and whenever a peg is connected to the circuit a current flows through the meter. This current is small, however, and the meter is not operated until a much larger current is passed through it. Calls are registered by pressing a key, which connects a battery through a position meter of very low resistance to the socket of the line jack, thereby furnishing the necessary energy to the meter. The position meter just mentioned is common to all the cords on one position and records all completed calls handled at the position. Some administrations, in addition to employing the ordinary position meter, use a second one for registering ineffective calls.

In large towns served by a number of exchanges the junction equipment is an important feature. In many cases from 60 to 80 per cent. of the calls originated at an exchange are for subscribers connected to other exchanges, and in these cases the junction plant forms a considerable fraction of the whole equipment. Moreover each call junctioned is dealt with by at least two operators. The junction circuits connecting two exchanges are invariably divided into two groups, one for traffic from exchange A to exchange B, the other for traffic from B to A. At the outgoing end the circuits are multiplied on the subscribers' switchboard, while at the incoming end they terminate in plugs on a special incoming junction switchboard upon which the subscribers' lines are multiplied in the usual way.

When a subscriber at exchange A asks for a connexion to a subscriber at B, the operator at A drives the signal, and instructs the receiver to essay connexion with B. He makes the connexion, and rings the subscriber. During the progress of these operations the A operator connects the originating subscriber to the junction circuit passed by the B operator. There is only one signal on the cord circuit at B, and that signal is controlled by exchange A. Each of the subscribers controls a signal at A, and when either or both of the telephones are replaced, the action is indicated by the lamps there. Control of the call is thus vested in the operator at the originating exchange, at which point the connexion must be severed before a clearing signal can appear at B.

Party Lines.—A circuit which serves more than one subscriber is termed a "party line." It was originally the practice to place the calling apparatus in series in the line circuit, but the effect of the large impedance introduced by the electromagnets of the call-

bells was such that not more than two or three persons could be connected without seriously impairing the efficiency of the circuit for speech transmission. An improvement was effected in this respect by the introduction of the "bridging" system, in which the bells possessing high inductance are placed in parallel between the two wires of the circuit, and thereby in circuit their high impedance prevents any appreciable interference with the telephonic currents. In America, on farmers' circuits, ten or more stations are frequently connected to one line; but in England ten is practically the maximum. In city districts the modern practice is to restrict the number to four stations per line, and to equip the exchanges and stations for selective ringing. In one arrangement, now in extensive use, each telephone is fitted with a relay of high inductance which is bridged across the circuit in series with a condenser. When the relay is actuated it connects a bell between one of the wires of the circuit and earth, while the bell itself is arranged to respond to current pulsations in one direction only. The four telephones on a circuit are so wired that the relays connect two of the bells between each wire and earth, and further that one of each pair of bells responds to positive and the other to negative pulsations. This system of course requires that the exchange equipment shall include machines capable of delivering a positive pulsating current and a negative pulsating current, besides the usual alternations required for the ringing of ordinary subscribers.

In another party line system a harmonic principle is employed; the ringing machines deliver alternating currents of four frequencies, while each bell is constructed to operate at a particular frequency. Of the four bells connected to a circuit each responds to a different frequency.

Trunk Line Working.—Trunk or long-distance working is complicated by the necessity for recording all calls. The system of the British Post Office is worked as follows: A subscriber desiring a long-distance connexion calls up his local exchange in the ordinary way, and the operator there, being informed that a trunk connexion is desired, extends the subscriber's line to the Post Office by means of a record circuit. At the Post Office a record operator supplies and takes particulars of the connexion, and these are entered upon a ticket. The record operator then removes her speaking apparatus from the circuit, and the local operator, receiving a disconnect signal, sever the connexion at the local exchange. Meanwhile the ticket is conveyed to the position where the lines to the town wanted are terminated. If there be a line free, or when the turn of the call is reached, particulars of the connexion wanted are passed to the distant end, and the trunk operators request the local exchanges to connect the subscribers by means of junction circuits to the trunk exchanges where the necessary connexions are made between the trunk line and the junctions. The call is controlled by the trunk operators, the junction circuits being equipped in such a manner that signals appear at the trunk exchanges, from which point disconnecting signals are sent automatically to the local exchanges, when the connexions between the trunk and the junction circuits are removed.

The large modern trunk exchanges are of the extendable-relay and lamps for signalling purposes. "Calculated graphs" are employed for stamping the time upon the tickets, and there is associated with each trunk circuit a device which lights a lamp as soon as the scheduled limit of the period of conversation is reached.

Particulars of calls are now passed between trunk centres to a great extent over telegraph circuits superposed upon the trunk
TELEPHONE

lines. This arrangement permits particulars of calls to be passed over lines while conversations are in progress.

Automatic Systems.—The idea of automatic telephony is to substitute electrical equipment for mechanical or other switching systems, which, controlled in its movement by the action of the subscriber, will automatically select, connect, and disconnect circuits of which there are many thousands, embodying this idea have been developed, and one of them has been put into extensive operation. Each subscriber's circuit on this system terminates upon the incoming portion of a selector switch, called a selector, and is multiplexed upon the outgoing portions of a number of similar switches called connector switches. Only calls originated by a subscriber pass through the selector switch (first selector) provided for his sole use; the calls incoming to him pass through one or other of the various connector switches upon which his circuit is multiplexed. Each connection involves the use of three switches, viz., a first selector, a connector switch, and a second selector which is brought into operation between the other two.

The subscribers' lines in an exchange are arranged in groups of 1000, which are divided in turn into sub-groups of 100 each. By means of his first selector the circuit of a calling subscriber is connected to the outgoing end of a junction whose other end terminates upon the incoming portion of a second selector in the thousand group to which the wanted subscriber belongs. The second selector in turn extends the connexion by means of another junction circuit to one of the selector switches in the hundred group wanted, while finally the connector switch completes the desired connexion. Conductors may be placed upon the outgoing portion of each switch, and the contacts upon which they terminate are arranged in a number of horizontal rows upon the face of a curved surface, at whose axis a vertical shaft is placed. This shaft usually consists of a number of ferrules, each ferrule supporting a number of conductors, so that the wipers may be brought, first opposite any particular horizontal row of conductors, and then opposite any particular row of conductors in the particular set in the series. The movements of the shaft are controlled by relays and electro-magnets which operate in response to the action of the subscriber whose telephone is fitted with a call-system. The circuit may be made for a certain number of times for each figure in the number of the wanted subscriber.

Wire Plant.—In suburban and rural districts subscribers are usually connected by means of wires laid upon the tops of iron poles. As subscribers’ lines are invariably short, the smallest gauge of wire possessing the mechanical strength necessary to withstand the stresses to which it may be subjected can be employed, and bronze wire weighing 40 lb per mile is commonly used. In large towns telephone distribution by means of open wires is practically impossible, and the employment of cables either laid in the ground or suspended from poles or other overhead supports is necessary.

In the types of cables that were first used, the wires, usually with a cotton insulation, were drawn into lead tubes, and the tubes filled with a strong paraffin filling which kept the wires from the injurious effects of any moisture which might penetrate the lead tube. This form of cable has been superseded by a type with paper insulation. The separate wires are surrounded only with a paper covering, or else each of such furnishing an improved insulation. In the manufacture of the cable the wires are first enclosed in the paper, which is applied sometimes longitudinally and sometimes spirally. The paper is then, with a double layer in the gauge of the paper now is, laid in the air. These pairs are laid up symmetrically into cables, each layer being protected with an additional covering of paper and all adjacent layers revolving with an opposite twist. The cable is then placed in an oven, and, after all moisture has been driven off, it is passed through a lead press whence it emerges protected by a continuous lead pipe. The electrostatic capacity of a cable of this type is low, and its direct application for the transmission of telephonic purposes is limited by the presence of a lead sheath. The direct advantages of the cable are therefore obtained by using a copper pipe either under the ground or on poles. Copper pipe is employed for communication purposes, and iron pipe for the transmission of telephonic purposes.

When a number of cables follow the same route, they are generally laid in conduits made up of earthenware or metal ducts; iron pipes are used when the number of cables is small. Manholes are placed at intervals, and accommodated for the introduction in and jointing of the cables, and surface boxes are placed in the footways for distributing purposes. Various methods of making the connexion between the large main pipes and the smaller pipes and manholes are employed. In one of them the main cables terminate in large air-tight iron boxes placed in the manholes. There, the large cables divide into a number of small cables, which are carried along the floors of the manholes in copper or earthenware conduits. Another method of distribution, largely adopted, is to run the lead cables into the interior of blocks of buildings, and to terminate them there in iron boxes from which the circuits are distributed to the surrounding buildings by means of rubber-covered wires run along the walls. Aerial distribution from distributing poles is a method frequently adopted. In this case the cables terminate upon the poles, the connexions between the cable wires and the open wires being made by means of earthing}

As no practical process of telephone relaying has been devised, it is extremely important that the character of the line should be such as to favour the rapidity of the transmission of the telephone current. In circuits possessing high resistance and capacity and low inductance per mile, telephonic currents are rapidly attenuated, and the higher the frequency the more rapid is the attenuation. Moreover, as the velocity of propagation is a function of the frequency, there is distortion of the complex waves. Oliver Heaviside showed mathematically that uniformly-distributed inductance in a telephone line would diminish both attenuation and distortion, and that if the inductance were great enough and the insulation resistance not too high the circuit would be distortionless, while currents of all frequencies would be equally attenuated. He also showed that by placing inductance coils in circuit, at distances apart of less than half the length of the shortest component wave to be transmitted, a uniform conductor might be made approximately distortionless. It was applied to submarine cables, so that by "loading" the manner proposed by Pupin during recent years, especially in underground cables, and it has been found in practice that the inductance coils inserted at regular intervals, from three to four times their value unloaded. Open aerial long-distance lines have also been loaded, but not to the same extent. The introduction of inductance coils into such circuits renders them susceptible to trouble from atmospheric electricity and more sensitive to leakage variations.

In consequence of their high capacity, the attenuation constant of submarine cables is high, and only a small number of cables, of comparatively low capacity, are employed. Attempts have been made to improve submarine cables in this respect, and in 1906 a short cable "loaded," with Pupin coils was laid across Lake Constance. The problem, however, of constructing a deep-sea cable satisfactorily, with suitable inductance coils inserted at short distances apart, is a difficult one, and one which it cannot be said has been solved (H. R. K.).

Commercial Aspects.—The records of the telephone industry in Great Britain during the thirty years from 1877 to 1907 form an instructive chapter in the industrial history of the country. The aspects which stand out most prominently in this history are: (a) The elevation of successive governments to the position of conscious custodians of the public rights of users of the telephone, and the provision of apparatus for transmitting messages or other communications with the aid of electricity, magnetism, or any other like agency.

1876. The Edison telephone Company of London was formed. Both the Bell and the Edison Companies opened negotiations with the Post Office for the sale of their patents to the government; but without success. The Edison Company proceeded to start telephone business in London, and the Postmaster-General instituted proceedings against the company
for infringement of his monopoly rights under the Telegraph Act 1869.

1880. The two companies amalgamated as the United Telephone Company Ltd. Mr Justice Stephen decided (Attorney-General v. Edison Telephone Company, 6 Q.B.D., 244) that the telephone was a patent infringing invention and that the companies could not legally be carried on except by the Postmaster-General or with his consent. The decision covered also future invention in regard to "every organized system of communica-
tion of messages by means of wires according to any precor-rected system of signals."

1881. The company's appeal against the decision was withdrawn, the Postmaster-General deciding in favour of the licence areas of about 5 m. in London and about 2 m. in the provinces. The licences merely conformed the infringement of the Telegraph Act 1869, and did not confer powers to erect poles and wires, to construct underground wires or to lay down any property. The licence was precluded from opening public call offices and from laying trunk lines from one town to another. The licences were for 31 years, expiring in 1922, without any provision for purchase or compensation, and were subject to the payment of a minimum royalty to the Post Office of 10 per cent. of the gross revenues. The United Telephone Company confined its operations to Local Com-
sidiary companies were formed to operate in the provinces. The Post Office at the same time established several telephone exchanges in provincial towns so as to enable the Postmaster-General to "exercise control over the telephone companies in a satisfactory manner for licences."

1882. The Postmaster-General (Mr Fawcett) declared that he would issue new licences unless the licensees agreed to sell telephones to the Post Office at a price fixed by the government. Eight companies out of over seventy that had applied obtained or accepted licences.

1883. The Post Office proposed to engage in active competition with the telephone companies, but the Treasury at that time opposed this policy on the ground that the state should at most be ready to supplement and not to superease private enterprise.

1884. The licences within restricted areas having proved unsatis-
factory for the growing business, public opinion appealed to the Post Office to issue new licences applicable to the whole country. All restriction was lifted, the licences being allowed to open public call offices but not to receive or deliver written messages, and they were allowed to erect trunk wires. The royalty of 10 per cent. was continued. The Post Office reserved the right to compete either directly or by granting other licences, and it was under no obligation to grant way-leaves. The new licences were to terminate in 1911 without any provision for purchase or compensation in that year, but with the option to the government to purchase the plant of the licensees in 1890, 1897, or 1904 at a price to be deter-
mined by arbitration. The United Telephone Company asked parliament for rights of way in streets, and its only right to place overhead wires was obtained by private way-leaves.

1885. The United Telephone Company again applied successfully for right to lay wires underground.

1888. The application for the company for permission to lay wires in streets was again refused.

1892. The Postmaster-General, after the removal of the restriction against the com-
pamies erecting trunk wires it became evident that the develop-
ent of the telephone service throughout the country would be facilitated by complete intercommunication and uniformity of systems, and that economies could be effected by concen-
tration of management. The various companies therefore amalgamated as the National Telephone Company.

1898. The government had the option to buy out the companies under the licences of 1884, but did not exercise it. The Bell telephone patents expired. The National Telephone Company applied to the London County Council for permission to lay wires underground, and continued efforts till 1899 to obtain this power, but without success.

1891. The duke of Marlborough, in the name of the New Tele-
phone Company, inaugurated a campaign for cheaper telephone service, because the telephone was thus far used only to make business calls at a cost that the public was much fearful of. The National Telephone Company was subsequently merged in the National Telephone Company.

1892. The National Telephone Company again applied to parlia-
ment for permission to lay underground wires under a bill dis-
cont with inadequate telephone services was expressed, and at the same time the competition of the telephone with the Post Office telegraph became more manifest. The government again changed its mind, and the combined companies, finding it more economical to use the existing trunk wires to the Post Office, leaving the local exchanges in the hands of the companies. It also expressed willingness that the companies should have rights of way in the streets. 

1893. The National Telephone Company applied to parliament for power to lay wires underground, but was refused.

1894. The draft agreement between the government and the National Telephone Company to carry out the policy of 1892 was submitted to parliament and led to much discussion. Local authorities (notably the City of London (Glasgow)) refused to permit the company to lay wires underground.

1895. A select committee of the House of Commons (with Mr Arnold Morley, Postmaster-General, as chairman) was ap-

nounced "to consider the support which has been or may be made for the telephone service in local areas is adequate, and whether it is expedient to supplement or improve this pro-

ever or licit in law, or of any other or otherwise."

The committee was unanimous and made no report, but merely submitted to the House the evidence it had received.

1896. The trunk wires were transferred to the Post Office in pursuance of the policy of 1892, but for all practical purposes the local authorities had vetoed the permission of the govern-
ment to the company to lay wires underground.

1897. The government had an option to purchase the plant of the company under the licences of 1884, but did not exercise it. The corporation of Glasgow having persisted in its efforts to obtain a licence, the Treasury appointed Sheriff Andrew Jameson (afterwards Lord Ardwall) a special commissioner to hold a local inquiry in Glasgow to report whether the tele-
phone service in that city was adequate and efficient and whether it was expedient to grant the corporation a licence. The commissioner reported that the service was adequate but not efficient; that the rates were reasonable but that the competition was not sufficiently complete to avoid withholding facilities, thus rendering the service inefficient; that it was inexpedient to grant the corporation a licence because the funds of a city ought not to be applied for the benefit of a limited number of citizens; that the trunk systems in one area would increase the difficulties of the government in 1911; and that the corporation had not proved that it would work the licence without placing a burden on the rates.

1898. The policy of the government was now changed; Mr R. W. Hanbury, Financial Secretary to the Treasury and representative in the House of Commons of the Post-
master-General, advocated the granting of licences to local author-
ities. A select committee was appointed with Mr Hanbury as chairman to consider whether the telephone service is calculated to be beneficial or is an idolatry, and whether it is being undertaken by municipal and other local authorities, and if so under what conditions. The committee reported (9th August) that the telephone service was not likely to become of general benefit "so long as the present practical monopoly in the hands of a private company shall continue."

The committee considered that the Post Office was not prevented either by legal agreement or by good faith from limiting or ending the monopoly of the company, and that competition appeared to be both expedient and necessary in order to extend and popu-
larize the service and to avoid the danger that a purchase of the company's service by the government would be forced upon the government. While considering that a really efficient Post Office service would afford the best means for service such competition between the Postmaster-General, imme-
diate and effective competition should at once be undertaken either by the Post Office or by local authorities. The Associa-
tion of Municipal Corporations passed resolutions on the 28th of August that "the telephones were to be used as an imperial and not as a local one, and that the Postmaster-
general should have the sole control of the telephone system," and that in the event of the Postmaster-General not taking over the telephone service it should be competent for municipal and other local authorities to undertake such services within areas composed of their own districts or combination of such districts."

1899. In pursuance of the report of the select committee, 1898, the Telegraph Act 1899 was passed to enable the Post Office to develop its telephone exchange business, for which a loan of £200,000 was raised, and to extend to the telephone service subject to certain conditions, to enter upon telephone business. The licence of the National Telephone Company was extended so as to be co-extensive with that of a competitive licence for any network on the Continent of Europe. The licence included intercommunication with the telephone systems of the new licensees. In short, all-round competition was authorized, and the Post Office designed to erect a telephone system in London in competition with the company.

1900. The Telegraph Act 1899, while providing for intercom-
munication between the telephone systems of the local author-
hities and the companies, gave no compulsion to demand intercommunication between its exchanges and those of the company. The Post Office co-operated with the London County Council to put difficulties in the way of the company which led to application for an injunction to restrict the consent of the local road authorities. In February the Postmaster-General applied for an injunction to restrain the
company from opening any street or public road within the county of London without a permit granted by the General and the London County Council, which injunction was granted in July.

1901. The government policy of 1899 was abandoned in London, the equal to 7½ per cent. more telephones with the consent and regard to the London business. The company consented to free intercommunication between its subscribers and those of the Post Office, and undertook to charge rates identical with those charged by the Post Office. The Postmaster-General on the other hand agreed to provide underground wires for the company on a rental, and agreed to buy in 1911 the company's plant (excluding at the cost of construction less allowance for repairs and depreciation.

1903. The government had option to purchase the company's provincial plant under the licence of 1884. Negotiations took no presentment was expected to be completed in 1907. The government contracted to buy the company's plant in 1911, thus in effect annulling the act of 1899 which had failed to accomplish its object of establishing an all-round competition.

By 1907 altogether 59 local authorities had examined the proposition of establishing telephone systems after 1899, and licences were granted to local authorities at Brighton, Belfast, Chard, Glasgow, Grantham, Huddersfield, Hull, Portsmouth, Swansea, Tunbridge Wells, Oldham, Scarborough and Hartlepool, but only six municipalities proceeded with the business. Glasgow opened its exchange in March 1901, Tunbridge Wells in May 1901, Portsmouth in March 1903, Brighton in October 1903 and Hull in October 1904. The Tunbridge Wells and Swansea municipal undertakings were subsequently sold to the National Telephone Company, and the Glasgow and Brighton undertakings to the Post Office.

These two with the other municipal telephone systems working in 1907.

The effect of the unsettled policy of the Post Office until 1903 and of the difficulties created by the local authorities was that the National Telephone Company was never able to do its best to develop the enterprise on the most efficient lines. In 1885 there were only 2,800 telephone subscribers in London and less than 10,000 in the rest of the United Kingdom, and telephonic services were available in only about 75 towns, while in the same year the American Telephone Company had over 134,000 subscribers. The removal in 1884 of the prohibition against the erection of trunk lines at once enabled considerable expansion to take place. Within six years the services had been extended to 400 towns with about 55,000 subscribers. Large as this progress was it would have been much greater if the Telephone Company had been granted adequate powers to put wires underground and thus install a complete metallic circuit in place of the single wire, earth-return, circuit which it was constrained to employ. Subsequently the progress was still greater. In 1906 there were 39,551 telephone subscribers in the United Kingdom than in the ten European countries of Austria, Hungary, Belgium, Denmark, Holland, Italy, Norway, Portugal, Russia, Sweden and Switzerland, having a combined population of 288 millions as against a population of 42 millions in the United Kingdom. Apart from France, Germany and Switzerland, there was no European country that had as many telephones working as London. That city, with a population of 6 millions, had nearly as many telephones as the whole of Sweden with about the same population, or as the whole of France, with a population of 39 millions. The only province which can be compared with the United Kingdom in telephone development is Germany. With a population of 53 millions there are 10-2 telephones per 1,000 of the population in that country compared with 10-15 in Great Britain and Ireland. The development of telephony in the United States of America is much greater than anywhere else; on the 1st of January 1907, 5 per cent. of the population were telephone subscribers.

Tariffs.—Telephone business is characterized by two features: (1) that the capital account is never closed, and (2) that the costliness of the service increases with the size of the undertaking. The original method of charging adopted in Great Britain took the telephone instrument as the unit, charging a fixed annual rental independent of the amount of use to which the instrument was put. The study of telephone economics showed that the proper basis for charging was the "message-mile," on the theory that the user should pay according to the facilities offered and the extent to which he uses them. The importance of the Post Office connected exchanges have to be built and thousands of subscribers are put into communication with each other, the service is at once more costly and more valuable than in a small town with a few hundred subscribers. The change in the way of charging in the country not only in the size of towns, but in the arrangement and characteristic of the population, make each district a telephone problem by itself, and nullify close comparisons between telephone rates and telephone efficiencies in different areas and different circumstances. But the tendency is towards a system of charging a moderate surcharge to cover the rent of the instrument and an additional fee per message or some similar basis. In the city of London, for instance, the tariff is 5s. per annum plus 1d. per call within the county and 2d. per call outside the county. Subscribers outside the county of London pay only 4d. in annual subscription and 1d. per call to subscribers within the county, and the same rate per 2d. per call to subscribers in the same county.

In each case the minimum annual amount for message fees is £1, 10s. The alternative is given of an unlimited service ("flat rate") at £17 per annum. In the provinces the unlimited service costs only £7 10s. for subscribers within half a mile of the exchange, £1, 5s. being charged for every additional quarter of a mile or fraction thereof. The toll or message rates are 3d. per call in the case of the service varies in proportion to the amount of use, the toll rate is more scientific, and it has the further advantage of discouraging the unnecessary use of the instrument, which causes congestion of traffic at busy hours. In order to encourage local subscribers to make more frequent use of the instrument, a toll is charged when serious business calls are made. The tariff for unlimited use has to be made very high to cover the cost of the additional burdens thrown upon the service, and it is only work economically that will be used in normal circumstances. There is usually a larger number of calls originating from his instrument. The message-rate system equalizes the charges according to the service rendered. Another advantage is that the charge, known as the "measured service," is designed to make the subscriber pay in proportion to the quality and quantity of the service he takes. It is widely used in America, and was introduced into Great Britain in 1907. The subscriber may make three different annual contracts with the Post Office, viz., (1) the ordinary telephones, say 500; additional calls he purchases in advance in blocks of several hundred at so much per hundred, the price being reduced as the number increases. (2) Subscribers who desire the telephone for occasional use, the party-line system has been devised, whereby several telephones are connected to one line leading to the exchange. In a telephone town party service costs 4d. per annum, the message fees being 1d. per call to subscribers within the county and 2d. per call to those outside it, with a minimum of 5s. The fee charged for the use of public telephone call offices is 2d. per message.

The trunk line service is charged at rates which vary from 3d. (for 25 m.) up to 1s. (for 100 m.) for a three minutes' conversation between 6 a.m. and 8 p.m. For every 40 m. above 100 m. an additional 6d. per conversation is charged. A telephone call placed the charges are 1d. for trunk calls at 120 miles, and calls for single periods of three minutes are allowed at half the ordinary rates between 7 p.m. and 7 a.m. A call between London and Liverpool, which ordinarily costs 2s., may be made for 1s. between 7 p.m. and 7 a.m. The growth of traffic on this basis has been considerable, and the arrangement has proved of advantage to the public, as it provides cheap facilities at times which are convenient for social conversation.

The charges for submarine and inter-island services of the Post Office may be reached through the local exchange system, or by means of the trunk wires, in order that the messages may be written down and forwarded as telegrams or express letters or ordinary letters. Subscribers to exchanges may also make arrangements to have all telegrams (except Press telegrams) addressed to them delivered by telephone instead of messenger. Telephone subscribers may also obtain the services of an express messenger by telephoning to the nearest post office connected with the exchange.

National Telephone Company.—The issued share and debenture capital in the company at the end of December 1907 was £2,251,670, consisting of 15,000 6½ per cent. first preference shares of £1 each £150,000, 15,000 6 per cent. 2nd preference shares of £1 each £150,000, 250,000 5 per cent. 3rd preference shares of £1 each £1,250,000, £2,250,000 preferred stock, 576,715 new shares of £1 each £576,715 share dividend £2,715, new shares of £1 each £2,715, debenture stock £5,700,000, debenture stock £1,716,593 £11,216,593.

The company has a reserve fund of £2,675,707, the major part of which is invested in the investments of the Post Office. The total capital and surplus of the company on 31st December 1907 amounted to £3,702,228, of which £2,557,920 was paid to the Post Office in respect of royalties. The working expenses amounted to
to £1,530,003 or 62.6 per cent. of the net income, leaving a profit for the year of £90,000.

At the time of the formation of the various telephone companies the enterprises were regarded as speculative, and much of the capital was raised at a discount. The business subsequently proved remunerative, and the companies, in the most part, commanded a premium in the market. After the consolidation of the companies in 1889-90 the profits declined, patent rights had expired, material reductions were made in the rates, and the public realized that the whole, although promising, was not necessary, the cost of which was charged to revenue.

Agreement of 1905.—By this agreement the Postmaster-General agreed to purchase all plant, land and buildings of the National Telephone Company, and that the Postmaster-General would construct after that date in accordance with the specifications and rules contained in the agreement, subject to the right of the Postmaster-General to object to take over any plant not suited to his requirements. Mr. Halliwell, the then Chairman of the Council, proposed that G. and C. Commissioners as arbitrators on the basis of the "then value," exclusive of any allowance for past or future profits or any compensation for compulsory sale or otherwise. In those cases in which the company's licence has been extended beyond 1911 (Glasgow to 1913, Swansea to 1926, Brighton to 1926 and Portsmouth to 1926) the Postmaster-General will buy the unexpired licence with allowance for goodwill. The company also agreed also to buy the private wire plant of the company at a value based upon three years' purchase of the net profits on the average of the three years ending 31st of December 1911. Postmaster-General, and the company would for the company an annual rental of £1 per mile of double wire in any local area in which the company was operating, but not in areas in which the number of subscribers had not increased. An agreement was established by the agreement between the subscribers of the company and those of the Post Office, and a scale of charges was adopted or arranged to be agreed as binding on both companies. The latest Mar. 31st 1911, the company's books showed an over £2,000,000 per annum and its net revenue of £950,000, which the company had built up. The company had had to pay for all the experiments and the full amount of the Post Office's expenses, of any new industry. It had paid the Post Office in royalties already £1,848,000, and the Post Office under the agreement would into the business in 1911 by merely paying for the plant employed. The London County Council, the London County Council, the Post Office and the London County Council, on the other hand, considered the terms of purchase to be too favourable to the company. The London County Council, according to the statement of its comptroller, was disturbed by the hope expressed by the manager of the company, that the holders of the company's ordinary shares would obtain the par value of their shares in 1911. Inasmuch as the debenture stocks and preferences of the company to be incorporated would amount to £1,700,000, of which the company may be between 3 and 5 per cent., the state would have to pay the company £353,000 in excess of the total of the outstanding securities in order to enable the ordinary shares to receive par, and in the company's opinion it would diminish the prospects of the Post Office being able to afford a substantial reduction in the telephone charges.

Post Office Telephone.—The number of trunk wire centres open on the 1st of March 1917 was 2,304, and the total number of tr. of 31st of March 1907 was 19,803,300. The gross revenue derived from the trunk services was £480,658, being an average of 5.92d. per conversation. The total number of subscribers of the Post Office provincial exchanges was 1,611,000 at the 1st of March 1907 (excluding those of Glasgow and Brighton) was 10,010, and the number of telephones rented was 12,006. The Glasgow system included 11,103 subscribers' lines with 2,900 miles, and the London system 101 miles with 1,000 subscribers' lines with 1,884 telephones. The sum received by the Post Office as rental in respect of private wires was £183,000. The years working of the whole telephone system of the Post Office shows that on an average the telephone service amounted to £2,522,000 at 3 per cent. on the total expenditure of £7,522,000 was £435,776. Of the exchanges connected with the Post Office system in the metropolitan area on the 31st of March 1907 was 41,236, and additional subscribers were being connected at the rate of about 15,000 per year. The Post Office is continually extending the London area. The length of underground pipelines which had been laid in the metropolitan area for telephone purposes was 2030 m. Cables containing 317,789 m. of wire had been laid, including 69,066 m. recorded for the purpose of constructing an exchange circuit in the metropolitan area (including the installation of telephone instruments and of exchange apparatus, but excluding the provision of spare plant) has been £33, taking into account the whole system (including the plant of all kinds) and the capital expenditure per station (i.e., per telephone connected, with an exchange) stands at less than £50.

Anglo-G. and C. Trunk Telephone Service, which was opened between London and Paris in April 1891, was extended to the principal towns in England and France on the 11th of April 1904. The service has since been extended to cities in the British provincial towns; and the Anglo-Belgian telephone service has similarly been extended. There are now four circuits between London and Paris, one between London and the Belgian capital, and several others extending to carrying an increasing amount of traffic. Experiments have been made in telephonic communication between London and Rome by way of Paris. It was found possible to exchange speech when the conditions were exceptionally favourable; but, in spite of the partial success of the experiment, a public service between the two capitals is not at present practicable.

References.—Royal Select Committee on Telephone and Telegraph Wires (1885), of Select Committee on Telegraph Bill (1892), of Joint Committee of the House of Lords and the House of Commons on Electric Powers (Protective Clauses) (1893), of Select Committee on Telephone Service (1895), of Select Committee on Telephones (1898), and of Select Committee on Post Office (Telephone) Agreement (1905); Treasury Minutes (1892 and 1899); Annual Reports of the Postmaster-General; Report to the Treasury by Sheriff Jameson (1903); the Office of Public Works, the Telephone in England (London, 1905); E. Carcke, Manual of Electrical Undertakings (1896-1908).

TELESCOPE, an optical instrument employed to view distant objects. The term "photographic telescope" has been applied to instruments employed to record the appearance of celestial objects by photography. The word was coined by Democritus, a Greek scholar, at the request of Fereglio Cesii, founder of the Accademia del Lince, from the Greek τηλεος, far, and οπαποιοι, to see. It was used by Galileo as early as 1612, and came into English use much later, when it supplanted the terms hitherto used to denote the telescope.

History

The credit of the discovery of the telescope has been a fruitful subject of discussion. Thus, because Democritus announced that the Milky Way is composed of vast multitudes of stars, it has been maintained that he could only have been led to form such an opinion from actual examination of the heavens with a telescope. Other passages from the Greek and Latin authors have similarly been cited to prove that the telescope was not invented until much later. In 1895 Dr. Robert Grant (History of Physical Astronomy, p. 515), we are no more warranted in drawing so important a conclusion from casual remarks, however sagacious, than we should be justified in stating that Seneca was in possession of the discoveries of Newton because he predicted that comets would one day be found to revolve in periodic orbits. William Molyneux, in his Dioptrica Nova (1602), p. 256, declares his opinion that Roger Bacon (who died c. 1264) "did perfectly well understand all kinds of optic glasses, and knew likewise the method of combining them so as to compose some such instrument as our telescope." He cites a passage from Bacon's Opus Majus, p. 377 of Jebb's edition, 1733, translated as follows—

"Greater things than these may be performed by refracted vision. For it is easy to understand by the canons above mentioned that the greatest objects may appear exceedingly small, and the contrary, also that the most remote objects may appear just at hand, and the converse; for we can give such figures to transparent bodies, and dispose them in such order with respect to the eye and the objects, that the rays shall be refracted and bent towards any place we please, so that we shall see the object near at hand or at any distance under any angle we please. And thus from an incredible distance we may read the smallest letters, and may number the smallest particles of dust and sand, by reason of the greatness of the figures which we can give to transparent bodies. All which stars may be made to descend hither in appearance, and to be visible over the heads of our enemies, and many things of the like sort, which persons unacquainted with such things would refuse to believe." Molyneux also cites from Bacon's Epistle ad Poriiseniem, p. 1176. The objections of the Ancients to the telescope—

"Glasses or diaphanous bodies may be so formed that the most remote objects may appear just at hand, and the contrary, so that..."
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physician to the king of France, published at The Hague, in 1655, a work De vero Telescopio Inventore. He was assisted in its preparation by Willem Janssen, who owned the patent, and the latter declares, as the result of patient investigation, that Jansen and his father were the real inventors of the telescope in 1610, and that Leonard had not discovered it accidentally or gratuitously.

These passages certainly prove that Bacon had very nearly, if not perfectly, arrived at theoretical proof of the possibility of constructing a telescope and a microscope; but his writings give no account of the trial of an actual telescope, nor any detailed results of the application of a telescope to an examination of the heavens. It has been pointed out by Dr Robert Smith, in his Complete System of Opticks, that Bacon imagines some effects of telescopes which cannot be performed by them, and his conclusion is that Bacon never actually looked through a telescope.

Gambattista della Porta, in his Magia Naturalis, printed in 1561, makes the following remarkable statement:—

"The concave and convex glasses, if joined together, you will see both remote and near objects larger than they otherwise appear, and withal very distinct."

Wolfsius infers from this passage that its author was the first actual constructor of a telescope, and it appears not improbable that by happy accident Porta really did make some primitive forms of a telescope which excited the wonder of his friends. Here, however, his interest in the matter appears to have ceased, and he was unable either to appreciate the importance of his discovery or to describe the means by which the object was attained. Kepler, who examined Porta’s account of his concave and convex lenses by desire of his patron the emperor Rudolph, declared that it was perfectly unintelligible. Poggendorff (Gesch. der Physik, p. 134) throws considerable doubt on the originality of Porta’s statement.

Thomas Digges, in his Stratioticus, p. 359, published in 1579, states that his father, Leonard Digges, "among other curious practices had a method of discovering by perspective glasses set at due angles all objects pretty far distant that the sun shone upon, which lay in the country round about," and that this was by the help of a manuscript book of Roger Bacon of Oxford, who he conceived was the only man besides his father who knew it. There is also the following passage in the Pantometria (bk. i., chap. 21) of Leonard Digges 1 (originally published by his son Thomas in 1571, and again in 1591):—

"Marvellous are the conclusions that may be performed by glasses concave and convex, of circular and parabolic forms, using for multiplication of beams sometime the aid of glasses transparent, which, by refraction, shall unite or dissipate the images or figures presented by the refraction of other."

He then describes the effects of magnification from a combination of lenses or mirrors, adding:—

"But of these conclusions I mind not here to intreate, having at large in a volume 2 by itselfe opened the miraculous effects of perspective glasses."

It is impossible to discredit the significance of these quotations, for the works in which they occur were published more than twenty years before the original date claimed for the discovery of the telescope in Holland.

But it is quite certain that previous to 1600 the telescope was not possessed not yet possibly to individuals who failed to see its practical importance, and was upon its use to "curious practices" or to demonstrations of "natural magic." The practical discovery of the instrument was certainly made in Holland about 1608, but the credit of the original invention has been claimed on behalf of three individuals, Hans Lipperhey and Zacharias Jansen, spectacle-makers in Middelburg, and James Metius of Alkmaar (brother of Adrian Metius the mathematician).

Descartes, in his treatise on Optics (1637), attributes the discovery to Metius "about thirty years ago," whilst Schuyraeus de Rhetta, a Capuchin friar, in his Quaest. Ench. et Eliae (Antwerp, 1645), gives the credit to Lipperhey about 1609. Peter Borel, 3

1. He died about 1570. His son alludes to his untimely death in the preface to the Pantometria.
2. There is no further trace of this volume.
4. Lettere d’Uomini Illustri, p. 112 (Venice, 174/).
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no tube was employed, and they were consequently termed aerial telescopes. Huygens contrived some ingenious arrangements for directing such telescopes towards any object visible in the heavens—the focal adjustment and centring of the eye-piece being preserved by a braced rod connecting the object-glass and eye-piece. Other contrivances for the same purpose are described by Philippe de la Hire (Mém. de l'Acad., 1715) and by Nicolaus Hartsoeker (Miscel. Berol., 1710, vol. i. p. 261).

Telescopes of such great length were naturally difficult to use, and must have taxed to the utmost the skill and patience of the observers. But even if they made admiration to the men who, with such troublesome tools, achieved such results.

Reflecting Telescopes.—Until Newton's discovery of the different refrangibility of light of different colours, it was generally supposed that object-glasses of telescopes were subject to no other errors than those which arose from the spherical figure of their surfaces, and the efforts of opticians were chiefly directed to the construction of lenses of other forms of curvature. James Gregory, in his Optics Promota (1663), devised for the production of images and objects produced by lenses and mirrors, and arranged that the intermediate surfaces of the lenses or mirrors are portions of spheres the images are curves concave towards the objective, but if the curves of the surfaces are conic sections the spherical aberration is corrected. He was well aware of the failures of all attempts to perfect telescopes by employing lenses of various forms of curvature, and accordingly proposed the form of reflecting telescope which bears his name. But Gregory, according to his own confession, had no practical skill; he could find no optician capable of realizing his ideas, and after some fruitless attempts was obliged to abandon all hope of bringing his telescope into practical use. Newton was the first to construct a reflecting telescope. When in 1666 he made his discovery of the different refrangibility of light of different colours, he soon perceived that the faults of the refracting telescope were due much more to this cause than to the spherical figure of the lenses. He overhastily concluded from some rough experiments (Optics, bk. i. pt. ii. prop. 3) "that all refracting substances diverged the prismatic colours in a constant proportion to their mean refracture"; and he drew the natural conclusion "that refraction did not produce, without colour," and therefore "that no improvement could be expected from the refracting telescope" (Treatise on Optics, p. 112). But, having ascertained by experiment that for all colours of light the angle of incidence is equal to the angle of reflexion, he turned his attention to the construction of reflecting telescopes. After much experiment he selected an alloy of tin and copper as the most suitable material for his specula, and he devised means for grinding and polishing them. He did not attempt the formation of a parabolic figure on account of the probable mechanical difficulties, and he had besides satisfied himself that the chromatic and not the spherical aberration formed the chief faults of previous telescopes. Newton's first telescope so far realized his expectations that he could see with its aid the satellites of Jupiter and the horns of Venus. Encouraged by this success, he made a second telescope of 63-in. focal length, with a magnifying power of 38 diameters, which he presented to the Royal Society of London in December 1671. A third form of reflecting telescope was devised in 1672 by Cassegrain (Journal des Savants, 1672). No further practical advance appears to have been made in the design or construction of the instrument till the year 1723, when John Hadley (best known as the inventor of the sextant) presented to the Royal Society his reflecting telescope of the Newtonian construction, with a metallic speculum of 6-in. aperture and 62½-in. focal length, having eye-pieces magnifying up to 230 diameters. The instrument was examined by Pound and Bradley, the former of whom reported upon it in Phil. Trans., 1723, No. 378, p. 382. After remarking that Newton's telescope "had lain neglected these fifty years," they stated that Hadley had sufficiently shown "that this noble invention does not consist

the first, he took it to Venice, where he communicated the details of his invention to the public, and presented the instrument itself to the doge Leonardo Donato, sitting in full council. The senate, in return, settled him for his life in his lectureship at Padua and doubled his salary, which was previously 500 florins and which then became treble that which any of his predecessors had enjoyed. Galileo may thus claim to have invented the telescope independently, but not till he had heard that others had done so. In fact the time was ripe; and, as often happens in similar circumstances, only a hint was necessary to complete the latent genius in the mind of the expert. He devoted all his time to improving and perfecting the telescope. Knowing the theory of his instrument, and possessed of much practical skill, coupled with unwearied patience, he conquered the difficulties of grinding and polishing the lenses, and soon succeeded in producing telescopes of greatly increased power. His first telescope magnified three diameters; but he soon made instruments which magnified eight diameters, and finally one that magnified thirty-three diameters. With this last instrument he discovered in 1610 the satellites of Jupiter, and soon afterwards the spots on the sun. This led to his invention of the microscope and the early valleys on the moon. He demonstrated the rotation of the satellites of Jupiter round the planet, and gave rough predictions of their configurations, proved the rotation of the sun on its axis, established the general truth of the Copernican system as compared with that of Ptolemy, and fairly routed the fanciful dogmas of the philosophers. These brilliant achievements, together with the immense improvement of the instrument under the hands of Galileo, overshadowed in a great degree the credit due to the original discoverer, and led to the universal adoption of the name of the Galilean telescope for the form of the instrument invented by Lipperhey.

Kepler first explained the theory and some of the practical advantages of a telescope constructed of two convex lenses in his Cælestrics (1611). The first person who actually constructed a telescope of this form was the Jesuit Christoph Scheiner, who gives a description of it in his Rosa Ursina (1630). William Gascoigne was the first who practically appreciated the chief advantages of the form of telescope suggested by Kepler, viz., the visibility of the image of a distant object simultaneously with that of a small material object placed in the common focus of the two lenses. This led to his invention of the micrometer and his application of telescopic sights to astronomical instruments of precision (see Micrometer). But it was not till about the middle of the 17th century that Kepler's telescope came into general use, and then, not so much because of the advantages pointed out by Gascoigne, but because its field of view was much larger than in the Galilean telescope. The first powerful telescopes of this construction were made by Huygens, after much labour, in which he was assisted by his brother. With one of these, of 12-ft. focal length, he discovered the brightest of Saturn's satellites (Titan) in 1655, and in 1659 he published his Systema Saturni, in which was given for the first time a true explanation of Saturn's ring, founded on observations made with the same instrument. The sharpness of image in Kepler's telescope is very inferior to that of the Galilean instrument, so that when a high magnifying power is required it becomes essential to increase the focal length. G. D. Cassini discovered Saturn's fifth satellite (Rhea) in 1672 with a telescope of 35 ft., and the third and fourth satellites in 1684 with telescopes made by Campani of 100- and 136-ft. focal length. Huygens states that he and his brother made object-glasses of 170 and 210 ft. focal length, and he presented one of 123 ft. to the Royal Society of London. Adrien Auzout (d. 1691) and others are said to have made telescopes of from 500 to 600 ft. focus, but it does not appear that they were ever able to use them in practical observations. James Bradley, on 27th December 1722, actually measured the diameter of Venus with a telescope whose object-glass had a focal length of 212½ ft. In these very long telescopes

1 This last power could not be exceeded with advantage in this form of telescope till after the invention of the achromatic object-glass.
TELESCOPE

in bare theory." They compared its performance with that of the object-glass of 125-ft. focal length presented to the Royal Society by Huygens, and found that Hadley's reflector

"will bear such a charge as to make it magnify the object as many times as the latter with its due charge, and that it represents objects as distinct, though not altogether so clear and bright... Norwithstanding the excellence in the original glass of the object

which was made compatible with this reflecting telescope to see whatever we have hitherto discovered with the Huygenian, particularly the transit of Jupiter's satellites and their shadows over his disk, the black line, burnt ring, and the edge of his shadow cast on his ring. We have also seen with it several times the five satellites of Saturn, in viewing of which this telescope had the advantage of the Huygenian at the time when we compared them; for, being in another, and the Huygenian telescope being managed for an eye-tube, the twilight prevented us from seeing in this some of these small objects which at the same time we could discern with the reflecting telescope.""Bradley and Molyneux, having been instructed by Hadley in his methods of polishing specula, succeeded in producing some telescopes of considerable power, one of which had a focal length of 8 ft.; and, Molyneux having communicated these methods to Scarlet and Hearne, two London opticians, the manufacture of telescopes as a matter of business was commenced by them (Smith's Opticks, bk. iii. ch. 1). But it was reserved for James Short of Edinburgh to give practical effect to Gregory's original idea. Born at Edinburgh in 1710 and originally educated for the church, Short attracted the attention of Maclaurin, professor of mathematics at the university, who persuaded him about 1731 to become a prelate, and to give the college buildings for experiments in the construction of telescopes. In Short's first telescopes the specula were of glass, as suggested by Gregory, but he afterwards used metallic specula only, and succeeded in giving to them true parabolic and elliptic figures. Short then adopted telescope-making as his profession, which he practised first in Edinburgh and afterwards in London. All Short's telescopes were of the Gregorian form, and some of them retain even to the present day their original high polish and sharp definition. Short died in London in 1768, having realized a considerable fortune by the exercise of his profession. Achromatic Telescope.—The historical sequence of events now brings us to the discovery of the achromatic telescope. The first person who succeeded in making achromatic refracting telescopes seems to have been Chester Moor Hall, a gentleman of Essex. He argued that the different humours of the human eye so refract rays of light as to produce an image on the retina which is free from colour, and he reasonably argued that it might be possible to produce a like result by combining lenses composed of different refracting media. After devoting some time to the study of the subject, and combining lenses found in different kinds of glass the effect of the unequal refrangibility of light was corrected, and in 1733 he succeeded in constructing telescopes which exhibited objects free from colour. One of these instruments of only 20-in. focal length had an aperture of 2½ in. Hall was a man of independent means, and seems to have been careless of fame; at least he took no trouble to communicate his invention to the world. At a trial in Westminster Hall about the patent rights granted to John Dollond (Watkin v. Dollond),2 Hall was admitted to 1 The same argument was employed by Gregory more than fifty years previously, but had been followed by no practical result. The lens of the human eye is not achromatic.

2 At a meeting of the Royal Astronomical Society held on 9th May 1886 a legal document, signed by Chester Moor Hall, was presented by R. B. Procter of the Patent Office to the society. On the same occasion A. C. Gray made the following interesting statement respecting Hall:—

"Some years ago very little was known about Moor Hall. It was generally supposed that he was the inventor of the achromatic object-glasses. In 1733 the Copley medal had been awarded to Dollond for making achromatic object-glasses, it was claimed by the latter that Hall had invented the achromatic object-glasses at least seven years before the patent for making achromatic object-glasses was granted to Dollond, and in 1747 Lord Mansfield held in an action that John Dollond was not the real inventor, and that such telescopes had been made twenty-five years before the granting of his patent by Mr Moor Hall. John Dollond, to whom the Copley medal of the Royal Society had been the first inventor of the achromatic telescope; but it was ruled by Lord Mansfield that "it was not the person who locked his invention in his scrutatory that ought to profit for such invention, but he who brought it forth for the benefit of mankind." In 1747 Leonhard Euler communicated to the Berlin Academy of Sciences a memoir in which he endeavoured to prove the possibility of correcting both the chromatic and the spherical aberration of an object-glass. Like Bradley and Hall, he argued that, since the various humours of the human eye were so combined as to produce a perfect image, it should be possible by suitable combinations of lenses of different refracting media to construct a perfect object-glass. Adopting Euler's mathematical line of reasoning, and using the rays of light, he proved analytically the possibility of constructing an achromatic object-glass composed of lenses of glass and water. But all his efforts to produce an actual object-glass of this construction were fruitless—a failure which he attributed solely to the difficulty of procuring lenses worked precisely to the requisite curves (Mem. Acad. Berlin, 1753). Dollond admitted the accuracy of Euler's analysis, but disputed his hypothesis on the grounds that it was purely a theoretical assumption, that the theory was opposed to the results of mathematical experiments, and that he proved it impossible to determine a physical law from analytical reasoning alone (Phil. Trans., 1753, p. 286). In 1754 Euler communicated to the Berlin Academy another memoir, in which, starting from the hypothesis that light consists of vibrations excited in an elastic fluid by luminous bodies, and that the difference of colour of light is due to the greater or less frequency of these vibrations in a given time, he deduced his previous results. He did not doubt the accuracy of Newton's experiments quoted by Dollond, because he asserted that the difference between the law deduced by Newton and that which he assumed would not be rendered sensible by such an experiment. Dollond did not reply to this memoir, but soon afterwards he received an abstract of a memoir by Samuel Klingenstierna, the Swedish mathematician and astronomer, which led him to doubt the accuracy of the results deduced by Newton on the dispersion of refracted light. Klingenstierna showed from purely geometrical considerations, fully appreciated by Dollond, that the results of Newton's experiments could not be brought into harmony with other universally accepted facts of refraction. Like a practical man, Dollond at once put his theory to the test of experiment, confirmed the conclusions of Klingenstierna, disproved "a difference far beyond his experiments in the refractive qualities of different kinds of glass with respect to their divergency of colours," and was thus rapidly led to the construction of achromatic telescopes in which first the chromatic and afterwards the spherical aberration were corrected (Phil. Trans., 1758, p. 733).

We have thus followed somewhat minutely the history of the gradual process by which Dollond arrived independently at his invention of the refracting telescope, because it has been asserted that he borrowed the idea from others. Montucla, given for his invention, was the dead, and his son brought an action for infringing the patent against Champness. There is no report of the case, but the facts are referred to in the reports of the committee. It appears that the workmen who had been employed by Mr Moor Hall were examined, and proved that they had made achromatic object-glasses as early as 1733. Dollond's patent was not set aside, though the evidence with regard to the prior manufacture was accepted by Lord Mansfield, who tried the case, as having been satisfactorily proved... Mr Hall was a bencher of the Inner Temple, and was alive at the time of the action. He was a man of some profession, and some property, and (as his tombstone as an excellent lawyer and mathematician. He was not a fellow of the Royal Society, but must certainly have known of the gift of the Copley medal to Dollond, as it was given to him in the same year that Dollond's patent was granted." (Astron. Register, May 1886, p. 219.)


4 For a good account of this controversy, see Dr H. Servus, Geschichte der Fernrohrs, p. 77 seq. (Berlin, 1880).
in his *Histoire des Mathématiques* (pp. 448-449), gives the following footnote, communicated to him by Lalande:

"Ce fut Chestertonhall" (an obvious misprint for Chest Moor Hall) "qui, vers 1750, eut l'idée des lunettes achronomiques. Il s'adressait à Dollond, comme il le dit, mais Dollond, ayant eu besoin de Bass pour un verre que demandait le duc d'Yorck, se reporta à Ayscough. Ayscough, qui fut le dernier maître verrier de Londres, a donné de la construction à Bird, qui n'en tint point compte. Dollond en profitant. Dans le procès qu'il eut entre Dollond et Watkin, au banc du roi, cela fut prouvé; mais Dollond gagna, parce qu'il étoit le premier qui eut fait d'ales lunettes achronomiques."  

It is clearly established that Hall was the first inventor of the achromatic telescope; but Dollond did not borrow the invention from Hall without acknowledgment in the manner suggested by Lalande. His discovery was beyond question an independent one. The whole history of his researches proves how fully he was aware of the conditions necessary for the attainment of achromatism in refracting telescopes, and he may be well excused if he so long placed implicit reliance on the accuracy of experiments made by so illustrious a philosopher as Newton. His writings sufficiently show that but for this constant limitation he might have arrived sooner at a discovery for which his mind was fully prepared. It is, besides, impossible to read Dollond's memoir (*Phil. Trans.*, 1758, p. 733) without being impressed with the fact that it is a truthful account, not only of the successive steps by which he independently arrived at his discovery, but also of the logical processes by which these steps were successively suggested to his mind.

The triple object-glass, consisting of a combination of two convex lenses of crown glass with a concave flint lens between them, was introduced in 1765 by Peter, son of John Dollond, and many excellent telescopes of this kind were made by him.

The limits of this article do not permit a further detailed historical statement of the various steps by which the powers of the telescope were developed. Indeed, in its practical form the principle of the instrument has remained unchanged from the time of the Dollonds to the present day; and the history of its development may be summed up as consisting not in new optical discoveries but in utilizing new appliances for figuring and polishing, improved material for specula and lenses, more refined means of testing, and more perfect and convenient methods of mounting.

About the year 1786, William Herschel, then a teacher of music in Bath, began to occupy his leisure hours with the construction of specula, and finally devoted himself entirely to their construction and use. In 1778 he had selected the *chef-d'œuvre* of some 400 specula which he made for the celebrated instrument of 7-ft. focal length with which his early brilliant astronomical discoveries were made. In 1783 he completed his reflector of 18½ in. aperture and 20-ft. focus, and in 1789 his great reflector of 4-ft. aperture and 40-ft. focal length. The fame of these instruments was rapidly spread by the brilliant discoveries which their maker's genius and perseverance accomplished by their aid. The reflecting telescope became the only available tool of the astronomer when great light grasp was requisite, as the difficulty of procuring disks of glass (especially of flint glass) of suitable purity and homogeneity limited the dimensions of the achromatic telescope. It was in vain that the French Academy of Sciences offered prizes for perfect disks of optical flint glass. Some of the best chemists and most enterprising glass-manufacturers exerted their utmost efforts without succeeding in producing perfect disks of more than 33 in. in diameter. All the large disks were crossed by striae, or were otherwise deficient in the necessary homogeneity and purity. The subsequent history of the development of the art of manufacturing glass disks for telescopic objectives will be found in the article GLASS: § Optical Instruments, &c.

We proceed to give an account of the methods and principles of construction of the various kinds of telescopes, and to describe in detail special typical instruments, which, owing to the work accomplished by their aid or the practical advances exemplified in their construction, appear most worthy of record or study.

**Refracting Telescope**

In its simplest form the telescope consists of a convex objective capable of forming an image of a distant object and of an eye-lens, concave or convex, by which the image so formed is magnified. When the axis of the eye-lens coincides with that of the object-glass, and the focal point of the eye-lens is coincident with the principal focus of the object-lens, parallel rays incident upon the object-glass will emerge from the eye-piece as parallel rays. These, falling in turn on the lens of the human eye, are converged by it and form an image on the retina.

Fig. 1 shows the course of the rays when the eye-lens is convex (or positive), fig. 2 when the eye-lens is concave (or negative). The former represents Kepler's, the latter Lippershey's or the Galilean telescope. The magnifying power obviously depends on the proportion of the focal length of the object-lens to that of the eye-lens, that is,

\[ \text{magnifying power} = \frac{F_e}{F_o} \]

where \( F_e \) is the focal length of the object-lens and \( e \) that of the eye-lens, and \( F_o \) is also the diameter of the pencil or parallel rays emerging from the eye-lens, which is the focal diameter of the object-lens inversely as the magnifying power of the telescope. Hence one of the best methods of determining the magnifying power of a telescope is to measure the diameter of the emergent pencil of rays, and to focus the telescope has been adjusted to focus upon a star, and to divide the diameter of the object-glass by the diameter of the emergent pencil. If we desire to utilize all the parallel rays which fall upon an object-glass it is necessary that the full pencil of emerging rays should enter the observer's eye. Assuming with Sir William Herschel that the normal pupil of the eye extends to one-fifth of an inch in diameter when viewing faint objects, we obtain the rule that the minimum magnifying power which can be efficiently employed is five times the diameter of the object-glass expressed in inches.

The defects of the Galilean and Kepler telescopes are due to the chromatic and spherical aberration of the simple lenses of which they are composed. The substitution of a positive or negative eye-piece for the simple convex or concave eye-lens in the Galilean, or achromatic object-glass for the simple object-lens, transforms these early forms into the modern achromatic telescope. The Galilean telescope with a concave eye-lens instead of an eye-piece still suffers from the defects of the modern achromatic combination, but the object-glass and eye-lens are achromatic combinations.

(D. G.)

**Telescope Objectives.**—In spite of the improvements in the manufacture of optical glass (see GLASS) practically the same crown and flint glasses as used by John Dollond in 1738 for achromatic objectives are still used for all the largest of the modern refracting telescopes.

It has long been known that the spectra of white or solar light yielded by ordinary crown and flint glasses are different: that while two prisms of such glasses may be arranged to give exactly the same angular dispersion between two Fraunhofer lines, in the case of short-sighted persons the image for very distant objects (that is, for parallel rays) is formed in front of the retina; therefore, to enable such persons to see distinctly, the rays emerging from the eye-piece must be slightly divergent; that is, they must enter the eye as if they proceeded from a comparatively near object. For normal eyes the natural adaptation is not to focus for quite parallel rays, but on objects at a moderate distance, and practically in the same manner, more or less to adjust the focus of a telescope, for most distinct and easy vision, so that the rays emerge from the eye-piece very slightly divergent. Abnormally short-sighted persons require to push in the eye-lens nearer to the object-glass, and long-sighted persons to withdraw it from the adjacent lens, employed by those of normal sight. It is usual, however, in computations of the magnifying power of telescopes, for the rays emerging from the eye-piece when adjusted for distinct vision to be parallel.

For the methods of grinding, polishing and testing lenses, see OBJECTIVE.
lines, such as C and F, yet the flint glass prism will show a relative drawing out of the blue end and a crowding together of the red end of the spectrum, while the crown prism shows an opposite tendency. This want of proportion in the dispersion for different regions of the spectrum is called the "irrationality of dispersion"; and it is as a direct consequence of this irrationality, that there exists a secondary spectrum or residual colour dispersion, showing itself at the focus of all such telescopes, and roughly in proportion to their size. These glasses, however, still hold the field, although glasses are now produced whose irrationality of dispersion has been reduced to a very slight amount.

The primary reason for this retention is that nothing approaching the difference in dispersive power between ordinary crown glass and ordinary dense flint glass (a difference of $1$ to $1\frac{1}{2}$) has yet been obtained between any pair of the newer glasses. Consequently, for a certain focal length, much deeper curves must be resorted to if the new glasses are to be employed; this means not only greater difficulties in workmanship, but also greater thickness of glass, which mitigates against the chance of obtaining large disks quite free from strain and perfect in their state of annealing. In fact, superfine disks of over 15 in. aperture are scarcely possible in most of the newer telescope glasses. Moreover the greater depths of the curves (or "curvature powers") in itself neutralize more or less the advantages obtained from the reduced irrationality of dispersion. When all is taken into consideration it is scarcely possible to reach the secondary curve at the focus of such a double object-glass to less than a fourth part of that prevailing at the focus of a double objective of the same aperture and focus, but made of the ordinary crown and flint glasses.

The only way in which the secondary spectrum can be reduced still further is by the employment of three lenses of three different sorts of glass, by which arrangement the secondary spectrum has been reduced in the case of the Cooke photo visual objective to about 1/30th part of the usual amount, if the whole region of the visible spectrum is taken into account. It is possible to construct a triple objective of two positive lenses enclosing between them one negative lens, the two former being made of the same glass. For relatively short focal lengths a triple construction such as this is almost necessary in order to obtain an objective free from aberration of the 3rd order, and it might be thought at first that, given the closest attainable degree of rationality between the colour dispersions of the two glasses employed, which we will call crown and flint, it would be impossible to devise another form of triple objective, by retaining the same flint glass, but adopting two sorts of crown instead of only one, which would have the secondary spectrum very much further reduced. Yet such is the rather surprising fact. But it can be well illustrated in the case of the older glasses, as the following case will show.

The figures given are the partial dispersions for ordinary crown and ordinary extra dense flint glasses, styled in Messrs. Schott's catalogue of optical glasses as o-60 and o-102 respectively, having refractive indices of 1.5179 and 1.6480 for the D ray respectively, and $(\mu_{0} - 1)/(\mu_{4} - \mu_{0}) = 62:2$ and 33:8 respectively to indicate their dispersive powers (inverted), $= \frac{4}{\mu}$. The $\Delta \mu$ from C to F being taken as unity in each case, then the $\Delta \mu$s for the other regions of the spectrum are expressed in fractions $\Delta \mu$ (C to F) and are given under the asterisks. Let it be supposed that two positive lenses of equal curvature powers are made out of these two glasses, then in order to represent the combined dispersion of the two together the two $\Delta \mu$s for each spectral region may be added together to form $\Delta \mu$ as in the line below, and then, on again expressing the partial $\Delta \mu$s in terms of $\Delta \mu$ (C to F) we get the new figures in the bottom row beneath the asterisks. We find that we have now got a course of dispersion or degree of rationality which very closely corresponds to that of an ordinary light flint glass, styled o-569 in Schott's catalogue, and having $\mu_{0} 1.5738$ and $(\mu_{4} - 1)/(\mu_{4} - \mu_{0}) = 41:4 = r$, the figures of whose course of dispersion are as below:

\[
\begin{array}{|c|c|c|c|c|}
\hline
\text{C to F} & A' to D & D to F & F to G \\
\hline
0.01385 & 1.000 & 0.00583 & 615. & 0.0087 & 713 & 0.00831 & 600 \\
\hline
\end{array}
\]

Hence it is clear that if the two positive lenses of equal curvature power of o-60 and o-102 respectively are combined with a negative lens of light flint o-569, then a triple objective, having no secondary spectrum (at any rate with respect to the blue rays), may be obtained.

But while an achromatic combination of o-60 and o-102 alone will yield an objective whose focal length is only 1:28 times the focal length of the negative or extra dense flint lens, the triple combination will be found to yield an objective whose focal length is 73 times as great as the focal length of the negative light flint lens. Hence impossibly deep curvatures would be required for such a triple objective of any normal focal length. This case well illustrates the much closer approach to strict rationality of dispersion which is obtainable by using two different sorts of glass for the two positive lenses, even when one of them has a higher dispersive power than the glass used for the negative lens.

It is largely to this principle that the Cooke photo visual objective of three lenses (fig. 3) owes its high degree of achromatism. This form of objective has been successfully made up to 12½ in. clear aperture. The front lens is made of baryta light flint glass.

![Fig. 3.](image)

(0-543 of Schott's catalogue) and the back lens of a crown glass, styled o-374 in Schott's older lists.

The table gives their partial dispersions for six different regions of the spectrum also expressed (in brackets) as fractional parts of the dispersion from C to F.

\[
\begin{array}{|c|c|c|c|c|c|}
\hline
\text{C to F} & A to D & D to F & E to F & F to G' & F to H \\
\hline
0.543 & 0.1145 & 0.00374 & 0.00790 & 0.00369 & 0.00650 & 0.01322 \\
(1-000) & (1-000) & (1-000) & (1-000) & (1-000) & (1-000) & (1-000) \\
\hline
0.374 & 0.00844 & 0.00296 & 0.00893 & 0.00247 & 0.00479 & 0.00976 \\
(1-000) & (1-000) & (1-000) & (1-000) & (1-000) & (1-000) & (1-000) \\
\hline
\end{array}
\]

Since the curvature powers of the positive lenses are equal, the partial dispersions of the two glasses may be simply added together, and we then have:

\[
\begin{array}{|c|c|c|c|c|c|}
\hline
\text{C to F} & A to D & D to F & E to F & F to G' & F to H \\
\hline
0.1959 & 0.00670 & 0.01383 & 0.00643 & 0.0129 & 0.02298 \\
(1-000) & (1-000) & (1-000) & (1-000) & (1-000) & (1-000) \\
\hline
\end{array}
\]

The proportions given on the lower line may now be compared with the corresponding proportional dispersions for borosilicate flint glass o-658, closely resembling the type o-164 of Schott's list, viz.:

\[
\begin{array}{|c|c|c|c|c|c|}
\hline
\text{C to F} & A to D & D to F & E to F & F to G' & F to H \\
\hline
0.068 & 1.546 & 0.0501 & 1.748 \\
(1-000) & (1-000) & (1-000) & (1-000) & (1-000) & (1-000) \\
\hline
\end{array}
\]
A slight increase in the relative power of the first lens of 0.543 would bring about a still closer correspondence in the rationality, but with the curves required to produce an object-glass of this type of 6 in. aperture and 108 in. focal length a discrepancy of 1 unit in the third decimal place in the above proportional figures would cause a linear error in the focus for that colour of only about 0.025 in., so that the largest deviation implied by the tables would be a focus for the extreme violet H ray about 0.37 longer than the normal. It will be seen, then, that the visual and photographic foci are now merged in one, and the image is practically as achromat as that yielded by a reflector.

Other types of triple object-glasses with reduced secondary spectra have recently been introduced. The extension of the image away from the axis or size of field available for converting a photographic plate with fair definition is a function in the first place of the ratio between focal length and aperture, the longer focus having the greater relative angular covering power, and in the second a function of the curvatures of the lenses, in the sense that the objective must be free from coma at the foci of oblique pencils or must fulfil the sine condition (see ABERRATION).

Eye-pieces.—The eye-pieces or oculars through which, in case of visual observations, the primary images formed by the objective are viewed, are of quite secondary importance as regards definition in the central portion of the field of view. If an eye-piece blurs the definition in any degree in the centre of the field it must be very badly figured indeed, but the definition towards the edge of the field, say at 20° away from the centre, is, of the field of view, depends very intimately upon the construction of the eye-piece. It must be so designed as to give as flat an image as is possible consistently with freedom from astigmatism of oblique pencils. The mere size of the apparent field of view depends upon obtaining the oblique pencils of light emerging from it to cross the axis at the great possible angle, and to this end the presence of a field-lens is indispensable, which is separated from the eye-lens by a considerable interval.

The earlier arrangement of two lenses of the Huygenian eye-piece (see MICROSCOPE) having foci with ratio of 3 to 1, gives a fairly large flat field of view approximately free from distortion of tangential lines and from coma, while the Mittenzwey variety of it (fig. 4) in which the field-lens is changed into a meniscus having radii in about the ratio of +1 to -9 gives still better results, but still not quite so good as the results obtained by using the combination of two convexo-plane lenses of the focal ratio 2 to 1.

In the Ramsden eye-piece (see MICROSCOPE) the focal lengths of the two plane-convex lenses are equal, and their convexities are turned towards one another. The field-lens is thus in the principal focal plane of the eye-lens, if the separation be equal to \( \frac{1}{2}(f+\frac{2}{3}r) \). This is such a practical drawback that the separation is generally \( \frac{3}{4}r \) or \( \frac{2}{3}r \) of the theoretical, and then the principal image viewed by the eye-piece may be rather outside the field-lens, which is a great practical advantage, especially when a reticule has to be mounted in the primary focal plane, although the edge of the field is not quite achromatic under these conditions.

Kellner Eye-piece.—In order to secure the advantage of the principal focal plane of the eye-piece being well outside of the field-lens and at the same time to obtain a large flat field of view with oblique achromatism and freedom from coma and distortion, there is no better construction than the modified Kellner eye-piece (fig. 5) such as is generally used for prismatic binoculars. It consists of a plane-convex field-lens, a convex glass and an approximately achromatic eye-lens, some distance behind it, consisting of an equi-convex crown lens cemented to a concavo-convex lens, the latter being attached.

There are also other eye-pieces having the field-lens double or achromatic as well as the eye-lens, in cases where it is important to get the maximum quantity of light into the eye, the field-lens is discarded and an achromatic eye-lens alone employed. This yields a very much smaller field of view, but it is very valuable for viewing feeble telescopic objects and very delicate planetary or lunar details. Zeiss and Steinhelf's monochromatic eye-pieces and the Cooke annular achromatic eye-piece (fig. 6) are examples of this class of oculars. (H. D. T.)

Reflecting Telescopes.

The following are the various forms of reflecting telescopes:

The Gregorian telescope is represented in fig. 7. A and B B are concave mirrors having a common axis and their concavities facing each other. The focus of A for parallel rays is at F, that of B for parallel rays at \( \frac{A}{B} \) between B and F. Parallel rays falling on A converge at F, where an image is formed of the rays after they have reflected from the two concave surfaces. A and B. In the case of parabolic mirrors the aberrations tend to increase each other, and it is extremely difficult to give a true elliptic figure to the necessarily deep concavity of the small specular. Short aperture telescopes having the spherical aberration in a manner, and his Gregorian telescopes act in the present day. The magnifying power of the telescope is \( \frac{F}{f} \), where F is the focal length of the large and small mirror, f the focal length of the eye-piece, and \( x \) the distance between the two (chief) foci of the two mirrors (\( =f \)) in the diagram when the instrument is in adjustment for viewing distant objects. The images are erect.

The Cassegrain telescope differs from the Gregorian only in the substitution of a convex hyperboloidal mirror for a concave ellipsoidal mirror as the small specular. This form has the following two distinct advantages: (1) If spherical mirrors are employed their aberrations have a tendency to correct each other; (2) the instrument is shorter than the Gregorian, caeteris paribus, by twice the focal length of the small Concave mirror. Fewer telescopes have been made of this than perhaps of any other form of reflector; but in comparatively recent years the Cassegrain has acquired importance from the fact of its adoption for the great Melbourne telescope and from its employment in the 60-in. reflector of the Mount Wilson Solar Observatory (see below). For spectroscopic purposes the Cassegrain form has peculiar advantages, because in consequence of the less rapid convergence of the rays after reflection from the convex hyperboloidal mirror, the equivalent focus can be made very great in comparison with the length of the tube. This permits the employment of a spectroscope furnished with a collimation of long focus. The magnifying power is computed by the same formula as in the case of the Gregorian telescope.

The Newtonian telescope is represented in fig. 8. A A is a concave mirror whose axis is \( \infty \). Parallel rays falling on A converge to a principal focal plane, and are reflected at right angles to the axis, forming an image in the focus of the eye-piece E. The surface of the large mirror should be a paraboloid of revolution, that of the small mirror a true optical plane. The magnifying power is \( \frac{F}{f} \). This form is employed in the
construction of most modern reflecting telescopes. A glass prism of
total reflection is sometimes substituted for the plane mirror.

The Herschelian or front view reflector is represented in fig. 9. A A is a concave parabolic mirror, whose axis is perpendicular to the axis of the tube a b so that the image of an object in the focus of the mirror may be viewed by an eye-piece at E, the angle a b c being equal to the angle e c E. This form was adopted by the elder Herschel to avoid the loss of light from reflection in the small mirror of the Newtonian telescope. The view from the telescope, however, has hardly been at all employed except by the Herschels. But at the same time two instruments have swept the whole sky for the discovery of faint nebulae; and

probably no other astronomers have worked for so many hours on end for so many nights as they did, and they emphasize the easy
position of the observer in using this form of instrument.

Construction of Specula.
The composition of metallic specula in the present day differs very little from that used by Sir Isaac Newton. Many different alloys have been suggested, some including silver, nickel, zircon or arsenic; but that which has been practically found best is an alloy of four equivalents of copper to one of tin, or the following proportions by weight: copper 252, tin 117-8. Such speculum metal is exceedingly hard and brittle, takes a fine white polish, and when subjected to flame has little liability to tarnish. The process of casting and annealing, in the case of the specula of the great Melbourne telescope, was admirably described by Dr Robinson in Phil. Trans., 1869, 159, p. 135. Shaping, polishing and figuring of specula are accomplished by methods and tools very similar to those employed in the construction of lenses. The reflecting surface is first ground to a spherical form, the parabolic figure being given in the final process by regulating the size of the pitch squares and the stroke of the polishing machine.

Soon after Liebig's discovery of a process for depositing a film of pure metallic silver upon glass from a salt of silver in solution, Steinheli (Gaz. Univ. d'Augsburg, 24th March 1850), and later, independently, Foucault (Comptes Rendus, vol. xliv., February 1857), proposed to employ glass for the specula of telescopes, the reflecting surface of the glass speculum to be covered with silver by Liebig's process. Those silver-on-glass specula are now the rivals of the achromatic telescope, and it is not probable that many telescopes with metal specula will be made in the future. The best speculum metal and the greatest care are no guarantee of freedom from tarnish, and, if such a mirror is much exposed, as it must be in the hands of an active observer, frequent repolishing will probably be necessary. This involves refiguring, which is the most delicate and costly process of all. Every time, therefore, that a speculum is repolished, the future quality of the instrument is at stake; its focal length will probably be altered, and thus the value of the constants of the micrometer also have to be reetermined. Partly for these reasons the reflecting telescope with metallic mirror has never been a favourite with the professional astronomer, and has found little employment out of England. In England, in the hands of the Herschels, Rosse, Lassell and De la Rue it has done

1 There is a noteworthy exception in the case of the 18-in. speculum-metal mirror employed by Sir William Huggins at Tulse Hill, with which a large part of his remarkable and important series of astrospectroscopic results have been obtained. So far as we know, this mirror has never been repolished since its first installation in 1870, and still retains its admirable surface. One of the mirrors, made about 1760 or 1770, of 6-in. aperture, now in the possession of Sir William Huggins, has surfaces which still retain their original perfection although they have never been repolished.

2 Herschel, Phil. Trans., 1795, 85, p. 347; Rosse, Phil. Trans. 1840, p. 503; 1861, p. 581.

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Mounting of Telescopes.
The proper mounting of a telescope is hardly of less importance
than its optical perfection. Freedom from tremor, ease and
delicacy of movement and facility of directing the instrument
to any desired object in the heavens are the primary qualifica-
tions. Where accurate differential observations or photographs
involving other than instantaneous exposures have to be made,
the additional condition is required that the optical axis of the
telescope shall accurately and automatically follow the object
under observation in spite of the apparent diurnal motion of
the heavens, or in some cases even of the apparent motion of
the object relative to neighbouring fixed stars.

We pass, therefore, directly to the equatorial telescope, the
instrument par excellence of the modern extra-meridian
astronomer. The article Transit Circle describes one form
of mounting in which the telescope is simply a refined sub-
stitute for the sights or pinules of the old astronomers. The
present article contains a description of the mounting of the
various forms of the so-called zenith telescope. In its simplest
form the mounting of an equatorial telescope consists of an axis
parallel to the earth's axis, called "the polar axis"; a second
axis at right angles to the polar axis called "the declination
axis"; and the telescope tube fixed at right angles to the
declination axis.

In Fig. 10 A A is the polar axis; the telescope is attached to the
declination axis; the latter rotates in bearings which are
attached to the polar axis and concealed by the telescope itself.
The telescope is counterpoised by a weight attached to the opposite
end of the declination axis. The lower pivot of the polar axis rests
in a cup-bearing at C, the upper bearing upon a strong metal casting
M M attached to stone ster piler S. A vertical plane
passing through A A is therefore in the meri-
dian, and the polar axis is inclined to the horizon at an angle equal to the
amount of the latitude of the place of
observation. Thus when the decli-
nation axis is horizontal the telescope
moves in the plane of the horizon
by rotation about the polar axis.

When the declination axis is hori-
izontal the telescope moves in the plane of the horizon by rotation about the
declination axis only. Now, if a
graduated circle B B is attached to the declination axis, together with
the necessary vernier for microscopes V V for reading it (see Transit
Circle), so arranged that when the telescope is turned on the declina-
tion axis till its optical axis is parallel to A A the vernier reads o°
and when at right angles to A A 90°, then we can employ the readings of
this circle to measure the polar distance of any star seen in the tele-
scope, and the readings will also be true (apart from the effects of
atmospheric refraction) in any position taking the meridian of the
observer as the axis A A. Thus one important attribute of an equatorially
mounted telescope that, if it is directed to any fixed star, it will
follow the diurnal motion of that star from rising to setting by
rotation of the polar axis only. If we now attach to the polar axis
a graduated circle D D, called the "hour circle," of which the
microscope or vernier K reads ° when the declination axis is
horizontal, we can obtain by this means the hour angle of the hour
of any star to which the telescope may be directed at the
instant of observation. If the local sidereal time of the observation
is known, the right ascension of the star becomes known by adding
the observed hour angle to the sidereal time if the star was on the
meridian, or subtracting it if east of the meridian. Since the
transit circle is preferable to the equatorial for such observations
wherein great accuracy is required, the declination and hour circles
of an equatorial are employed, not for the determination of the right
ascensions and declinations of celestial objects, but for directing
the telescope with ease and certainty to any object situated in an
approximately known position, and which may or may not be
visible to the naked eye, or to define approximately the position of
an unknown object. Further, by causing the hour circle, and
with it the polar axis, to rotate by clockwork or some similar
mechanical contrivance, at the same angular velocity as the earth
on its axis, but in the opposite direction, the telescope will, apart
from the effects of refraction, automatically follow a star from
rising to setting.

Types of Equatorials.—Equatorial mountings may be divided into
six types. (A) The pivots or bearings of the polar axis are placed
at its upper extremities. The declination axis rests on bearings attached
to opposite sides of the polar axis. The telescope is attached to
the end of the declination axis, and counterpoised by a weight at
the other end, as in fig. 10. (B) The polar axis is supported as in
the preceding; the telescope is mounted on the declination axis and
is mounted symmetrically with respect to the polar axis; no
counterpoise is therefore requisite. (C) The declination axis
is mounted on the prolongation of the upper pivot of the polar axis;
the telescope is placed at one end of the declination axis and counter-
poised by a weight at the other end. (D) The declination axis
is mounted on a forked piece or other similar contrivance attached
to a prolongation of the upper pivot of the polar axis; the tele-
scope is mounted between the pivots of the declination axis. (D)
The eye-piece of the telescope is placed in the pivot of the polar
axis; a portion or the whole of the axis of the telescope tube co-
incides with the polar axis. (F) The telescope is fixed and the rays
are reflected along its axis from an external mirror or mirrors.
Mountings of types A and B—that is, with a long polar axis sup-
ported at both ends—are often called the "English mounting," and
type C, in which the declination axis is placed on the extension
of the upper pivot of the polar axis, is called the "German mounting,"
from the first employment of type C by Fraunhofer. A description
of some of the best examples of each type will illustrate their relative
advantages or peculiarities.

Type A.—Fig. 10 may be taken as a practical example of the
earlier equatorials as made by Troughton in England and afterwards
by the various English and French observatories. In the Phil. Trans.
for 1824 (part 3, pp. 1-421) will be found a description by Sir John
Herschel of the Great Refractor of Sir James South, one of the
earliest equatorial telescopes which they employed in their measurements
of double stars. The polar axis was
similar in shape to that of fig. 10,
and was composed of sheets of tinned
iron. In Smyth's celebrated Bedford telescope the polar axis was
made of mahogany. Probably the best
example of this type of mounting
applied to a refractor is that made
by the late Mr. Cooke of the firm of
Dorset, of Tarnbank: the polar axis
is of cast iron and the mounting very satisfactory and convenient, but
unfortunately no detailed description has been published. In recent
years another important type of mounting has been introduced.

Type B.—The most important examples of type B are Airy's
equatorial at Greenwich (originally made to carry a telescope of
13-in. aperture, but now fitted with a telescope by Grubb of 28-in.
aperture), and the photographic equatorials of 13-in. aperture
employed at Paris and other French observatories. Some slight
alterations have been made in the design in this plan; but type B
has been chosen by Grubb for the great Melbourne reflector, of 48-in. aperture, with marked
success. The various parts of the instrument are peculiarities of the case.
Fig. 11 shows the whole instrument on
a small scale with the telescope directed to the pole, and the hour
circle set ° from the meridian.

Great
Mel-
bourne
tele-
scope.
Fig. 12.—Paris Observatory Instrument.
After an Illustration in La Nature, by permission of Masson et Cie.

FIG. 11.—Melbourne Reflector.

FIG. 12.—Paris Observatory Instrument.
After an Illustration in La Nature, by permission of Masson et Cie.

pendently of the clock. Slow motion in declination can be com-
monicated by a screw acting on a long arm, which latter can be
cramped at pleasure to the polar axis. An oblong metallic box
fitted with pivots, whose bearings are attached to the triangular
frame, forms for the tube for two parallel telescopes: these are
separated throughout their length by a metallic diaphragm. The
chromatic aberration of the object-glass of one of these telescopes
is corrected for photographic rays, and the image formed by it is
received on a highly sensitive photographic plate. The other
telescope is corrected for visual rays and its image is formed on the
plane of the spider-threads of a micrometer. The peculiar form
of the tube is admirably suited for rigid preservation of the relative
parallelism of the axes of the two telescopes, so that, if the image
of a certain selected star is retained on the intersection of two wires
of the micrometer, by means of the driving clock, aided by small
axes in composed of hollow metal in right ascension and declination
(required on account of irregularity in the clock movement, error
in astronomical adjustment of the polar axis, or changes in the star's
apparent place produced by refraction), the image of a star will
continue on the same spot of the photographic film during the whole
time of exposure. In these telescopes the photographic object-
glass has an aperture of 15 in. and the visual object-glass of 10 in.
Both telescopes have the same focal length, viz. 112 ft., so that,
in the image produced, 1 mm. is = 1° of arc. An excellent mounting
of type B, made by T. Cooke & Sons of York, has been employed
by Franklin Adams for making his maps of the sky.

Type C.—Many more telescopes have been made of type C than
of any other, and this form of mounting is still most generally
employed for the mounting of modern reflectors. Fraunhofer's
chef-d'oeuvre, the great Dorpat reflector, made for Otto Struve
about 1820, had a mounting of this type, and was the first equatorial
of any importance to be provided with clockwork. The instrument,
shown in fig. 13, is described in detail by Struve (Beschreibung des
auf der Sternwarte zu Dorpat befindlichen grossen Refraktors von
Fraunhofer, Dorpat, 1825), and was an enormous advance upon all previous telescopes for micrometric research. In the hands of Struve results were obtained by it which in combined quality and quantity had never before been reached. Its success was such that the type of Fraunhofer's telescope became stereotyped for many years not only by Fraunhofer's successors but throughout Germany. When, twelve years afterwards, Struve ordered the 15-in. refractor for the new observatory at Pulkovo, the only important change made by Fraunhofer's successors was, at Struve's suggestion, the substitution of a stone pier for the wooden stand in the original instrument.

Both the Dorpat and the Pulkovo refractors are defective in rigidity, especially in right ascension. The declination circle is most inconvenient of access, and slow motion in declination can only be accomplished when the instrument is clamped by a long and inconvenient handle; so that, practically, clamping in declination was not employed. The slow motion in right ascension is defective, being accomplished in the Dorpat refractor by changing the rate of the clock, and in the Pulkovo refractor by a handle which, when used, affects very injuriously the rate of the clock for the time being. Struve's skill as an observer was such that he used to complete the bissection on the fixed wire of the micrometer by a pressure of the finger on the side of the tube—a method of proved efficiency in such hands, but plainly indicative of the want of rigidity in the instrument and of the imperfection of the slow motions (see Micrometer).

The driving circle is also much too small, so that a very slight mechanical freedom of the screw in the teeth invades a large angular freedom of the telescope in right ascension, while its size increases the lower end of a too weak polar axis tends to create instability from torsion of that axis. Strange to say, the wooden tube long retained its place in German telescope-mountings.

About 1840 a great advance was made by the Repsold of Hamburg in the equatorial mounting of the Oxford heliometer. The driving circle was greatly increased in diameter and placed at the upper end of the polar axis, and both the polar and declination axes were made much stronger in proportion to the mass of the instrument they were designed to carry. (A figure of the instrument is given in the Oxford Observations for 1850.) About 1850 Thomas Cooke of York began his career as a maker of equatorial telescopes. The largest example of his work is the refractor of 24-in. aperture, originally made for the private observatory of Robert Stirling Newall at Gateshead, Northumberland, and afterwards presented by him to the University Observatory, Cambridge. Cooke's mounting is admirable for its symmetry and simplicity of design, its just apportioning of strength, and a general suitability of means to ends.

It is not a little curious that the obvious improvement of trans-

![Fig. 13. Dorpat Refractor.](image)

fering the declination axis as well as the declination-clamp to the telescope end of the declination axis was so long delayed; we can only suppose that the desire to retain the declination circle as a part of the counterpoise. We believe the first important equatorials in which the declination was read from the eye-end were the 15-in. by Grubb and the 6-in. by Cooke, made for the observatory of Lord Crawford (Lord Lindsay) at Dun Echt, Aberdeenshire, about 1873. The plan is now universally adopted. Telescopes of such dimensions can be conveniently directed to any object by the circles without the observer being under the necessity to climb a special ladder. But when much larger instruments are required the hour circle becomes inaccessible from the floor, and means have to be devised for reading both circles from the eye-end. This was first accomplished by Grubb in the great refractor of 27-in. aperture which he constructed for the Vienna observatory, represented in section in fig. 14. The observer's eye is applied to the small telescope E, which (by means of prisms numbered 1, 2, 3, 4) views the vernier attached to the cross-head and the graduated arc at the upper end of the polar axis. Light to illuminate the vernier and circle is thrown from the lamp L upon prism 4 by the prisms 6 and 5. Prism 1 is in the axis of the declination circle and always reflects rays along that axis, whatever the position of the telescope may be, whilst the prisms 2, 3, 4 and 5 are attached to the cross-head and therefore preserve their relative positions to each other. Through the eyepiece of the bent telescope E another hour circle attached to the lower end of the polar axis can be seen; thus an assistant is able to direct the telescope by a handle at H to any desired hour angle. A slight rotatory motion of the telescope E on its axis enables the vernier of the declination circle to be read through prism 1. The leading features of this fine instrument represent those of all Grubb's large telescopes. The mode of relieving the friction of the declination axis is similar to that employed in the Melbourne telescope and in the account of the Vienna telescope published by Grubb. The end friction of the polar axis is relieved by a ring of conical rollers shown in section beside the principal figure. From this point we must condense farther description into a few words only.

(1) Telescopes of Moderate Size for Micrometric Research Only.—Fig. 15 shows the mounting of the 8-in. refractor, of 4-ft. focal length, at the private observatory of Dr Engelmann, Leipzig. The object-glass is by Messrs Clark of Cambridge, Mass., the mounting, by the Repsold of Hamburg. The declination circle reads from the eye-end, and four handles for clamping and slow motion in right ascension and declination are situated near the observer's hands. The tube is of sheet steel, light, stiff, and free from tremor. The eyepiece carries the micrometer with an illuminating apparatus similar to that described under Micrometer. The lamp near the eye-end illuminates the field or the wires at pleasure, as well as the position circle of the micrometer and the declination circle; a separate lamp illuminates the hour circle. An excellent feature is the short distance between the eye-piece and the declination axis, so that

![Fig. 14. Grubb's 27-in. Refractor (Vienna).](image)
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The observer has to follow the eye-end in a comparatively small circle; another good point is that the flattening of the cast-iron centrepiece of the tube so that the flange of the declination axis is attached as near as to the axis of the telescope tube as is consistent with free passage of the cone of rays from the object-glass. The substitution of small incandescent electric lamps is an improvement now universally adopted.

(2) Telescopes for General Purposes.—The modern equatorial should, for general purposes, be capable of carrying spectrosopes of considerable width, so that the proportional strength of the axes and the rigidity of the instrument have to be considerably increased. The original mounting of the Washington refractor of 26-in. aperture and 324-ft. focal length (described in Washington Observations, 1874, App. 1) was in these respects very defective, the polar and declination axes being only 7 in. in diameter. The great Pulkovo refractor (fig. 16) erected in 1885 is of 30-in. aperture and 45-ft. focal length. The object-glass is by Clark, the mounting by the Repsold. The tube is cylindrical, of riveted steel plate, graduated in thickness from the centre to its extremity by very powerful flanges to a strong short cast-iron central tube, in which, as in Dr. Engelmann’s telescope (fig. 15), the attachment to the flange of the declination axis is placed as close as it can be to the axis of the tube without interfering with rays converging from the object-glass to any point in the field of view. A new feature in this instrument is the platform at the lower end of the polar axis, where an assistant can view the hour circle by one eye-piece and the declination circle by another (looking up the perforated polar axis), and where he can also set the telescope to any hour angle by one wheel, or to any declination by a second, with the greatest ease. The observer at the eye-end can also read off the hour and declination circles and communicate quick or slow motions to the telescope both in right ascension and declination by conveniently placed handles. The eye-end presents an appearance too complicated to be figured here; it has a micrometer and its illumination for the position circle, a micrometer head, and a bright or dark field, clamps in right ascension and declination and quick and slow motion in the hour circle. Microscopes for reading the hour and declination circles, an illuminated dial showing sidereal time, and driven by an electric current from the sidereal clock, and counter weights which can be removed when a spectroscope or other heavy appliance is added. All these, although making up an apparently complicated apparatus, are conveniently arranged, and are all necessary for the quick and easy working of so large an instrument. We have the authority of Otto for stating that in practice they are all that can be desired. There is in this instrument a remarkably elegant method of relieving the friction of the polar axis. Let A A (fig. 17) be a section of the polar axis; it is then easy to adjust the weight P at such a distance from its lower end so that the centre of gravity X of the whole moving part of the instrument shall be in the vertical (V V) of a line passing through the apex of the hollowed flange p q at q, which forms a part of p q. If now a wheel W is forced up against q with a pressure equal to the weight of the moving part of the instrument, the whole weight of the moving part would rest upon W in unstable equilibrium; or if a pressure R, less than W, is exerted, we have the end friction on the inclined plane of the upper pivot removed to the extent R sin φ, where φ is the latitude of the place. The wheel W is therefore mounted on a guided rod, which is pressed upwards by suitable levers and weights so that the relief is precisely proportional to the pressure on the respective bearings. The Repsold find it unnecessary to relieve the friction of the declination axis.

In such large telescopes it becomes a matter of the first importance to provide means of convenient access to the eye-end of the instrument. This the Repsold have done in the Pulkovo telescope by means of two platforms, as shown in fig. 16. These platforms are capable of easy motion so that the astronomer may be conveniently situated for observing an object at any azimuth or altitude to which the telescope may be directed. For the great refractor mounted at Potsdam, Messrs. P. & F. Repsold have a large platform mounted on a framework which is moved in azimuth by the dome, so that the observer on the platform is always opposite the dome-opening. This framework is provided with guides on which the platform, whilst preserving its uniformity, is raised and lowered nearly in an arc of a circle of which the point of intersection of the polar and declination axes is the centre of the dome, and with it the platform-framework, is accomplished by means of electric motors, as also is the raising and lowering of the platform on its framework. The current is supplied by accumulators, and the switch-board is attached to the platform in a position convenient for use by the astronomer or his assistant.

The original design supplied for the 36-in. telescope of the Lick Observatory at Mount Hamilton, California, Grubb suggested that the whole floor, 70 ft. in diameter, should be raised and lowered by water power, under control of the observer by means of electric keys which act on secondary mechanism that in turn works the valves and reversing gear of the water engines. Other water engines, particularly at key-sets at the observer’s hands, rotate the dome and perform the quick motions in right ascension and declination. (An illustration showing these arrangements appeared in The Engineer of July 9, 1886.) Grubb’s suggestion of the raising floor and mechanism, although his original plans for the mounting were not carried out; the construction of the mounting, dome, floor, etc., having been entrusted to Messrs. Warner & Swasey of Cleveland, Ohio, U.S.A. It has been contended that it is undesirable to move so great a mass as a floor when a platform alone is required to carry the observer. But a floor, however heavy, suspended by three wire ropes and properly balanced over large, well-mounted pulleys, requires an amount of energy to work it which does not exceed that required to operate a platform of moderate dimensions, and there is a freedom, a safety, and a facility of working with a complete floor that a semicircular platform can be most satisfactorily operated by hydraulic means, a platform cannot be so well worked in this way. The best floor mounting we know of is that designed by O. Chadwick for the Victoria Telescope of the Cape Observatory. An account of it will be found in the History and Description of the Cape Observatory. This floor can be raised at the rate of 1 ft. per second or as slowly as the observer desires—whilst in all the large platforms we have seen (Potsdam, Paris), the rate of shift is tedious and tiresome.

The largest refracting telescope in active use is the Yerkes telescope, with an object-glass of 40-in. diameter by Alvan Clark & Son of Cambridge, U.S.A., and with a mounting dome floor by Warner & Swasey of Cleveland, Ohio, U.S.A. The reader will gather a good general idea of the design from fig. 16. The eye-end is shown on the plate, fig. 25. The chief defect in equatorial mountings of type C is that in general they are not capable of continued observing much past the meridian without reversal. This is an unquestionable drawback when long exposures near the meridian are required. By the
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Fig. 18.

60-in. Telescope
60-ft. Dome and 75-ft. Elevating Floor
For the Yerkes Observatory
Fig. 25.—EYE END OF 40" YERKES TELESCOPE.
use of an overhanging polar axis the difficulty can be overcome; it has been successfully adopted by Repsolds for their astrographic equatorials of 15-in. aperture and 11-25-ft. focus, and on a much smaller scale by Warner & Swasey for the Bruce telescope of 10-in. aperture and 60-in. focus, made for the Yerkes Observatory. The latter is shown in fig. 19. Stability in this method of mounting can only be secured by excessive weight and rigidity in the support of the overhanging axis. In the case of the Victoria telescope (24-in. aperture and 224-ft. focus) mounted at the Cape of Good Hope on this plan, it has been found necessary to add supporting stays where great rigidity is required, and thus to sacrifice continuous circum-meridional motion for stars between the zenith and the elevated pole.

Type D.—The first important equatorial of type D was the 4-ft. reflecting telescope of Lassell (Mem. R.A.S., xxxvi. 1-4), and later Lord Rosse’s 36-in. reflecting telescope at Birr Castle (Phil. Trans., clxxi. 153), and A. Compton’s 36-in. reflecting telescope mounted by him at Ealing (Mem. R.A.S., xlvii. 173-181). In Lassell’s instrument (a reflector of the Newtonian type) the observer is mounted in the open air on a supplementary tower capable of motion in any azimuth about the centre of motion of the telescope, whilst an observing platform can be raised and lowered on the side of the tower. In Lord Rosse’s instrument (also of the Newtonian type) the observer is suspended in a cage near the eye-piece, and the instrument is used in the open air. Compton’s telescope presents many ingenious features, especially the relief-friction by flotation of the polar axis in mercury, and in the arrangements of the observatory for giving ready access to the eye-piece of the telescope.

Type C seems indeed to be the type of mounting most suitable for reflecting telescopes, and this form has been adopted for the 60-in. reflector completed by G. W. Ritchey, under the direction of Professor G. E. Hale, for the Mount Wilson Solar Observatory. The instrument is shown in fig. 20, and its design is unquestionably the most perfect yet proposed for modern astrophysical research.

The declination axis is here represented by what are practically the trunnions or pivots of the tube, resting in bearings which are supported by the arms of a very massive cast-iron fork bolted to the upper end of the polar axis. This axis is a hollow forging of nickel steel, of which the accurately turned pivots rest on bearings attached to cast-iron uprights bolted upon a massive cast-iron base plate. The base plate rests upon levelling screws which permit the adjustment of the polar axis to be made with great precision. The combined overhanging weight of the cast-iron fork, the mirror and tube is so great, that without a very perfect relief-friction system the instrument could not be moved in right ascension with any approach to practical ease. But a hollow steel float, 10 ft. in diameter, is bolted to the upper end of the polar axis just below the fork. This float dips into a tank filled with mercury so that practically the entire instrument is floated by the mercury, leaving only sufficient pressure on the bearings to ensure that the pivots will remain in contact with them. The 60-in. silver-on-glass mirror (weighing about one ton) rests at the lower end of the tube on a support-system consisting of a large number of weighted levers which press against the back of the glass and distribute the load. Similar weighted levers around the circumference of the mirror provide the edge support. The telescope is moved in right ascension and declination by electric motors controlled from positions convenient for the observer. The driving clock moves the telescope in right ascension by means of a worm-gear wheel, 10 ft. in diameter, mounted on the polar axis.

The 60-in. mirror is of 25-ft. focus, but for certain classes of work it is desirable to have the advantage of greater focal length. For this purpose the telescope can be used in the four different ways shown in fig. 21.

1. As a Newtonian reflector, fig. 21 (a), the converging rays from the 60-in. mirror being reflected to the side of the tube where

![Diagram](imageURL)

**FIG. 19.**—Bruce Telescope, made for the Yerkes Observatory.

From Professor Hale's *The Study of Stellar Evolution*, by permission of the University of Chicago Press.

![Diagram](imageURL)

**FIG. 21.**

From Professor Hale's *The Study of Stellar Evolution*, by permission of the University of Chicago Press.
mirror, which returns the rays towards the centre of the large mirror and causes them to converge less rapidly. They then meet a small plane mirror supported at the point of intersection of the polar and declination axes, whence they are reflected down through the hollow polar axis as shown in fig. 2, and come to focus on the slit of the powerful spectroscope that is mounted on a pier in the chamber of constant temperature as shown in fig. 20. In this case the equivalent focal length is 150 ft.

(3) As a Cassegrain reflector, for photographing the moon, planets or very bright nebulae on a large scale, as shown in fig. 21 (c), with an equivalent focal length of 100 ft.

(4) As a Cassegrain reflector, for use with a spectroscope mounted in place of the photographic plate, fig. 21 (d); in this case a convex mirror of different curvature is employed, the equivalent focus of the combination being 80 ft.

Type E.—In the Comptes Rendus for the year 1883, vol. 96, pp. 735-741, Loewy gives an account of an instrument which he calls an ‘equatorial could,’ designed (1) to attain greater stability and so to measure larger angles than is generally possible with the ordinary equatorial; (2) to enable a single astronomer to point the telescope and make observations in any part of the sky without changing his position; (3) to abolish the usual expensive dome, and to substitute a covered shed on wheels (which can be run back at pleasure), leaving the telescope in the open air, the observer alone being sheltered. These conditions are fulfilled in the manner shown in fig. 22. E P is the polar axis, rotating on bearings at E and P. The object-glass is at O, the eye-piece at E. There is a plane mirror at M, which reflects rays converging from the object-glass to the eye-piece at E. A second mirror N, placed at 45° to the optical axis of the object-glass, reflects rays from a star at the pole; but by rotating the box which contains this mirror on the axis of its supporting tube T a star of any declination can be observed, and by combining this motion with rotation of the polar axis the astronomer seated at E is able to view any object whatever in the visible heavens, except circumpolar stars near lower transit. An hour circle attached to E P and a declination circle attached to the box containing the mirror N, both of which can be read or set from E, complete the essentials of the instrument. There must be a certain loss of light from two additional reflections; but that could be tolerated for the sake of other advantages, provided that the mirrors could be made sufficiently perfect optical planes. By making the mirrors of silvered glass, one-fourth of their diameter in thickness, the Henriys have not only succeeded in mounting them with all necessary rigidity free from flexure but have given them optically true plane surfaces, notwithstanding their large diameters, viz., 11 and 15.7 in.

Sir David Gill tested the equatorial could on double stars at the Paris Observatory in 1884, and his last doubts as to the practical value of the instrument were dispelled. He has never seen more perfect optical definition in any of the many telescopes he has employed, and certainly never measured a celestial object in such favourable conditions of physical comfort. The easy position of the observer, the convenient position of the handles for quick and slow motion, and the absolute rigidity of the mounting leave little to be desired. In a much larger
instrument of the same type subsequently mounted at Paris, and in like instruments of intermediate size mounted at other French observatories, the object-glass is placed outside the mirror $N$, so that both the silvered mirrors are protected from exposure to the outside air.

A modification of Lowey's equatorial coudeé has been suggested by Lindemann (Astr. Nachr., No. 3933); it consists in placing both of the mirrors of Lowey's "equatorial coudeé" at the top of the polar axis, so that the lower end of the reflecting tube becomes unnecessary, and neither the pier nor the observer obstruct the view of objects above the horizon near lower declinations. This arrangement also avoids the necessity of having to pass down the tube from the direction of the elevated pole instead of upward towards that pole. The observer, however, is, at the bottom of the tube instead of the top and looks upward instead of downward to the eyepiece, which is large enough to be visible through the aperture of the large size of the upper pivot (viz. the diameter of the tube) and of the lower pivot (which must be perforated by a hole at least equal in diameter to the photographic field of the telescope), conditions which involve very refined arrangements for relief of friction, and (2) the less comfortable attitude of looking upward instead of downward. The plan, however, would be a very favourable one for spectroscopic work and for observation, especially of the polar ground room of constant temperature. The difficulties of relief friction could probably be best overcome by a large hollow cylinder concentric with the polar axis fixed near the centre of gravity of the tube. But this must be barred by the necessity of having to float the tube in the Mount Wilson 60-in. reflector already described, but in this case the floating cylinder would be below and not above the upper pivot.

In 1884 Sir Howard Grubb (Phil. Trans. R. Dub. Soc., vol. iii. series 2, p. 61) proposed a form of equatorial telescope of which an excellent example was erected at Cambridge (Eng.), in which the axis of rotation is always horizontal. This is the equatorial coudeé of Lowey, but instead of two mirrors there is only one. A flanged cast-iron box, strongly ribbed and open on one side, forms the centre of the tube, and the polar axis is attached to the lower end of this box, and a strong hollow metal cone, terminating in the other pivot, forms the upper part of the polar axis. The declination axis passes through the two opposite sides of the central box. Upon an axis concentric with the declination axis is carried a plane mirror, which is geared so as always to bisect the angle between the polar axis and the optical axis of the telescope. If there is a direct view, the reflected beam from the object-glass is received by the plane mirror from which it is reflected upwards along the polar axis and viewed through the hollow upper pivot. Thus, as in the equatorial coudeé, the observer remains in a fixed position looking down the polar axis from above. He is provided with quick and slow motions in right ascension and declination, which can be operated from the 60-end, and he can work in a closed and comfortably heated room. A long tube is also provided, and all the other parts of the polar axis, in order to allow the telescope to be pointed nearer to the pole than would otherwise be possible; even so, stars within $12^\circ$ of the pole may be observed. A detailed description of the instrument is given by Sir Robert Ball (Mon. Not. R.A.S., lix. 152). The instrument has a triple photo-visual Taylor object-glass of 121 in. aperture and 19-3 ft. focal length.

The previously described types of telescope mounting the axis of rotation of the object-glass directly at the object or at the pole; in the latter case the rays from the star under observation are reflected along the polar axis by a mirror or mirrors attached to or revolving with it. Equatorials of types A, B, C and D have the advantage of avoiding interposed reflecting surfaces, but they involve inconveniences from the continual motion of the eye-piece and the consequent necessity for providing elaborate observing stages or rising floors. In those of type B, the eye-piece has a fixed position and the observer may even occupy a room maintained at uniform temperature, but he must submit to a certain loss of light from one or more reflecting surfaces, and from possibly considerable air and other interferences for the position of the eye-piece and the mirror or mirrors. In all these types the longer the telescope and the greater its diameter (or weight) the more massive must be the mount, and the mechanical difficulties both in construction and management.

But if it be possible to mount a fixed telescope by which a solar or stellar image can be formed within a laboratory we give the following description of a practical design of the equatorial type, viz.:

(1) the focal length of the telescope; (2) the clockwork and other appliances to move the mirror, which reflects the starlight along the axis, are much lighter and smaller than those required to move a large telescope; (3) the position of the object-glass in any scopes of any weight can be used on piers within the laboratory; and (4) the angular value of any linear distance on a photographic plate can be determined by direct measurement of the distance of the photographic image from the plate.

The difficulty is that the automatic movement of a single mirror capable of reflecting the rays of any star continuously along the axis of a fixed horizontal telescope, requires a rather complex mechanism owing to the variation of the angle of reflexion with the diurnal motion.

Forcaut appears to have been the first to appreciate these advantages and to surmount the difficulty of designing a siderostat which, theoretically at least, fulfills this condition. A large siderostat, constructed by Eichens after Forcaut's design, was completed in 1868—the year of Forcaut's death. It remained at Paris Observatory, but this apparatus was subsequently employed by Deslandres for solar photography. The largest refracting reflecting telescope yet made, viz., that constructed by Gautier for the Paris Observatory in 1900, was arranged on this plan (type F), the stars' rays being reflected along the horizontal axis of a telescope provided with visual and with photographic object-glasses of 49-in. diameter and nearly 200-ft. focal length, in order both to secure the optical qualities of the images furnished by the object-glass and to avoid the use of the object-glass necessary in a first class reflecting telescope. However, the working of the instrument, have, so far as we know, been submitted to any severe test. It is, however, certain that the Forcaut siderostat is not capable, in practice, of maintaining the reflected image in a constant direction with perfect uniformity on account of the sliding action on the arm that regulates the motion of the for such an action must, more or less, take place by jerks. There are further inconveniences in the use of such a telescope, viz., that the image undergoes a diurnal rotation about the axis of the horizontal telescope, so that, unless the sensitive plate is provided with clockwork, it is not possible to obtain sharp photographs with any but instantaneous exposures. A sidereal rotation of a single star with a slit-spectroscope, this rotation of the image presents no inconvenience, and the irregular action of a clockwork on Forcaut's plan might be overcome by the following arrangement:

A B (fig. 23) is a polar axis, like that of an equatorial telescope, and terminates in a fork C D, on which is mounted a mirror C D, capable of turning about A on an axis at right angles to it. If A B is a fixed axis instead of being parallel to the latter axis. The mirror C D is set at such an angle as to reflect rays from the stars in the direction of the mirror R and thence to the horizontal telescope T. The mirrors are at the extremity of a line (1) the equatorial coudeé reflecting light downwards upon the mirror $R$ would furnish an ideal siderostat for stellar spectroscopy in conjunction with a fixed horizontal telescope.

Coelostat.—If a mirror is mounted on a truly adjusted polar axis, the plane of the mirror being parallel to that axis, the normal to the mirror surface will fall on the polar axis. The observer, therefore, stands at the point on the celestial equator through which whatever angle the axis is turned. Also, if the axis is made to revolve at half the apparent diurnal motion of the star, an image of the celestial sphere, viewed by reflection from such a moving mirror, will describe a circle in the direction of the apparent motion of the star, and the image thus formed is the coelostat. Any telescope may be fitted with such a coelostat, or, by rotating the polar axis independently of the clockwork, the observer can pass in review all the stars visible above the horizon whose declinations come within the limits of his original field of view. Therefore, to observe stars of a different declination it will be necessary either to shift the direction of the fixed telescope, keeping its axis still pointed to the coelostat mirror, or to employ a second mirror to reflect the rays from the coelostat mirror along the axis of a fixed telescope. In the latter case it will be necessary to provide means to move the coelostat on a carriage by which it can be moved east and west without changing the altitude or azimuth of the mirror. For a polar axis with a coelostat, it may receive all the light from the reected beam. Besides these complications there is another drawback to the use of coelostats for general astronomical work, viz., the obliquity of the angle of reflection, which can never be less than that of the declination of the star, and may be greater to any extent. For these reasons the coelostat is never likely to be largely employed in general astronomical work, but it is admirably adapted for spectroscopic and other work where a fixed point is required. For details of the coelostat applied to the Snow telescope—the most perfect installation for spectroheliography and bolometer work—see The Study of Stellar Evolution by Prof. G. E. Hale, p. 131.

The Zenith Telescope

The zenith telescope is an instrument generally employed to measure the difference between two nearly equal and opposite positions of the same object at geographical latitudes in the field work of geodetic operations; more recently it has been extensively employed for the determination of
of variation of latitude, at fixed stations, under the auspices of the International Geodetic Bureau, and for the astronomical determination of the constant of aberration. The instrument is shown in its most recent form in fig. 24. A is a sleeve that revolves very freely and without shake on a vertical steel cone. This cone is mounted on a circular base b which rests on three levelling screws, two of which are visible in the figure. The sleeve carries a cross-piece on its upper extremity to which the bearings of the horizontal axis c are attached. A reversible level d rests on the accurately turned pivots of this axis. The telescope is attached to one end of this axis and a counterpoise e to the other. The long arm f serves to clamp the telescope in zenith distance and to communicate slow motion in zenith distance when so clamped. On the side of the telescope opposite to the horizontal axis is attached a graduated circle g, and, turning concentrically with this circle, is a framework h, to which the readers and verniers of the circle are fixed. This frame carries very sensitive levels k and l, and the whole frame can be clamped to the circle g by means of the clamping screw m.

The object-glass of the telescope is, of course, attached by its cell to the upper end of the telescope tube. Within the focus of the

time. Assuming, for example, that the northern star has the ascension of the object-glass, it is necessary to place 5, placed in the meridian towards the north; the verniers of the graduated circle g are set to read the reading \( \phi = (\lambda - \phi_s) + (\alpha + \phi) \), where \( \phi \) is the approximate latitude of the place and \( \phi_s \), \( \phi \), the declination of the object of the star as observed. The level frame h is turned till the levels k and l are in the middle of their run, and then clamped by the screw m, aided in the final adjustment by the level l.

The telescope is now turned on the horizontal axis till the levels read near the centres of these scales and the telescope is clamped to the arm f. When the star enters the field of view its image is very difficultly obtained by the spider web of the micrometer, the exact bisection being completed in the immediate neighbourhood of the meridian. The readings of the levels k and l and the reading of the micrometer drum are then entered, and the observation is completed. Now the instrument is slowly turned towards the south, till the azimuth arm is gently brought into contact with the corresponding stop s, care being taken not to press on any part of it, except the south arm itself. When the southern star enters the field the same process is repeated.

Suppose now, for the moment, that the readings of the levels k and l are identical in both observations, we have then, in the difference between the micrometer readings north and south, a measure of the difference of the two zenith distances expressed in terms of the micrometer screw; and, if the "value of one revolution of the micrometer screw" is known in seconds of arc we have for the resulting latitude

\[ \phi = \frac{1(\lambda - \phi_s) + (\alpha + \phi)}{2} \]

where \( \phi_s \), \( \phi \), are the difference of the micrometer readings converted into arc—it being assumed that increased micrometer readings correspond with increased zenith distance in the star.

If between the north and south observation there is a change in the level readings of the levels k and l, this indicates a change in the zenith distance of the object, the object being directed to the telescope to a distant object, or to the intersection of the webs of a fixed collimating telescope (see TRANSIT CIRCLE), it is easy to measure the effect of a small change of zenith distance of the axis of the telescope in terms both of the level and of the reading of the micrometer. This and, thus, if the levels are perfectly sensitive and uniform in curvature and graduation, to determine the value of one division of each level in terms of the micrometer screw. The value of "one revolution of the micrometer screw" is thus determined, and to observe at transit the difference of zenith distance of two stars of known declination in terms of the micrometer screw, the instrument remaining at rest between their transits; or by measuring at known instants in terms of the screw, the mean of two levels therefore adds to the accuracy of the result.

Attempts have been made to overcome the difficulties connected with this method by adopting the method of using one micrometer and observing transit the difference of the true altitudes of the two stars, without the division of the micrometer.

S. C. Chandler in 1884 constructed an equal altitude instrument on this principle, which he called the almucantar, and he found that after disturbance the telescope recovered its original zenith distance within \( \frac{1}{5} \)° of a second of arc. R. A. Sampson at Durham (see Trans. R. A. Soc. of Durham) had a similar instrument constructed in 1872 (the A. H. Howe Bubble Level transit instrument). Dr. J. Lyon had instruments constructed on the same general principle. It is, however, obviously impossible to apply a micrometer with advantage to such instruments, because to touch such an instrument with the fingers is impossible, and to turn a micrometer screw, would obviously set it into motion. The almucantar was therefore used only to observe the vertical transits of stars in different azimuths over fixed horizontal levels, without observing transit the vertical distance of the stars.

By the use of photography, however, it is possible to photograph the trail of a star as it transits the meridian when the telescope is directed towards the north, and another trail be similarly photographed when the telescope is turned towards the south. The interval between the two trails, measured at right angles to the direction of the trails, obviously corresponds to the difference of zenith distance of the two stars. This principle has been applied with great completeness and accuracy of result by John A. Cook, and to the construction of a "photographic floating zenith telescope."
which he has erected at Cambridge (Eng.) and applied to an investigation of the change of latitude and a determination of the constant of refraction. A description of the instrument, and some preliminary results obtained by it, is given by him (Monthly Notices R.A.S., xi. 314).

TELELSIA [mod. Telesa], a town of the Samnites, 24 m. N.W. from Beneventum. It possesses remains of walls in opus reticulatum, of a total length of over a mile; two inscriptions of the Republican period record the erection of towers. The remains of baths (Thermæ Subiniani) and of an amphitheatre still exist: and the city was supplied with water by an aqueduct. There are sulphur springs in the vicinity, which may have supplied the baths.

TELESILLA, Greek poetess, a native of Argos, one of the so-called nine lyric muses. According to the traditional story, when Alexander, king of Sparta, invaded the land of the Argives in 310 B.C., and slew all the males capable of bearing arms, Telesilla, dressed in men's clothes, put herself at the head of the women and repelled an attack upon the city of Argos. To commemorate this exploit, a statue of the poetess, in the act of putting on a helmet, with books lying at her feet, was set up in the temple of Aphrodite at Argos. The festival Hybristica or Endymatia, in which men and women exchanged clothes, also celebrated the heroism of her female compatriots. Herodotus (vi. 76) does not refer to the intervention of Telesilla, but mentions an oracle which predicted that the female should conquer the male, whence the tradition itself may have been derived. Further, the statue seen by Pausanias may not have been intended for Telesilla; it would equally represent Aphrodite, in her character as wife of Ares and a warlike goddess (the books, however, seem out of place). The Hybristica, again, was most probably a religious festival connected with the worship of some androgynous divinity. Of Telesilla's poems only two lines remain, quoted by the grammarians Hephastion, apparently from a Parthenion, or song for a chorus of maidens.

See Curtius, 18, 20; Plutarch, De Virtut. Muliebris, 8; Clement of Alexandria, Stromata, iv. 19, p. 522; Bergk, Poetae Lyrici Graeci, iii.; and especially Macan, Herodotus iv.-vi., i. 336 foll. and notes.

TELESIO, BERNARDINO (1509-1588), Italian philosopher and natural scientist, was born of noble parentage at Cosenza near Naples in 1509. He was educated at Milan by his uncle, Antonio, himself a scholar and a poet of eminence, and afterwards at Rome and Padua. His studies included all the wide range of knowledge then possessed by the philosophers, which constituted the curriculum of the Renaissance scholars. Thus equipped, he began his attack upon the medieval Aristotelianism which then flourished in Padua and Bologna. Resigning to his brother the archbishopric of Cosenza, offered to him by Pope Pius IV., he began to lecture at Naples and finally founded the academy of Cosenza. In 1563, or perhaps two years later, appeared his great work De Rerum Natura, which was followed by a large number of scientific and philosophical works of subsidiary importance. The heterodox views which he maintained aroused the anger of the Church on behalf of its cherished Aristotelianism, and a short time after his death his books were placed on the Index.

Telesio was the head of the great South Italian movement which protested against the accepted authority of abstract reason, and sowed the seeds from which sprang the scientific methods of Campanella and Bruno, of Bacon and Descartes, with their widely divergent results. He, therefore, abandoned the purely intellectual sphere and proposed an inquiry into the data given by the senses, from which he held that all true knowledge really comes. Instead of postulating matter and form, he bases existence on matter and force. This force has two opposing elements: heat, which expands and cold, which contracts. These two processes account for all the diverse forms and types of existence, while the mass on which the force operates remains the same. The harmony of the whole consists in this, that each separate thing develops in and for itself in accordance with its own nature while at the same time its motion benefits the rest. The obvious defects of this theory, (1) that the simplest cases cannot be reduced to this (2) that he adduced no evidence to substantiate the existence of these two forces, were pointed out at the time by his pupil, Patrizzi (see article on Patrizzi, Francesco). Moreover, his theory of the cold earth at rest and the hot sun in motion was doomed to disproof at the hands of Copernicus. At the same time, they were sufficiently coherent to make a great impression on Italian thought. When Telesto went to Rome, his mind and matter, he was still more heterodox. Material forces are, by hypothesis, capable of feeling; matter must also have been formed by the first essential and the air, and when consciousness exists, and could not have been developed out of nothing. Again, the soul is influenced by material conditions; consequently the soul must have a material existence. He further held that all knowledge is sensation ("non ratione sed sensu"); and that intellectual evidence is, therefore, an agglomeration of isolated data, given by the senses. He does not, however, succeed in explaining how the senses allow the mind to perceive objects. His work has been generally held, but there is room for doubt, especially in the few passages where he appears to have been probably in disproof to theological prejudices, he added an element which was utterly alien, namely, a higher impulse, a soul superimposed by God, in virtue of which we strive beyond the world of sense. The whole system of Telesio shows lucidity in argument, and ignorance of essential facts, but at the same time it is a forerunner of all subsequent empiricism, scientific and philosophical, and marks clearly the period of transition from authority and reason to experiment and individual responsibility. Beside the De Rerum Natura, he wrote De Somno, De his quae in aere sunt, De Mari, De Comets e CirculoLoctete, De usi respirations, etc.

TELESPHORUS, bishop of Rome from about 126 till about 132, was a successor of Cerealus.

TELFORD, THOMAS (1757-1834), British civil engineer, was the son of a shepherd, and was born at Westerلكir in Eskdale, Dumfriesshire, on the 9th of August 1757. From early childhood he was employed as a herdsman, occasionally attending the parish school of Westerkirk, where his quickness and diligence helped to make up for his lack of opportunity. On being apprenticed, at the age of fifteen, to a stonemason at Langholm, he found leisure not only to gain an acquaintance with Latin, French and German, but to gratify his literary tastes by a wide variety of reading. In his early manhood he was much given to the writing of verses; a poem of some length on Eskdale appeared in 1784 in the Poetical Museum, published at Hawick; under the signature of "Eskdale Tam" he contributed verses to Ruddiman's Weekly Magazine; and he addressed an epistle in rhyme to Burns, which was published in James Currie's Life of the poet. In 1780 Telford went to Edinburgh, where he was employed in the erection of houses in the "new" town, and occupied much of his spare time in learning architectural drawing. Proceeding to London two years later, he found employment in the erection of Somerset House, having expanded his education and experience sufficiently for the commissioner at Portsmouth dockyard, he next repaired the castle of Sir W. Pulteney, member for Shrewsbury, who conceived such a high opinion of his talents that he got him made surveyor of public works for the county of Salop. In 1793 he was appointed engineer of the Ellesmere canal, for which he built the Chirk and Pont-Y-Cysylte aqueducts, and this work established his reputation as a canal engineer. He was consulted in 1806 by the king of Sweden regarding the construction of the Göta Canal, and, his plans having been adopted, he visited the country in 1810 to superintend some of the more important excavations. In the early years of the 19th century the question of improving the communications in the Highlands of Scotland engaged the attention of the government, and Telford was commissioned to report on the matter. In consequence of his recommendations, he was appointed engineer for the Caledonian Canal, which was begun in 1824 and forms one of the largest but by no means the most useful of his undertakings, and also for the construction of 920 miles of roads, a great part through very difficult country. Of the numerous bridges built in this line of roads mention may be specially made of that across the Tay at Dunkeld. Consequently he was employed on the improvement of the road between Carlisle and Glasgow, which was undertaken as a result of a parliamentary inquiry in 1814, and he was then entrusted with the execution of another scheme, of equal magnitude and importance with that in the Highlands of Scotland, for a system of roads through the more inaccessible parts of Wales, which involved the erection of the magnificent
TELIGNY—TELL, WILLIAM

suspension bridge across the Menai Straits, begun in 1820, and the Conwy Bridge, begun in 1824. While his fame rests chiefly on his road and canal engineering, and the erection of these and of the Grand Canal and aqueducts which this involved, he also did good work in harbour construction. The fisheries and industries of Scotland benefited by the improvements he effected at many of the harbours on the east coast; he constructed the St Katherine's Docks, London (finished in 1828); and his last piece of professional work was a plan for the improvement of Dover harbour. Other achievements of his later years were the drainage of the north level of the eastern Fen district, an area of 48,000 acres, and erection of the Dean Bridge, Edinburgh, and of the Broomielaw Bridge, Glasgow. He died at Harrow on 29th September 1854 in London, and was buried in Westminster Abbey.

Telford was never married. For twenty-one years he lived at the Salopian coffee-house, afterwards the Ship Hotel, Charing Cross, whence he removed to 24 Abingdon Street. He was a fellow of the Royal Societies of London and of Edinburgh, and was annually elected president of the Institution of Civil Engineers from its foundation. He received the Swedish order of knighthood of Gustavus Vasa.

See Telford's Memoirs, written by himself and edited by John Richardson; also Smiles's Lives of the Engineers. **TELIGNY, CHARLES DE** (c. 1535-1572), French soldier and diplomat, belonged to a respected Huguenot family of Rouerque, and received an excellent training in letters and arms at the house of Coligny. He was employed on several peace missions; he represented the Protestants before the king, and was entrusted by Condé with the presentation of his terms to the queen-mother in 1567, and in the following year he assisted at the conference at Châlons and signed the peace of Longjumeau, which was destined to be of short duration. On the outbreak of war, he took part in the siege of Poitiers, distinguishedly, while, as the war was largely a struggle between the court under Coligny at Moncontour, and participated in the negotiations ending in the treaty of Saint-Germain (8th of August 1570). In 1571 he retired to La Rochelle and married Louise de Coligny, but was speedily recalled to Paris to serve on the bi-partisan commission of adjustment. Although he won the special favour of Charles IX., he was one of the first victims in the massacre of St Bartholomew's Day (24th of August 1572). His remains were taken to the Castle of Téligny in 1627, but eight years later were thrown into the river by the hiss and hoots of the populace.**

**TELL, WILLIAM.** The story of William Tell's skill in shooting at and striking the apple which had been placed on the head of his little son by order of Gessler, the tyrannical Austrian bailiff of Uri, is so closely bound up with the legendary history of the origin of the Swiss Confederation that they must be considered together. Both appear first in the 15th century, probably as results of the war for the Toggenburg inheritance (1430-59); for the intense hatred of Austria, greatly increased by her support of the claims of Zürich, favoured the circulation of stories which assumed that Swiss freedom was of immemorial antiquity, while, as the war was largely a struggle between the civic and rural elements in the Confederation, the notion that the (rural) Schwyzers were of Scandinavian descent at once separated them from and raised them above the German inhabitants of the towns.

The Tell story is first found in a ballad the first nine stanzas of which (containing the story) were certainly written before 1474. There is no mention made of the names of the bailiff or of his master, or of the hat placed on a pole. Tell is called "the first Confederate," and his feat is treated as the real and only reason why the Confederation was formed and the tyrants driven out of the land. It is probably to this ballad that Melchior Russ of Lucerne (who began his Chronicle in 1482) refers when, in his account (from Justinger) of the evil deeds of the bailiffs in the Forest districts, he excuses himself from giving the story. He goes on to narrate how Tell, irritated by his treatment, stirred up his friends against the governor, who seized and bound him and was conveying him by boat to his castle on the lake of Lucerne, when a storm arose, and Tell, by reason of his great bodily strength, was, after being unbound, given charge of the rudder on his promise to bring the boat safely to land. He steers it towards a shelf of rock, called in Russia's time Tell's Plate, springs on shore, shoots the bailiff dead with his crossbow, and goes back to Uri, where he stirs up the great strife which ended in the battle of Morgarten. In these two accounts, which form the basis of the Uri version of the origin of the Confederation, it is Tell and Tell only who is the actor and the leader. We first hear of the cruelties of Austrian bailiffs in the Forest districts in the Bernese Chronicle of Conrad Justinger (1460). No names or details are given, and these are those which are described in Tschudi's Chronicle as "olden days before Bern was founded" (i.e. before 1191 and 1260. Several details, but only one name, are added in the De Nobilitate et Rusticitate Dialogus (cap. 33) of Felix Hemmerli, a canon of Zürich, who wrote it after 1451 and before 1454; in this last year he was imprisoned by the Schwyzers, whom he had repeatedly insulted and attacked in his books. According to him the men of Schwyz and of Unterwalden were the first to rise, those of Uri following suit much later. But neither Justinger nor Hemmerli makes any allusion to Tell or his feat.

The Tell story was later worked up into a ballad by Hans Sachs, and the first recensions of the Chronicle combined in a MS. known as the White Book of Sornen. They are contained in a short chronicle written between 1467 and 1476, probably about 1470, and based on oral tradition. Many details are given of the oppressions of the bailiffs: we hear of Gessler, of the meeting of Stoupacher of Schwyz, Fürst of Uri, and a man of Nidwalden at the Rüttli,—in fact, the usual version of the legend. To give an instance of tyranny in Uri, the author tells us the story of the refusal of "der Thall " to do reverence to the hat placed on a pole, of his feat of skill, and of his shooting the bailiff, Gessler, from behind a bush in the " hollow way," or Kantonweg. Tell is the immediate occasion of the rising who swore at the Rüttli to drive out the oppressors; but the narrative of his doings is merely one incident in the general movement which began quite independently of him. The chronology is very confused, but the events are placed after Rudolf's election to the empire in 1273. This is the only account in which Tell is called " der Thall," which name he himself explains by saying, " If I were short (wittig) I should be called something else and not der Tali," i.e. the simpleton or slow-witted man. (It is worthy of notice that the same meaning is attributed to the name Tell by the Swiss, the "der Tell") is the abridgment of the Historia Danica of Saxo Grammaticus, which may, somehow, have influenced the Swiss version.)

The only other known instance of the Uri version of the legend relating to the origin of the Confederation are the Latin hexameters of Glareanus (1513), in which Tell is compared to Brutus as " assertor patriae, vindex ulterior tyrannum," and the Urserspiel (composed in 1511-12), a play acted in Uri, in which Russ's version is followed, though the bailiff, who is unnamed, but announces that he has been sent by Albert of Austria, is slain in the " hollow way." Tell is the chief of the Rüttli leaguers, and it is his deed which is the immediate occasion of the rising against the oppressors, which is dated in 1296. Mutius (1540) is the latest writer who, in his description of the origin of the Confederation, does not mention Tell and his act. The two stories are now firmly bound together; the version contained in the White Book is the accepted one, though small additions in names and dates are often made.

The task of filling up gaps, smoothing away inconsistencies, rounding off the tale, was accomplished by Giles Tschudi (q.v.), whose recension was adopted, with a few alterations, by Johannes von Müllner in his History of the Confederation (1580). In the final recension of Tschudi's Chronicle (1734-36), which, however, differs in many particulars from the original draft still preserved at Zürich, we are told how Albert of Austria, with the view of depriving the Forest lands of their ancient freedom, sent bailiffs (among them Gessler) to Uri and Schwyz, who committed many tyrannical acts, so that finally on
TELL, WILLIAM

8th November 1307, at the Rütli, Werner von Stauffacher of Schwyz, Walter Fürst of Uri, Arnold von Melchthal in Unterwalden, each with ten companions, among whom was William Tell, resolved on a rising to expel the oppressors, which was fixed for New-Year's Day 1308. A few days later (November 15th) the Tell incident takes place (described according to the White Book version), and on the appointed date the general rising. Tschudi thus finally settled the date, which had before varied from 1260 to 1314. He utterly distorts the real historical relations of the Three Lands, though he brings in many real historical names, their owners being made to perform historically impossible acts, and introduces many small additions and corrections into the story as he had received it. In particular, while in his first draft he speaks of the ballif as Gryssler—the usual name up to his time, except in the White Book version of Stumpf's Chronicle of 1540—his final revision he calls him Gessler, knowing that this was a real name. Later writers added a few more particulars,—that Tell lived at Bürglen and fought at Morgarten (1358), that he was the son-in-law of Fürst and had two sons (early 15th century), &c. Johannes von Müller (1780) gave a vivid description of the oath at the Rütli by the three (Tell not being counted in), and threw Tschudi's version into a literary form, adding one or two names and adopting that of Hermann for Gessler, calling him of "Bruneck." Schiller's play (1804) gave the tale a world-wide renown, and Voltaire expressed the opinion that it was suspicious as regards by Guiliam in a private letter of 1607, and doubts were expressed by the brothers Iselin (1727 and 1754) and by Voltaire (1754); but it was not till 1760 that the legend was definitely attacked, on the ground of its similarity to the story of Tokko (see below), in an anonymous pamphlet by Freudenher, a Bernese pastor. This caused great stir; it was publicly burnt by order of the government of Uri, and many more or less forged proofs and documents were produced in favour of Tell. The researches of J. E. Kopp (Urkunden zur Geschichte d. eidgenössischen Bünde, 2 parts, 1835 and 1851, and Geschichte der eidgenössischen Bünde, vol. i, 1847), first cleared up the real early history of the league, and overthrew the legends of the White Book and Tschudi. Since then many writers have worked in the same direction. Vischer (1867) has carefully traced out the successive steps in the growth of the legend, and Rochholz (1877) has worked out the real history of Gessler as shown in authentic documents. The general result has been to show that a mythological markman and an impossible ballif bearing the name of a real family have been joined with confused and distorted reminiscences of the events of 1245-47, in which the names of the ground of many of evidence have been imitated and many unauthentic acts attributed to them. Th. von Liebenau has, however, shown (in an article reprinted from the Katholische Schweizerblätter in the Bulletin Storico della Svizzera Italiana for 1890) that in 1283 the Emperor Rudolf of Habsburg gave the right of receiving the tolls for escort over the St Gotthard Pass to his sons, the dukes of Austria. The levying of these tolls gave rise to various disputes between the men of Uri and the ballifs of the dukes of Austria, and by 1310 (if not already in 1300) the claim to levy them was silently given up. These facts show (what could not hitherto be proved) that at the time when legends arose these days have been imitated and many unauthentic acts attributed to them. Th. von Liebenau has, however, shown (in an article reprinted from the Katholische Schweizerblätter in the Bulletin Storico della Svizzera Italiana for 1890) that in 1283 the Emperor Rudolf of Habsburg gave the right of receiving the tolls for escort over the St Gotthard Pass to his sons, the dukes of Austria. The levying of these tolls gave rise to various disputes between the men of Uri and the ballifs of the dukes of Austria, and by 1310 (if not already in 1300) the claim to levy them was silently given up. These facts show (what could not hitherto be proved) that at the time when legends arose these days have been imitated and many unauthentic acts attributed to them.

The story of the skillful markman who succeeds in striking some small object placed on the head of a man or child is very widely spread; we find it in Denmark (Tokko), Norway (two versions), Iceland, Holstein, on the Rhine, and in England (William of Cloudesley). How it came to be localized in Uri we do not know; possibly, through the story of the Scandinavian colonization of Schwyz, the tale was fitted to some real local hero.

The alleged proofs of the existence of a real William Tell in Uri in the 14th century break down hopelessly. (a) The entries in the parish registers are forged. (b) As to the Tell chapels,—(a) that in the "hollow way" near Küsnacht was not known to Melchior Rius and is first mentioned by Tschudi (1572). (b) That on Tell's Platte is first mentioned in 1504. The document which alleges that this chapel was built by order of a "landgemeinde" held in 1538, at which 114 men were present who had been personally acquainted with Tell, was never heard of till 1759. The procession in boats to the place where the chapel stands may be very old, but is not connected with Tell till about 1582. (c) The chapel at Bürglen is known to have been founded in 1582. Other documents and statements in support of the Tell story have even less claim to credit. It has been pointed out above that with two exceptions the ballif is always called Gryssler or Grissler, and it was Tschudi who popularized the name of Gessler, though Grissler occurs as late as 1765. Now Gessler is the name of a real family, the history of which from 1250 to 1753 has been worked out by Rochholz, who shows in detail that no member ever played any part attributed to the ballif in the legend, or could have done so, and that the Gesslers could not have owned or dwelt at the castle of Küsnacht; nor could they have been called Von Bruneck.

In the Urnerispiel the name of the ballif's servant who guarded the hat on the pole is given as Heintz Vögely, and we know that Friedrich Vögeli was the name of one of the chief military officers of Peter von Hagenbach, who from 1495 to 1743 administered for Charles the Bold, duke of Burgundy, the lands of Tell. It is greatly to be regretted (and we are not走得 to see why) that Hagenbach is known to have committed many cruelties like those attributed to the ballifs in the legend, and it has been plausibly conjectured that his case has really given rise to these stories, especially when we find that the Confederates had a hand in his capture and execution, that in a document of 1358 Hagenbachs and Gesslers appear side by side as witnesses, and that the Hagenbachs had frequent transactions with the Habsburgs and their vassals.

In general see two excellent works by Franz Heinemann, Tell-Iconographie, Lucerne, 1902 (reprint, with text, of the chief documents of Tell in the Schweizerblatter, and Tell-Bibliographie (including that of Schiller's play), published in 1908 at Bern.

Among the vast number of books and pamphlets on the Tell story, the two most to be recommended are W. Vischer, Die Sage von der Befreiung der Waldstätte (Leipzig, 1867), and E. L. Rochholz, Tell und Gessler, with a volume of documents 1250-1515 (Heilbronn, 1877). Convenient summaries of the controversy will be found in any modern book on Swiss history, and more particularly in G. von Wyss, Über d. Gesch. d. drei Länder—U, Schwyz, a. Unterwalden (Bâle, 1871), and many articles in the Schweizer Monatsschrift. Of the many biographies of Habsburg, telluris, the relic of Old Norse, is preserved in the parish churches of those villages, whereas the pilgrims go to the chapels therein, he brings forward no new evidence. His book is a striking proof that the popular Tell legend cannot
claim the support of authentic history, while his attempt to find room for the atrocities of the wicked ballifs elsewhere than at Aldorf consists only in suggesting an intricate series of possibilities, none of which are supported by any positive evidence.

In his pamphlet Die Sagen v. Tell u. Slawfachser (Basel, 1896) August Bernoulli, and in his elaborate Geschichte d. Schweiz. Politik (vol. 1; Frauenfeld, 1906) J. Schollenberger, have applied the same sort of method, but without attaining any great degree of historical success.

(W. A. B. C.)

TELL EL AMARNA, the name now given to a collection of ruins and rock tombs in Upper Egypt near the east bank of the Nile, 58 m. by river below Assiut and 190 m. above Cairo. The ruins are those of Ekhaton (Akhet-Aton), a city built c. 1360 B.C. by Akhenaton (Amenophis IV.), as the new capital of his empire (in place of Thebes) when he abandoned the worship of Ammon and devoted himself to that of Aton, i.e. the sun (see Egypt: History, § Ancient). Shortly after the death of Akhenaton the court returned to Thebes, and the city, after an existence of perhaps only twenty years—of which little was abandoned. Not having been inhabited since, the lines of the streets and the ground-plans of many buildings can still be traced. The chief ruins are those of the royal palace and of the House of the Rolls; there are scanty remains of the great temple. In the palace are four pavements of painted stucco work in fair preservation. They were discovered in 1891–92 by Prof. Fliinders Petrie (see his Tell el Amarna, 1894). In the Rolls House were discovered in 1887 by the feliah some 300 clay tablets inscribed with cuneiform characters. They are letters and state documents addressed to Amenophis IV. and his father, from the kings of Babylon, Assyria, &c., and from the Egyptian governors in Syria and neighbouring districts. The greater part of them were purchased for the Berlin Museum, but a large number were secured for the British Museum. Their contents proved invaluable for the reconstruction of the history, social and political, of Egypt and Western Asia during that period.

Hewn out of the sides of the hills which close in on the east the plain on which Ekhaton stood are two groups of tombs; one group lies 1 ½ m. N.E., and the other 3 m. S. of the city. The tombs, all of which belong to the time of Akhenaton, are full of interesting scenes in the peculiar style of the period, accompanied by hymns to the sun god. The most important tomb is, perhaps, that of Meri-Ra, high priest of the sun, which has a façade nearly 100 ft. long and two large chambers. On one of the walls of the main chamber is depicted the scene, now well known, in which a blind choir of harpists and singers celebrate the arrival of the court at the temple. In the early centuries of Moslem rule in Egypt the northern tombs were inhabited by Copis, one tomb, that of Pa-Nehesi, being turned into a church. In a ravine opening into the plain between the north and south tombs, and some seven miles from the city, is a tomb supposed to be that of Akhenaton.

The tombs and the great stela sculptured on the cliffs which mark the bounds of the city of Akhet-aton have been the object of special study by N. de G. Davies on behalf of the Archaeological Survey of Egypt. The results, with numerous plates and plans, are embodied in a series of memoirs, Rock Tombs of El Amarna (six parts, 1903–8).

For the tablets see Tell el Amarna Tablets in the British Museum (1892); C. Bezold, Oriental Diplomacy; the transcribed text of the Cuneiform Despatches discovered at Tell el Amarna (1893); The Tell el Amarna Letters (English translation by M. Winckler, Berlin, 1896); E. A. Kraeling, Die El-Amarna Tafeln (Leiden, 1901); W. M. F. Petrie, Syria and Egypt from the Tell el Amarna Letters (1898).

TELLER, WILHELM ABRAHAM (1734–1804), German Protestant divine, was born at Leipzig on the 9th of January 1734. His father, Romanus Teller (1703–1750), was a pastor at Leipzig, and afterwards became professor of theology in the university. He edited the earlier volumes of a Bibelwerk (19 vols., 1749–70) which was designed as an adaptation for German readers of the exegetical works of Andrew Willet, Henry Alswes, Symon Patrick, Matthew Poole, Matthew Henry and others. Wilhelm Abraham studied philosophy and theology in the university of his native town. Amongst the men whose influence mainly determined his theological position and line of work was J. A. Ernesti. Teller’s writings present rationalism in its course of development from biblical supernaturalism to the borders of deistical naturalism. His first learned production was a Latin translation of Benjamin Kennicott’s Dissertation on the State of the Printed Hebrew Text of the Old Testament (1758), which was followed the next year by an essay in which he charged his appointed, pastor, professor of theology and general superintendent in the university of Helmstedt. Here he pursued his exegetical, theological and historical researches, the results of which appeared in his Lehrbuch des christlichen Glaubens (1764). This work caused some commotion, as much by the novelty of its method as by the heterodoxy of its matter, and more by its omissions than by its positive teaching, though everywhere the author seeks to put theological doctrines in a decidedly modern form. In 1767 Teller, whose attitude had made his position at Helmstedt intolerable, was glad to accept an invitation from the Prussian minister for ecclesiastical affairs to the post of provost of Kölln, with a seat in the supreme consistory of Berlin. Here he found himself in the company of the rationalistic theologians of Prussia—F. S. G. Sack (1738–1817), Johann Joachim Spalding (1714–1804) and others—and became one of the leaders of the rationalistic party, and one of the chief contributors to C. F. Nicolai’s Allgemeine Deutsche Bibliothek. Teller was not long in making use of his freest position in Berlin. In 1772 appeared the most popular of his books, Wörterbuch des Neuen Testamentes zur Erklärung der christlichen Lehre (4th ed., 1801), in which he reduced the language and ideas of the New Testament and gave them the form of 18th-century Illuminism. The author maintains that the Graeco-Hebraic expressions must not be interpreted literally, but explained in terms intelligible to the modern mind. By this lexicon Teller had put himself amongst the most advanced rationalists, and his opponents charged him with the design of overthrowing positive Christianity altogether. In 1786 the author became a member of the Berlin Academy of Sciences.

The "Wöllner edict" of July 9, 1788, for the enforcement of Lutheran orthodoxy, and Teller’s manly action, as member of the consistorial council, in defiance of it (cf. his Wohlgemeinte Erinnerungen, 1788), led the Prussian government to pass upon him the sentence of suspension for three months, with forfeiture of his stipend. He was not, however, to be moved by such means, and (1792) issued his work Die Religion der Völkermoneren, an exposition of his theological position, in which he advocated at length the idea, subsequently often urged, of "the perfectibility of Christianity,"—that is, of the ultimate transformation of Christianity into a scheme of simple morality, with a complete rejection of all specifically Christian ideas and methods. This book represents the culminating point of German Illuminism, and is separated by a long process of development from the author’s Lehrbuch. In the same year he published his Anleitung zur Religion überhaupt und zum Allgemeinen des christenthums besonders; für die Jugend höhere und gebildeter Stände aller Religionsparteien. Teller died on the 9th of December 1804. Besides his contributions to the Allgemeine Deutsche Bibliothek, he edited a popular and practically useful Magazin für Prediger (1792–1801).

See W. Gass, Geschichte der protestantischen Dogmatik, iv. pp. 206–222; P. Wolf, art. in Herzog-Hauck, Realencyklopädie (ed. 1907); Heinrich Döring, Deutsche Kanzelredner des 17ten und 18ten Jahrh., p. 506 seq.; Edward Pusey, Causes of the Late Rationalistic Character of the English Church and theology, in his Popular Lectures, p. 150; and cf. the article in the Allgemeine Deutsche Bibliographie.

TELCHELLERY, a seaport of Britain, in the Malabar district of Madras, between Cannanore and the French settlement of Mahe. Pop. (1901) 27,893. It is a healthy and picturesque town, built upon a group of wooded hills running down to the sea, and is protected by a natural breakwater of rock. The town with its suburbs occupies about 5 sq. m., and was at one time defended by a strong mud wall. The old fort
TELLURIUM—TEMESVÁR

The town stands to the north of the town. The East India Company established a factory here in 1685 for the pepper and cardamom trade. For two years (1780-82) the factory stood a siege by Hyder’s general, and in the subsequent wars with Mysore Tippoo Sultaan the castle was the base of operations for the ascent of the Ghats from the west coast. The town is a busy centre of export trade in coffee, cacao-nut produce, spices and sandal-wood. The Basel Protestant mission has a station here. The municipality manages the Brennen college founded in 1862.

TELLURIUM [Symbol Te, atomic weight 127.5 (O=16)], a chemical element, found to a certain extent in nature in the uncombined condition, but chiefly in combination with other metals in the form of tellurides, such, for example, as sylvanite, blende, galena, grey or silver telluride, and quartz telluride. It is occasionally met with in iron pyrites, and hence tellurium is found with selenium in the flue dust, or chimney deposits of sulphuric acid works. Tellurium was first recognized as a distinct element in 1798 by M. H. Klaproth. It may be obtained by heating tellurium bismuth with sodium carbonate, lixiviating the fused mass with water, filtering, and exposing the filtrate to air, when the tellurium is gradually precipitated as a grey powder (J. J. Berzelius). J. Farbaky (Zeit. angew. Chem., 1897, p. 17) extracts the element from black tellurium as follows:

Tellurium is also obtained as an insoluble grey powder, if the solution of tellurium dichloride in dilute hydrochloric acid is allowed to stand on the bench, or if dilute hydrochloric acid is added to a solution of tellurium which is somewhat decomposed, or if the solution is heated to boiling. The element is obtained by precipitating tellurium with sulphur dioxide from a solution in hydrochloric acid, or from an alcoholic solution of a mercury telluride, or from a solution of a potassium telluride; or by evaporating the solution on a water bath, or by distilling the solution into water. It is a colourless solid and behaves as a dibasic acid. The alkaline tellurides are soluble in water. It also gives rise to super-acid salts, such as KHTeO2, H2TeO4 and other acid salts, which are decomposed by water or by boiling with water, or by diluting the solution with water. Tellurium is also obtained by distilling the solution with copper oxide, or by adding a solution of potassium chloride to a solution of tellurium nitrate, and precipitating the element from the resulting solution by added copper oxide; or by boiling the solution with water, or by boiling the solution with water, or by evaporating the solution on a water bath, or by distilling the solution with copper oxide, or by adding a solution of potassium chloride to a solution of tellurium nitrate, and precipitating the element from the resulting solution by added copper oxide.
on the navigable Béga canal and on the river Béga, and consists of the inner town, formerly strongly fortified, and of four outlying suburbs. Several parks have been laid out on the site of the broad glacis which formerly separated Temesvár from its suburbs, which are now united with it by broad avenues. Temesvár is the seat of a Roman Catholic and a Greek Orthodox bishop. Amongst its principal buildings are the Roman Catholic cathedral, built (1735-57) by Maria Theresa; the Greek Orthodox cathedral; a castle built by Hunyady Janos in 1442, now used as an arsenal; the town and county hall, the museum and large barracks. In the principal square rises a Gothic column, 40 ft. high, erected by the Emperor Francis Joseph in 1851 to commemorate the successful resistance of the town to the siege of 107 days laid by the Hungarian revolutionary army in 1849. Temesvár is the most important centre of commerce and industry of south Hungary, and carries on a brisk trade in grain, flour, spirits and horses. Its industrial establishments include factories for tobacco, cloth, matches, leather, artificial manure, besides breweries and distilleries.

Temesvár is an old town, and although destroyed by the Tatars in 1242, it was a populous place at the beginning of the 14th century, and was strongly fortified by King Charles Robert of Anjou, who resided here several years. The Hunyady family held the middle of the pass. In 1514 the pestilence, Stephen Dozsa, was defeated by the Transylvanian voivod, John Zápolya, near Temesvár, captured and executed. Unsuccessfulley besieged by the Turks in 1552, it was captured by them in the following year after a heroic resistance. It remained in their hands until 1716, when it was liberated by Prince Eugene of Savoy. New strong fortifications were erected, and the town grew steadily in importance, serving as the capital of the whole Banat. It endured another siege in 1849, when it resisted successfully the attacks of a Hungarian revolutionary army.

**Tempe—Temperance**

**Tempe, Vale Of,** the ancient name (i.e. "eleft," from Gr. τέλων, to cut) of a narrow valley in N. Thessaly, through which the river Peneus (mod. Salamandra) reaches the sea. The valley, which the Greeks were accustomed to associate with rural delights, is a chasm, cleft in the rocks, the fable tells us, by the trident of Poseidon, between Olympus and Ossa; but though it possesses every element of the sublime, yet its features are soft and beautiful, from the broad winding river, the luxuriant vegetation, and the glades that at intervals open out at the foot of the cliffs. It is about four miles and a half long, and towards the middle of the pass. The precipices in the direction of Olympus fall so steeply as to bar the passage on that side; but those which descend from Ossa are the loftiest, for they rise in many places not less than 1500 ft. from the valley. Owing to the length and narrowness of the ravine, it was a position easily defended, but still it offered a practicable entrance to an invading force; a number of castles (of which the ruins still exist) were built at different times at the strongest points. Tempe was sacred to Apollo, to whom a temple was erected on the right bank. Every ninth year a sacred mission proceeded to the valley to pluck the laurel for the chaplets for the Pythian games. Owing to its widespread fame, the name Tempe was given also to the valley of the Velinus near Reate (Italy) and that of the Helorus in Sicily.

**Temper (from Lat. temperare, to mingle or compound in due proportion, to qualify, rule, regulate, to be moderate, formed from tempus, time, fit or due season), to blend, modify, or qualify by mixing, to combine in due proportions, hence to restrain, calm. A specific application of the word is to the bringing of steel or other metal to a proper hardness and elasticity (see MELT and IRON AND STEEL). The word is also used as a substantive, especially in the transferred sense of disposition or frame of mind, generally with some qualifying epithet, but when used absolutely signifying a hasty, passionate temper, or display of such.**

**Tempera (the Italian term), or Distemper, a method of painting in which solid pigments are employed, mixed with a water medium, in which some kind of gum or gelatinous substance is dissolved to prevent the colours from scaling off. Tempera is also called in Italian fresco a secco, as distinguished from fresco buono, or true fresco, painted on freshly laid patches of the Rough. Various media have been used for tempera work, such as the glutinous sap of the fig and other trees, various gums which are soluble in water, and size made by boiling down fish-bones, parchment and animals' hoofs. A mixture of egg and vinegar has also been found to make a good medium, especially when it is desirable to apply the colours in considerable body or impasto. For the nature and history of painting in tempera and fresco, see Painting.**

**Temperance.** The word "temperance," which strictly means moderation, has acquired a particular meaning in connection with intoxicating liquor, and it is here used in that limited sense. The "temperance question" is the equivalent in English of *Palcoholismus* and *Alcoholismus* in French and German-speaking countries respectively; it embraces all the problems that arise in connexion with the use or abuse of alcoholic drink. This usage has arisen from the practice of societies formed for the purpose of suppressing or reducing the consumption of such liquors, and calling themselves Temperance Societies. Their activity is often spoken of as the Temperance Movement, though that term properly covers very much wider ground.

**Hence it was also called "water-work"; see Shakespeare, Hen. IV., part ii. act ii. sc. 1.**
Temperance Organization.—In 1808 a temperance society was founded at Saratoga in the state of New York, and in 1813 the Massachusetts Society for the Suppression of Intemperance made its appearance. These have been the earliest organizations, though the device of a pledge of abstinence had been introduced in 1800. The movement made rapid progress mainly under the influence of the Churches. In 1826 the American Society for the Promotion of Temperance was founded in Boston, and by 1833 there were 6000 local societies in several states with more than a million members. The campaign was for the most part directed against the use of spirits only, and the proposal to include all alcoholic drinks in the pledge of abstinence, though adopted by a few societies, did not attract much interest in the American Society, but accepted in 1836 and retained ever since.

In Europe the earliest organizations were formed in Ireland. A temperance club is said to have been started at Skibbereen in 1818, and others followed; but it was in 1829 that the organized movement began to make effectual progress with the formation of the Ulster Temperance Society. By the end of that year there were twenty-five societies in Ireland and two or three in Scotland. In 1830 the movement spread to Yorkshire and Lancashire, and supported a newspaper called the Temperance Advocate. According to which there were then 127 societies with 23,000 paying members and 17,000 associated abstainers. In 1831 the British and Foreign Temperance Society was founded in London with the Bishop of London (Blomfield) for president and Archbishop Sumner for one of the vice-presidents. This important society, of which Queen Victoria became patron on her accession in 1837, came to an end in 1859, when the whole cause was under an eclipse.

The latter part of this quotation is particularly interesting because it proves the participation of women in public drunkenness at this period and shows that the physical ruin caused by excess and its national consequences were then for the first time recognized. It was the first step towards the inauguration of the Temperance Movement in the sense of a spontaneous and conscious effort on the part of the community as distinguished from the action of authority responsible for public decency. The need was only realized by degrees. Intemperance was one of many questions which we can now see were struggling into existence during the latter half of the 18th century, to become the subject matter of "social reform" in the 19th. Like the majority of them it was a question of bodily welfare, of health. A breach had been made in the unthinking traditional belief in the virtue of alcoholic liquor by the experiences referred to; and medical thought, as soon as it began to busy itself with health as distinguished from the treatment of diseases, took the matter up. In 1804 Dr Trotter of Edinburgh published a book on the subject, which was an expansion of his academic dissertation written in 1788; Dr Benjamin Rush of Philadelphia, a distinguished American physician and politician, who had studied in Edinburgh and London, wrote a striking paper on the same subject in the same year; and very soon after this the organized Temperance Movement was set on foot in the United States, where the habit of spirit-drinking had been transplanted from the British Islands.
in 1853 of the United Kingdom Alliance "to procure the total and immediate legislative suppression of the traffic in intoxicating liquors as beverages."

Since that time the organized movement has embraced both elements, the voluntary and the compulsory, and has combined the voluntary and the compulsory with the legislative, in the form of legislation for the reduction or suppression of the traffic. On the whole the latter has predominated, particularly in the United States, where organized agitation has for more than half a century made temperance a political question and has produced the various experiments in legislation of which an account is given in the article on Liquor Laws. In 1869 a National Prohibition Party was formed. In Great Britain the political element has been less predominant but sufficiently pronounced to form a distinguishing feature between the early and more enthusiastic stage of the movement, which after lasting twenty years suffered a reaction, and the later one, which began between 1860 and 1870 and made way more gradually. In addition to combining the moral and the political elements the modern movement is characterized by the following features:

(1) International organization, (2) organized co-operation of women, (3) juvenile temperance, (4) teaching of temperance in schools and elsewhere, (5) scientific study of alcohol and inebriety.

(1) International organization appears to have been started by the Order of Good Templars, a society of abstainers formed in 1851 and spread over the United States and Canada, and in 1858 it was introduced into Great Britain. Some years later it was extended to Scandinavia, where it is very strong, and to many other countries, especially Italy and the continent of Europe. The Good Templar organization has spread to several other European countries, to Australasia, India and South Africa, and to many American states and territories. There are also several other international societies, and international congresses have been held, the first in 1885 at Antwerp. A World's Prohibition Conference was held in London in 1909. It was attended by almost all the countries of the continent of Europe and by nearly all nations of the world, and resulted in the foundation of an International Prohibition Federation, which embraces every country in Europe with three or forty exceptions, the United States, Mexico, Argentina, the British self-governing Dominions, India, China, Japan, Palestine, Tunisia and Hawaii. The formation of this body indicates the growth of the most uncompromising form of antagonism to the liquor traffic. Its object is the total abolition of the legalized traffic throughout the world.

(2) The organization of women, which has also become international, dates from 1874, when the National Women's Christian Temperance Union was founded at Cleveland in the United States. In 1897 it had branches in every state in the Union and in about 10,000 towns and villages with an aggregate membership of 550,000. It passed 246 laws in 1890, the greatest number of any temperance organization, although it has not exercised as great influence as the women's organizations in the United States, but it has exercised great influence in promoting that drastic legislation which characterizes the United States. It has also taken up many other questions relating to women, in addition to temperance, and opened the way for the advancement of other interests. About the year 1883 Miss Frances Willard, who had been the moving spirit of the Union, carried the organization of women into other lands and formed the World's Woman's Christian Temperance Union, which now possesses branches in some fifty countries with a total membership of half a million. It has held several conventions in America and Europe and circulated a polyglot petition, said to be the largest record, on which has been presented to a large number of sovereigns and other heads of states. There are several other female organizations in the United Kingdom.

(3) The inclusion of children in temperance organization goes back to 1847, when a society was formed at Leeds, in Yorkshire, of juvenile abstainers who had taken the pledge; it took the name of Band of Hope. The practice spread, and in 1851 a Band of Hope Union was formed. There are now a number of such societies, for the temperance movement is strong in Scotland, Ireland and separate counties in England; the Bands of Hope are said to number 15,000 in all. There are also several other juvenile organizations, some of which are, however, of very recent formation. Out of the whole section of the Church of England Temperance Society, which has 485,888 members (1910). Children's societies in the United States are usually called the Loyal Temperance Legion, but there are societies in the United Kingdom in the United States and Canada. Some of these organizations exist in several countries and notably in Sweden and Belgium (sociétés scolaires).

(4) The teaching of temperance in schools, which has become a great question, began to be pressed by private effort in 1852, when the late Mr John Hope inaugurated a regular weekly visitation of day-schools in Edinburgh. In 1876, at the invitation of the Edinburgh Temperance Society, Sir Henry M. Hope-Brown wrote his Temperance Lesson Book, which was adopted by many schools as a primer. In 1889 school-teaching by travelling lecturers was taken up by the United Kingdom Band of Hope and extended to the existing schools. The Band of Hope Unions in England alone have spent over £3,000 a year for the last twenty years in itinerant lectures; object-lessons on the nature and effects of alcohol are given in some fifteen schools. The Church of England Temperance Society carries on similar work in diocesan schools, and examines the children in the subject of temperance; in 1909 it had in use 6,000 temperance and alcoholic problems, and 100,000 temperance books have been given free to schools for use in teaching the subject. The voluntary temperance teaching having grown continuously and become very extensive, has led to action by central education authorities. In 1906 the Board of Education in Ireland made it compulsory in some of the denominational schools and in 1909 the Board for England and Wales made compulsory teaching in temperance in all of the elementary schools optional. In Scotland also courses of teaching on hygiene and temperance are permissive and have been adopted by many local educational authorities. In the United States compulsory teaching is of much longer standing and more advanced. The Temperance Union (see above) in 1879; it was believed that by teaching the physiological effects of alcohol to all children the problem of in-temperance would be effectually "solved," and a systematic policy on the subject was adopted. In Europe plans have been drawn up for legislation to make temperance teaching a compulsory subject. The campaign was successful in New York in 1884, in Pennsylvania in 1885 and subsequently in other states of the American confederation. Legislation has been introduced in Canada, Japan, China, Japan, Palestine, Tunisia and Hawaii. The formation of this body indicates the growth of the most uncompromising form of antagonism to the liquor traffic. Its object is the total abolition of the legalized traffic throughout the world.

(5) The scientific study of the physiology and pathology of alcohol is a very large subject in itself. As has been shown above, the pioneers of the temperance movement were medical men; and though the Churches soon became interested, the interest was more in reform than science, and in more recent times since people learnt to bow down to the name of Science there has been a marked tendency to have recourse to scientific authority for arguments. Some of the first and most notable works in this line of science is an illustration. At the same time the increasing interest taken in all questions relating to health has directed the attention of scientific investigators to this subject, and the subject has been studied by the National Researches of physiology or hygiene is an illustration. At the same time the increasing interest taken in all questions relating to health has directed the attention of scientific investigators to this subject, and the subject has been studied by the National Researches of physiology and hygiene are one of the most important results of this activity. There is no doubt that it has had a strong influence on public opinion and on the whole in the direction of temperance. A great change of attitude has taken place not only among medical men, but among the public, who have come to look upon alcohol, especially of distilled spirits, have long been recognized, but the tendency now is to question whether any alcohol-containing drinks are of any value at all and to deny any valid distinction between intoxicating and non-intoxicating drinks. Numerous societies have been formed in England, Germany, Belgium, Holland, Norway, Sweden and Denmark.

Present State of the Movement.—No comprehensive data are available for estimating the numerical strength of the temperance organizations or the number of abstainers at the present time; but
The Alliance Year Book contains a directory of societies, which at least give some idea of the wide distribution of the movement. The following summary figures are extracted from the list; they relate to distinct organizations, exclusive of branches and sub-sections, having for their object the promotion of individual abstinence or of legislation: The United Kingdom; 62; Australasia; 11; Canada; 2; South Africa; 3; India; 2; United States; 10; Austria-Hungary; 8; Belgium; 2; Denmark; 5; France; 4; Germany; 12; Holland; 6; Sweden; 6; Switzerland; 11. The figures are no doubt very imperfect and must not be taken in any way to represent the relative strength of temperance organizations in the several countries. The list for the United Kingdom is much more complete than for the other countries. The Alliance Year Book indeed gives the names of 130 organizations in the United Kingdom connected in some way with temperance work; but these include local branches, juvenile sections, insurance companies, orphanages and so on. An attempt has been made to pick out the temperance societies as ordinarily understood; but some of those included are merely committees for promoting particular pieces of legislation, and on the other hand bodies like the Salvation Army and the Church Army, which do a great deal of temperance work but are not primarily or principally engaged in it, have been omitted. Altogether the subject is full of confusion and not susceptible of exact statement. The number of societies is no guide to the number of individuals, for many persons belong to several organizations. There can be little doubt that the organized movement is numerically strongest in the United States and next strongest in the United Kingdom, but no reliable estimates can be made.

Some of the British societies call for particular notice. The two principal ones are the Church of England Temperance Society and the United Kingdom Alliance. The latter, founded in 1853, is the chief fighting political organization, having total prohibition of the liquor traffic for its object; its income is about £12,000 a year. The Church of England Temperance Society is much the largest of the British societies. It was founded in 1862 and reconstituted in 1873 on a dual basis of total abstinence and general

### Consumption per Head of Population

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<td>Italy</td>
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<td>United States</td>
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<td>Australia</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>New Zealand</td>
<td>0.70</td>
<td>0.71</td>
<td>0.70</td>
<td>0.65</td>
<td>0.63</td>
<td>0.64</td>
<td>0.66</td>
<td>0.66</td>
<td>0.69</td>
<td>0.72</td>
<td>0.76</td>
<td>0.75</td>
<td>0.76</td>
<td>0.73</td>
<td>0.70</td>
</tr>
</tbody>
</table>
anti-intemperance. Its objects are (1) the promotion of habits of temperance, (2) the reform of the intemperate; (3) the removal of the causes which lead to intemperance. Thus it embraces both the moral and the legislative spheres, but the former takes first place. In the circles of the latter, there are few better proofs of the "forward movement" in spiritual activity. On the legislative side the society supports measures of reform rather than prohibition; in the latter there is still a considerable movement directed by the temperance body. The table is marked a increase in the consumption of beer. It has occurred in some measure in the following countries—Russia, Sweden, Denmark, Belgium, Holland, Germany, Spain, and India. In each of these countries, the United Kingdom and Norway, in both of which the consumption has fallen largely and steadily since 1899. In Germany it has also fallen somewhat since 1900, but not so steadily, and over the whole period there has risen in that country. It is impossible to detect these various movements either with legislation or with temperance organization. If the fall in Norway is ascribed to them, it must be chiefly to the effects of the temperance movement among the young. The consumption of spirits shows no such movement, having risen since 1897. No one who has studied the subject in the different countries affected can doubt that the rise is due to the introduction and growing popularity of the light beers originally brewed in Germany and Austria, and commonly called "lager." This is notably the case in France, Sweden, and many of the central European states.

The temperance movement has been accompanied by a corresponding reduction of other alcoholic wine. The consumption of spirits is largely consumed only in countries where it once was grown, namely, in France, Italy, and Switzerland, out of the countries enumerated. The consumption is very irregular and dependent mainly on the abundance of the crop. But the tendency of wine has also been to rise; it has very much increased in the United States, Belgium, Germany, Italy, and Austria. With regard to spirits, the only general movement is that consumption has fallen in most European countries since 1900. But this does not appear to be compensatory to the rise of beer, which extends over the whole period and went on when spirits were rising too.

Exceptions to the downward movement of spirits since 1900 are offered by the United States and Canada, and to a less extent by Russia, Italy, and Norway. The only country in which all classes of drink have steadily fallen is the United Kingdom; this singular fact will be discussed presently, but its peculiarity should be noted here in connexion with other countries.

In the tables, an attempt has been made to express the total consumption of each country in terms of alcohol by allowing a certain percentage of spirit for wine and beer and reducing all three to a common denominator. The calculation yields a simple and uniform measure of consumption of alcohol in the order of their alcoholic consumption; but it must be regarded as a somewhat arbitrary estimate, because the strength of both wine and beer varies considerably. The Brewer's Almanac gives the following table based on the results quoted above:

<table>
<thead>
<tr>
<th>Country</th>
<th>Wine</th>
<th>Beer</th>
<th>Spirits</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>0.70</td>
<td>0.06</td>
<td>0.16</td>
<td>0.96</td>
</tr>
<tr>
<td>Italy</td>
<td>0.27</td>
<td>0.00</td>
<td>0.00</td>
<td>0.27</td>
</tr>
<tr>
<td>Belgium</td>
<td>0.25</td>
<td>0.38</td>
<td>0.11</td>
<td>0.55</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0.35</td>
<td>0.11</td>
<td>0.00</td>
<td>0.46</td>
</tr>
<tr>
<td>Spain</td>
<td>0.00</td>
<td>0.62</td>
<td>0.00</td>
<td>0.62</td>
</tr>
<tr>
<td>Portugal</td>
<td>0.12</td>
<td>0.00</td>
<td>0.00</td>
<td>0.12</td>
</tr>
<tr>
<td>Austrian</td>
<td>0.97</td>
<td>0.23</td>
<td>0.00</td>
<td>1.20</td>
</tr>
<tr>
<td>Germany</td>
<td>0.36</td>
<td>0.00</td>
<td>0.00</td>
<td>0.36</td>
</tr>
<tr>
<td>Denmark</td>
<td>0.00</td>
<td>0.48</td>
<td>0.00</td>
<td>0.48</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0.08</td>
<td>0.33</td>
<td>0.09</td>
<td>0.46</td>
</tr>
<tr>
<td>Hungary</td>
<td>0.97</td>
<td>0.12</td>
<td>0.00</td>
<td>1.09</td>
</tr>
<tr>
<td>United States</td>
<td>0.11</td>
<td>0.23</td>
<td>0.00</td>
<td>0.34</td>
</tr>
<tr>
<td>Sweden</td>
<td>0.00</td>
<td>0.48</td>
<td>0.00</td>
<td>0.48</td>
</tr>
<tr>
<td>Australia</td>
<td>0.32</td>
<td>0.00</td>
<td>0.00</td>
<td>0.32</td>
</tr>
<tr>
<td>Holland</td>
<td>0.09</td>
<td>0.00</td>
<td>0.00</td>
<td>0.09</td>
</tr>
<tr>
<td>New Zealand</td>
<td>0.17</td>
<td>0.00</td>
<td>0.00</td>
<td>0.17</td>
</tr>
<tr>
<td>Canada</td>
<td>0.50</td>
<td>0.00</td>
<td>0.00</td>
<td>0.50</td>
</tr>
<tr>
<td>Russia</td>
<td>0.00</td>
<td>0.00</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Cape</td>
<td>0.17</td>
<td>0.00</td>
<td>0.00</td>
<td>0.17</td>
</tr>
<tr>
<td>Norway</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Natal</td>
<td>0.05</td>
<td>0.00</td>
<td>0.00</td>
<td>0.05</td>
</tr>
<tr>
<td>Newfoundland</td>
<td>0.02</td>
<td>0.00</td>
<td>0.00</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Apart from the gaps in the information, which speak for themselves, allowance must be made for other defects. In no case is the nominal consumption per head a valid index to the relative temperatures of different peoples unless other conditions are by equal. That they are of the drinking has to be taken into account, and this is conditioned by the age and sex constitution of the population and by the habits of the people. A country in
TEMPERANCE

which every person except infants takes a minute quantity of drink at every meal every day will have a far larger consumption per head and yet may be far more temperate than one in which a large proportion of the population consumes nothing at all and the drinking is concentrated in regard to both time and person. The Portuguese and Spaniards, for instance, are more temperate than any of the nations below them on the list; drunkenness is never seen in Portugal and in the south of Spain (the bishop of Barcelona has in many instances bore testimony to the sobriety even of such a large seaport as Barcelona). The aggregate consumption is brought up to a comparatively high level by the national practice of drinking a little wine freely diluted with water, a beverage which contains less alcohol than many "temperance" drinks. In like manner the French and Italians, whose high place is due to wine, are more sober than the greater part of the nations ranked below them. They are the only nations of the extensive inquiries on this head in France. There is drunkenness, to which Zohn's "I'Assommoir" bears testimony, but outside Paris and the seaports it is rare. Employers of labour in all the principal industrial centres, including the mining districts of the north, agree on this point. The very high position of Belgium is mainly due to a prodigious consumption of beer, which is explained by the general practice of giving it to children. On the other hand, drunkenness is exceedingly prevalent in Russia, which is near the bottom of the list, and is due to the consumption of vodka. The comparatively small amount per head put down in the returns may, if it is correct, be explained by the very large proportion of children in the population. The opposite condition is illustrated by Western Australia, which has a consumption per head nearly three that of any other Australian province. These instances will show the conditions that must be taken into account when making comparisons and the fallacy of measuring national sobriety by consumption per head.

Consumption in United Kingdom.—Statistics of consumption for a long period of time than that covered by the table given above are available for the United Kingdom, the United States and Scandinavia, and they are of particular interest because these are the only countries in which the Temperance Movement has been most active and productive of most legislation. The United Kingdom is distinguished by being the only country in the list which shows a distinct fall in the consumption of all three kinds of liquor since 1856. To estimate the significance of this interesting fact it must be placed in historical perspective. The following table, compiled from the official returns, gives the annual average consumption per head in decennial periods from 1831 to 1890, and subsequently for each year to 1909. No continuous record of beer was kept until after 1856.

United Kingdom: Average Annual Consumption per head in Gallons.

<table>
<thead>
<tr>
<th>Year</th>
<th>Wine</th>
<th>Beer</th>
<th>Spirits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1831-40</td>
<td>0.26</td>
<td>0.05</td>
<td>1.11</td>
</tr>
<tr>
<td>1841-50</td>
<td>0.23</td>
<td>0.25</td>
<td>1.04</td>
</tr>
<tr>
<td>1851-60</td>
<td>0.23</td>
<td>0.25</td>
<td>1.04</td>
</tr>
<tr>
<td>1861-70</td>
<td>0.31</td>
<td>0.25</td>
<td>1.17</td>
</tr>
<tr>
<td>1871-80</td>
<td>0.27</td>
<td>0.29</td>
<td>1.06</td>
</tr>
<tr>
<td>1881-90</td>
<td>0.30</td>
<td>0.01</td>
<td>1.03</td>
</tr>
<tr>
<td>1891-1909</td>
<td>0.32</td>
<td>0.29</td>
<td>1.06</td>
</tr>
</tbody>
</table>

It will be observed that the consumption has oscillated up and down during the whole period of 70 years. More spirits were drunk in 1851-60 than in the three following decades, and more wine than in the two following decades. The decennial period of greatest consumption was 1871-80; and the highest points reached were: wine, 0.36 gal. in 1876; beer, 0.34 gals. in 1874; spirits, 1.20 gals. in 1876. Since then the consumption has been always on the wane, with fluctuations. The up and down movement is always associated with the state of trade, and the connexion is well marked in the last ten years. The progressive fall is striking, particularly in regard to beer, which is the staple drink of the people; but the period is too short to warrant the inference that it represents a permanent movement which will continue. The fluctuations shown for the decennial table may be attributed to the fallibility of a subsequent rise with a revival of trade. Chronic depression and unemployment have prevailed in many industries since 1900, and these conditions always cause a diminished consumption. Nevertheless they do not fully account for the movement by any means, because the fall in consumption has been progressive, whereas the state of trade has fluctuated considerably; the curves do not coincide. Some other factor has been at work, and there is reason to think that it is a gradual change in the habits of the people.

The facts of consumption agree with much other evidence in pointing to this conclusion. The expenditure in drink is not so high as it was in the 1880s and 1890s, and in any event the country is much more prosperous than in the earlier period. The calculation of annual expenditure prepared for the United Kingdom Alliance, and commonly called the National Drink Bill, points to this conclusion. It is based on an arbitrary estimate of the cost of drink to the consumer and must not be taken to represent established facts; but it has some comparative value. The following table gives this calculation for the last 26 years:

National Drink Bill, United Kingdom.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Expenditure</th>
<th>Expenditure per head</th>
</tr>
</thead>
<tbody>
<tr>
<td>1884</td>
<td>1,447,341.214</td>
<td>4.1 0.8</td>
</tr>
<tr>
<td>1885</td>
<td>1,404,001.14</td>
<td>3.8 0.7</td>
</tr>
<tr>
<td>1886</td>
<td>1,410,580.12</td>
<td>3.9 0.8</td>
</tr>
<tr>
<td>1887</td>
<td>1,426,798.43</td>
<td>3.9 0.7</td>
</tr>
<tr>
<td>1888</td>
<td>1,415,015.35</td>
<td>3.9 0.7</td>
</tr>
<tr>
<td>1889</td>
<td>1,511,691.24</td>
<td>4.1 0.8</td>
</tr>
<tr>
<td>1890</td>
<td>1,586,777.09</td>
<td>4.0 0.7</td>
</tr>
<tr>
<td>1891</td>
<td>1,266,557.47</td>
<td>3.9 0.7</td>
</tr>
<tr>
<td>1892</td>
<td>1,261,796.25</td>
<td>3.8 0.7</td>
</tr>
<tr>
<td>1893</td>
<td>1,284,989.17</td>
<td>3.9 0.7</td>
</tr>
<tr>
<td>1894</td>
<td>1,266,271.09</td>
<td>3.8 0.7</td>
</tr>
<tr>
<td>1895</td>
<td>1,281,032.31</td>
<td>3.9 0.7</td>
</tr>
<tr>
<td>1896</td>
<td>1,303,393.36</td>
<td>3.8 0.7</td>
</tr>
<tr>
<td>1897</td>
<td>1,237,640.68</td>
<td>3.8 0.7</td>
</tr>
<tr>
<td>1898</td>
<td>1,303,393.36</td>
<td>3.8 0.7</td>
</tr>
<tr>
<td>1899</td>
<td>1,337,432.31</td>
<td>3.9 0.7</td>
</tr>
</tbody>
</table>

The table begins and ends in two periods of marked depression, with one of marked prosperity in between; but it is to be noted that in the earlier term of depression, although it was very acute, the expenditure never sank so low as in the later one. During the four lowest years (1884-88) the mean expenditure was nearly 4s. a head more than in the five lowest years (1905-9). At the other end of the scale the high-water mark in the table, which is the year 1859, shows an expenditure per head of 1.8d. for the whole high-water mark comparable with it, namely 1876, shows an expenditure of £5, 1s. 9d., when calculated on the same basis. The figures, therefore, rather confirm than contradict the general belief that the population have grown more temperate in the last 40 years.

With regard to the expression "national drink bill," which tacitly suggests so much money thrown away on drink, it must be remembered that a large proportion is devoted to public purposes and would hardly be found in a bill which was balanced in the ordinary manner. In condensation which 1909 the trade paid a direct contribution of £37,494,575 to the national exchequer in excise and customs duties, in addition to income-tax and local taxation; all this comes back to the public pocket. Then it also maintains directly and indirectly a population reckoned at 2,000,000. The net amount spent on drink which might have been saved and spent on other things is not more than a third of the total sum.

The United States.—The movement in the United States has been totally different. The figures below are taken from the statistical abstract of the U.S. government as quoted in the American Prohibition Year Book. The figures for each state differ widely throughout from those given for the same years in the Board of Trade returns of international consumption quoted on p. 581. The discrepancy is too great and too constant to admit of any explanation, but that the two sets of returns are calculated from different bases. It illustrates the defects of these statistics and the need of caution in using them. The American figures show a far larger consumption in the United States than the British.

The most noticeable fact here shown is the continuous and large increase in the consumption of beer. Every year shows a rise down to 1898, when for the first time in 70 years a fall was recorded. It was continued in 1899 and 1900, and since then the consumption has always been on the rise, with fluctuations. The up and down movement is also no doubt mainly attributable to the financial state of the country. Down to 1880 beer was to a considerable extent taking the place of spirits, the consumption of which has been very large, and the fall in the consumption of beer was not accompanied by a reverse movement in spirits; and from 1896 to 1907 all three kinds of liquor rose together, though not with equal steadiness. The rising consumption of beer has been accompanied
TEMPERANCE

by an enormous increase in home production, the capital invested in breweries having risen from 4 million dollars in 1850 to 515 million dollars in 1905. The consumption of spirits is at a much higher level than in the United Kingdom, and two considerations and greatly to the significance of the fact—one is that drinking takes place more between meals and less at them, and the other that it is more confined to men. Women, other than prostitutes,

Consumption per head in Gallons, United States.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1840</td>
<td>2.52</td>
<td>0.29</td>
<td>1.36</td>
<td>4.17</td>
</tr>
<tr>
<td>1860</td>
<td>1.26</td>
<td>0.27</td>
<td>0.52</td>
<td>2.05</td>
</tr>
<tr>
<td>1870</td>
<td>1.40</td>
<td>0.32</td>
<td>0.74</td>
<td>2.46</td>
</tr>
<tr>
<td>1880</td>
<td>1.48</td>
<td>0.32</td>
<td>1.01</td>
<td>2.81</td>
</tr>
<tr>
<td>1890</td>
<td>1.40</td>
<td>0.31</td>
<td>1.36</td>
<td>3.07</td>
</tr>
<tr>
<td>1892</td>
<td>1.48</td>
<td>0.37</td>
<td>1.73</td>
<td>3.58</td>
</tr>
<tr>
<td>1894</td>
<td>1.28</td>
<td>0.45</td>
<td>1.20</td>
<td>2.93</td>
</tr>
<tr>
<td>1898</td>
<td>1.26</td>
<td>0.61</td>
<td>1.26</td>
<td>3.13</td>
</tr>
<tr>
<td>1890</td>
<td>1.40</td>
<td>0.46</td>
<td>1.66</td>
<td>3.52</td>
</tr>
<tr>
<td>1892</td>
<td>1.49</td>
<td>0.43</td>
<td>1.57</td>
<td>3.49</td>
</tr>
<tr>
<td>1894</td>
<td>1.34</td>
<td>0.32</td>
<td>1.52</td>
<td>3.18</td>
</tr>
<tr>
<td>1896</td>
<td>1.30</td>
<td>0.27</td>
<td>1.47</td>
<td>3.04</td>
</tr>
<tr>
<td>1898</td>
<td>1.28</td>
<td>0.39</td>
<td>1.61</td>
<td>3.28</td>
</tr>
<tr>
<td>1901</td>
<td>1.33</td>
<td>0.37</td>
<td>1.70</td>
<td>3.40</td>
</tr>
<tr>
<td>1903</td>
<td>1.30</td>
<td>0.43</td>
<td>1.70</td>
<td>3.43</td>
</tr>
<tr>
<td>1904</td>
<td>1.28</td>
<td>0.43</td>
<td>1.70</td>
<td>3.41</td>
</tr>
<tr>
<td>1905</td>
<td>1.27</td>
<td>0.43</td>
<td>1.70</td>
<td>3.40</td>
</tr>
</tbody>
</table>

do not frequent the bar as they do in the United Kingdom, and children not at all. The expenditure in drink, so far as it can be calculated, has fluctuated somewhat, but shows a general tendency to rise. The following table has been prepared by Mr G. B. Waldron, an American statistician. It is taken from the Prohibition Year Book, with the American currency converted into English on the basis of 4s. to the dollar, omitting fractions of a penny; for purposes of comparison with the British statistics given above.

Annual Drink Bill, United States.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Expenditure</th>
<th>Expenditure per head</th>
<th>Year</th>
<th>Total Expenditure</th>
<th>Expenditure per head</th>
</tr>
</thead>
<tbody>
<tr>
<td>1878</td>
<td>$90,655,754</td>
<td>2.49</td>
<td>1898</td>
<td>$208,315,573</td>
<td>2.71</td>
</tr>
<tr>
<td>1888</td>
<td>$163,617,545</td>
<td>2.64</td>
<td>1899</td>
<td>$214,137,995</td>
<td>2.71</td>
</tr>
<tr>
<td>1889</td>
<td>$168,176,160</td>
<td>2.64</td>
<td>1900</td>
<td>$234,445,322</td>
<td>2.71</td>
</tr>
<tr>
<td>1890</td>
<td>$160,529,173</td>
<td>2.64</td>
<td>1901</td>
<td>$243,999,558</td>
<td>2.71</td>
</tr>
<tr>
<td>1891</td>
<td>$193,946,581</td>
<td>2.64</td>
<td>1902</td>
<td>$262,587,728</td>
<td>2.71</td>
</tr>
<tr>
<td>1893</td>
<td>$202,978,872</td>
<td>2.64</td>
<td>1903</td>
<td>$282,122,043</td>
<td>2.71</td>
</tr>
<tr>
<td>1894</td>
<td>$215,896,634</td>
<td>2.64</td>
<td>1904</td>
<td>$292,735,706</td>
<td>2.71</td>
</tr>
<tr>
<td>1895</td>
<td>$204,429,296</td>
<td>2.64</td>
<td>1905</td>
<td>$293,180,332</td>
<td>2.71</td>
</tr>
<tr>
<td>1896</td>
<td>$194,189,496</td>
<td>2.64</td>
<td>1906</td>
<td>$301,604,934</td>
<td>2.71</td>
</tr>
<tr>
<td>1897</td>
<td>$192,418,995</td>
<td>2.64</td>
<td>1907</td>
<td>$305,461,570</td>
<td>2.71</td>
</tr>
<tr>
<td>1898</td>
<td>$185,640,711</td>
<td>2.64</td>
<td>1908</td>
<td>$335,167,059</td>
<td>2.71</td>
</tr>
</tbody>
</table>

Comparison with theKitchen at a glance shows an opposite movement in the two countries. While expenditure has steadily fallen in the United Kingdom since 1890, it has as steadily risen in the United States; and whereas in 1888 the expenditure in the former was 41 per cent. higher than in the latter, the two had drawn equal in 1906 and since then have changed places. Moreover the different system of taxation brings back a much larger proportion of the whole expenditure into the exchequer in the United Kingdom (see Liquor Laws). The comparison is of much interest in view of the very different laws and regulations under which the trade is conducted in the two countries. It may be objected that the statistics are merely estimates, but both sets are put forward by the advocates of prohibition and are of equal authority, so that they hold good for comparison.

Norway and Sweden.—The statistics for these countries are imperfect, because there is no record of wine, and in recent years the use of spirits has been supplemented to a considerable extent by artificial wines heavily loaded with spirits. But, as they stand, the statistics derive special interest from the peculiar conditions under which the traffic is conducted. The Scandinavian company system was started in Sweden in 1865 and in Norway in 1871 (see Liquor Laws).

Consumption per head in Litres, Norway.

<table>
<thead>
<tr>
<th>Year</th>
<th>Batalin.</th>
<th>Beer.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1831-60</td>
<td>5.9</td>
<td>5.9</td>
</tr>
<tr>
<td>1861-70</td>
<td>6.6</td>
<td>6.6</td>
</tr>
<tr>
<td>1871-80</td>
<td>7.2</td>
<td>7.2</td>
</tr>
<tr>
<td>1881-90</td>
<td>7.5</td>
<td>7.5</td>
</tr>
<tr>
<td>1891</td>
<td>7.7</td>
<td>7.7</td>
</tr>
<tr>
<td>1892</td>
<td>7.7</td>
<td>7.7</td>
</tr>
<tr>
<td>1893</td>
<td>7.7</td>
<td>7.7</td>
</tr>
<tr>
<td>1894</td>
<td>7.7</td>
<td>7.7</td>
</tr>
<tr>
<td>1895</td>
<td>7.7</td>
<td>7.7</td>
</tr>
</tbody>
</table>

Consumption per head in Litres, Sweden.

<table>
<thead>
<tr>
<th>Year</th>
<th>Batalin.</th>
<th>Beer.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1856-60</td>
<td>9.5</td>
<td>9.5</td>
</tr>
<tr>
<td>1861-70</td>
<td>9.7</td>
<td>9.7</td>
</tr>
<tr>
<td>1871-80</td>
<td>10.9</td>
<td>10.9</td>
</tr>
<tr>
<td>1881-90</td>
<td>11.2</td>
<td>11.2</td>
</tr>
<tr>
<td>1891</td>
<td>11.4</td>
<td>11.4</td>
</tr>
<tr>
<td>1892</td>
<td>11.4</td>
<td>11.4</td>
</tr>
<tr>
<td>1893</td>
<td>11.4</td>
<td>11.4</td>
</tr>
<tr>
<td>1894</td>
<td>11.4</td>
<td>11.4</td>
</tr>
<tr>
<td>1895</td>
<td>11.4</td>
<td>11.4</td>
</tr>
</tbody>
</table>

The difference between these contiguous countries is remarkable. The consumption of spirits has always been much higher in Sweden than in Norway. In the old days before any legislation the estimated consumption was in Sweden 46 litres (1829) and in Norway 16 litres (1833) a head. In recent years, under the company system, the figures for both countries are vastly less, but the Swedish consumption has hardly ever been less than the Norwegian and sometimes three times as great. The difference, observed over a long period before regulation and after, points to different conditions and national habits; but such constant differentiating factors hardly explain the strikingly dissimilar movements shown by the tabulated countries are obviously affected by the trade of state. The high-water mark of spirit-drinking in modern times for both was the same period, 1874-76, as noted above for the United Kingdom; Sweden then averaged 12.4 litres a head and Norway 6.6. Both show also the influence of the 1900 boom in trade and the subsequent decline. But in Sweden the increase of beer-drinking, which in 1871-80 was less than in Norway, has been enormous. If the two drinks are put together it cannot be said that the consumption in Sweden was appreciably less in 1866-1905 than in 1871-80, whereas in Norway it was distinctly less. This may in part be explained by the substitution of the made wine, called laddern, to which reference has already been made. The marked fall in the consumption of spirits which occurred in 1866-98 is attributed to this cause (Rowntree and Sherwell); the importation of wine alone from 2,330,300 litres in 1861-92 to 5,876,750 litres in 1898. Subsequently importation was checked by heavier duties and reduced consumption followed. In 1886-90 the quantity consumed per head in litres averaged o-88; in 1896-1900 it was increased to 2.49, with a maximum of 2.75 in 1898; in 1905 it had fallen again to o-88 (Pratt). A careful study of the foregoing statistics of consumption in the three countries—United Kingdom, United States and the Scandinavian peninsula—which have paid most attention to the problem and have for a long period applied forcible but widely different methods of control, does not permit any confident conclusion upon the comparative merits of any particular system. The United States, in whose multitudinous liquor laws prohibition plays the most prominent part, has most conspicuously failed to check consumption. Norway and Sweden, both of which combine the
TEMPERANCE

principle of disinterested management, though not in the same form, with a certain amount of prohibition, show markedly different results. British temperance systems have long been the subject of considerable study, the British legislative system has been held to be the least adequate as any of the others. The most probable conclusion to be drawn from the facts is that the movement in each country has been mainly determined by other forces; the rise of consumption in the United States by the rapid and progressive urbanization of the people and the great increase of wealth; the diminution of consumption in the United Kingdom by a change in the habits of the people due to many causes, to which further reference is made below; we may add that the introduction of temperance in Norway is due to differences of national character and habits already noted, though some influence must be attributed to the superior system and more stringent control of Norway. But if we go back to earlier periods there is no doubt at all that an incomparably worse state of things existed in the United Kingdom and in Scandinavia when the spirit traffic was under little control or none at all.

They vary according to (1) the laws relating to drunkenness; (2) the administration by police and justices; (3) the method of compounding returns. All these vary in different countries and towns and at different times, so that the statistics must not be used for minute comparisons. But properly handled they are of great value, and the discrepancies are less than might be supposed, because it is found on inquiry that the actual behaviour of the police towards drunkenness, however, does not at all differentially interfere with the liquor trade, nor is there any evidence as to the ascertainment of the number of persons who have been recently drinking; the mode of compounding returns is the most serious cause of error. Many countries have no returns, and in others they are incomplete. Those available, however, throw considerable light on the subject.

The following quinquennial table shows the movement in England and Wales since the drunken period 1874-78. The important act of 1872, which increased the number of offences, vitiates comparison with the earliest returns, which are, however, given in the article on Drunkenness.

Drunkenness, England and Wales.

<table>
<thead>
<tr>
<th>Year</th>
<th>Scotland</th>
<th>Ireland</th>
</tr>
</thead>
<tbody>
<tr>
<td>1890</td>
<td>36,293</td>
<td>100,202</td>
</tr>
<tr>
<td>1900</td>
<td>43,543</td>
<td>97,457</td>
</tr>
<tr>
<td>1901</td>
<td>88,295</td>
<td></td>
</tr>
<tr>
<td>1902</td>
<td>91,276</td>
<td></td>
</tr>
<tr>
<td>1903</td>
<td>69,108</td>
<td></td>
</tr>
<tr>
<td>1904</td>
<td>41,852</td>
<td>81,775</td>
</tr>
<tr>
<td>1905</td>
<td>43,518</td>
<td>79,968</td>
</tr>
<tr>
<td>1906</td>
<td>55,408</td>
<td>77,262</td>
</tr>
<tr>
<td>1907</td>
<td>55,260</td>
<td>76,860</td>
</tr>
<tr>
<td>1908</td>
<td>55,104</td>
<td></td>
</tr>
</tbody>
</table>

When allowance is made for the act of 1902 it is seen that the movement of drunkenness corresponds broadly with that of consumption, but the decline of drunkenness is more marked; the level is lower than it was to be whether good or bad times be taken. This plainly shows a large change in the habits of the people, which is further emphasized by the fact that police procedure has become more stringent and the returns more complete. The exceptional figure for 1909 (estimated) is ascribed to the heavy increase of spirit duties in that year. The change has been accompanied by a decided diminution in the number of drunken persons arrested. Between 1870 and 1900 the number of licences was reduced from 53,3 to 26,3 per 10,000 of the population; but the corresponding number of public-houses has fallen steadily from year to year, whereas drunkenness, like consumption, has fluctuated with the state of trade. The facts, therefore, demonstrate a connexion, but it is not a direct one. The reasons why which have brought about the general decline of drunkenness are more and deeper. The standard of behaviour has gradually changed with education and the provision of alternative recreations in many forms. The habits of the people have been altered, for example, public libraries, institutes, tea shops and eating houses. At the same time great social changes have taken effect and have tended to remove class barriers and foster the aspirations of the working classes. But in some measure we conduct ourselves in a manner prevalent among the more highly educated sections of society. The old drinking habits of the latter, which were notorious at the end of the 19th century, began to give way to greater sobriety early in the 19th century; and the movement was greatly promoted, as a feature of social life, by the influence of Queen Victoria's reign. It is worthy of note that police drunkenness is higher in Wales, Scotland and Ireland than in England. The respective numbers of licences per 10,000 in the years 1899-1903 were: England, 49-8; Wales, 55-2; Scotland, 123-3; Ireland, 175-6. The figures for Wales are strictly comparable, those for Scotland and Ireland less so; but the difference is striking. The greater prevalence of spirit drinking as a national habit, particularly in Scotland and Ireland, may account in part for the discrepancy. Other points which distinguish the three countries from England are their Celtic blood and Sunday closing. No connexion can be shown between the number of licensed houses and the prevalence of drunkenness; they are fewer in Scotland than in England and Wales, but more numerous in Ireland, though there has been a diminution there since 1902, which may have something to do with the fall in drunkenness. The same lack of correspondence is shown more fully by the detailed figures for England and Wales published in the official volume of the licensing statistics. Taking the county groups according to the number of licences in proportion to the population we get the following:

Licences and Drunkenness, County Boroughs, 1905

<table>
<thead>
<tr>
<th>Licences per 10,000</th>
<th>under 20</th>
<th>20 to 30</th>
<th>30 to 40</th>
<th>40 to 50</th>
<th>over 60</th>
</tr>
</thead>
<tbody>
<tr>
<td>71-05</td>
<td>35-59</td>
<td>62-4</td>
<td>36-3</td>
<td>35-27</td>
<td></td>
</tr>
</tbody>
</table>

The corresponding figures for the counties are as follows:

Licences and Drunkenness, Counties, 1905

<table>
<thead>
<tr>
<th>Licences per 10,000</th>
<th>under 30</th>
<th>30 to 40</th>
<th>40 to 50</th>
<th>over 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>57-39</td>
<td>36-74</td>
<td>40-0</td>
<td>33-2</td>
<td></td>
</tr>
</tbody>
</table>
If any other year be taken similar discrepancies are shown. In 1909 the six counties with the highest and the six with the lowest number of licences exclusive of county boroughs, gave the following results:

<table>
<thead>
<tr>
<th>County</th>
<th>Licences per 10,000</th>
<th>Convictions per 10,000</th>
<th>County</th>
<th>Licences per 10,000</th>
<th>Convictions per 10,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huntingdon</td>
<td>91-51</td>
<td>20-68</td>
<td>Middlesex</td>
<td>11-84</td>
<td>33-32</td>
</tr>
<tr>
<td>Cambridges</td>
<td>11-18</td>
<td>19-09</td>
<td>Northumberland</td>
<td>13-12</td>
<td>33-44</td>
</tr>
<tr>
<td>Oxford</td>
<td>9-56</td>
<td>19-13</td>
<td>Essex</td>
<td>7-92</td>
<td>9-56</td>
</tr>
<tr>
<td>Brecon</td>
<td>54-38</td>
<td>20-56</td>
<td>Glamorgan</td>
<td>7-34</td>
<td>38-48</td>
</tr>
<tr>
<td>Rutland</td>
<td>14-18</td>
<td>21-44</td>
<td>Lancaster</td>
<td>36-31</td>
<td>45-48</td>
</tr>
<tr>
<td>Buckingham</td>
<td>39-75</td>
<td>22-50</td>
<td>Durham</td>
<td>60-49</td>
<td>39-75</td>
</tr>
<tr>
<td>Mean</td>
<td>69-00</td>
<td>20-93</td>
<td>Mean</td>
<td>18-95</td>
<td>62-94</td>
</tr>
</tbody>
</table>

It is curious that the mean figures for these two groups at opposite ends of the scale exactly reverse the number of licences and convictions; but the individual discrepancies show that other factors really determine the results. The chief of these is unquestionably occupation. All the counties with the highest number of convictions are pre-eminently mining counties. Year after year Northumberland, Durham and Glamorgan occupy the same place at the head of the convictions, and other mining counties are always high. These areas are as drunken because the publicans are few, but vice versa; the licences are kept down because of the drunkenness. The influence of occupation and character is further revealed by a broader survey. The following table from the judicial statistics for 1894 brings out these elements very clearly:

<table>
<thead>
<tr>
<th>Persons Proceeded Against for Drunkenness per 10,000.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seaports</td>
</tr>
<tr>
<td>Mining counties</td>
</tr>
<tr>
<td>Metropolis</td>
</tr>
<tr>
<td>Manufacturing towns</td>
</tr>
<tr>
<td>Pleasure towns</td>
</tr>
</tbody>
</table>

In other countries the same distribution is observed; drunkenness is most prevalent in seaports and mining districts. It is further fostered by a northerly situation, and these three factors go far to explain the condition of Scotland, as of Northumberland and Durham.

The United States.—The Census Bureau at Washington issues from time to time statistics of cities, which contain a good deal of information concerning drunkenness. The last return, published in 1910, contains details of 158 cities having a population of over 30,000 in the year 1907, to which the statistics relate. It appears from these returns that drunkenness is exceedingly prevalent in American towns. The figures are not comparable with the English ones, because they relate to arrests, which are more numerous than "proceedings" and still more than convictions. The number of women included is very considerable, but the data are too imperfect to permit the calculation of a general percentage. In New York the proportion of women arrested for drunkenness and disorder was 24-3 per cent. of the whole number. The cities are divided into four groups according to population:—(1) 10,000, (2) 100,000 to 300,000, (3) 500,000 to 1,000,000, (4) 3,000,000 to 5,000,000. The average number of arrests per 10,000 inhabitants in each group and in all cities together is—(1) 191-0, (2) 193-6, (3) 249-8, (4) 248-8. The comparative small range of difference between the groups is remarkable, and indicates a general prevalence of police drunkenness. The higher figures for groups (3) and (4) are explained by the excessive number of cases in certain manufacturing, mining and Southern coloured towns of small and medium size. These figures are for drunkenness alone, so that they cannot be confused with other offences; but on examining the details of individual cities it becomes clear that the cause varies considerably in making up the returns, and that in some places nearly all the arrests of drunken persons are charged to drunkenness whereas in others a large proportion are returned under the head of disorderly conduct. In considering the relation between drunkenness and the number of licensed houses, therefore, it seems desirable to put both sets of figures, as in the following table. It will be seen that there is a correspondence between the number of licensed houses and the amount of drunkenness alone or of drunkenness and disorderly conduct together, except that the fourth group has the largest number of licences and the most disorder.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>191-0</td>
<td>108-8</td>
<td>39-3</td>
</tr>
<tr>
<td>Group 2</td>
<td>193-6</td>
<td>112-8</td>
<td>27-7</td>
</tr>
<tr>
<td>Group 3</td>
<td>245-8</td>
<td>78-7</td>
<td>28-4</td>
</tr>
<tr>
<td>Group 4</td>
<td>244-8</td>
<td>121-4</td>
<td>31-5</td>
</tr>
<tr>
<td>Mean</td>
<td>205-1</td>
<td>106-8</td>
<td>29-6</td>
</tr>
</tbody>
</table>

There are large discrepancies between different cities, but not greater than among British towns. The following table gives the figures corresponding to the above for each of the great cities included in group 1, with the exception of San Francisco, the population of which could not be estimated:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>105-9</td>
<td>120-2</td>
<td>25-5</td>
</tr>
<tr>
<td>Chicago</td>
<td>169-1</td>
<td>5-3</td>
<td>34-2</td>
</tr>
<tr>
<td>Phila.</td>
<td>287-5</td>
<td>7-2</td>
<td>28-4</td>
</tr>
<tr>
<td>St Louis</td>
<td>106-3</td>
<td>173-7</td>
<td>33-5</td>
</tr>
<tr>
<td>Boston</td>
<td>614-9</td>
<td>16-9</td>
<td>13-5</td>
</tr>
<tr>
<td>Baltimore</td>
<td>75-1</td>
<td>302-5</td>
<td>41-3</td>
</tr>
<tr>
<td>Pitsburgs</td>
<td>351-8</td>
<td>362-9</td>
<td>39-4</td>
</tr>
<tr>
<td>Cleveland</td>
<td>355-2</td>
<td>34-9</td>
<td>40-4</td>
</tr>
<tr>
<td>Buffalo</td>
<td>318-9</td>
<td>153-3</td>
<td>38-4</td>
</tr>
<tr>
<td>Detroit</td>
<td>87-2</td>
<td>82-5</td>
<td>40-6</td>
</tr>
<tr>
<td>Cincinnati</td>
<td>82-4</td>
<td>66-4</td>
<td>44-8</td>
</tr>
<tr>
<td>Milwaukee</td>
<td>100-5</td>
<td>53-1</td>
<td>70-4</td>
</tr>
<tr>
<td>New Orleans</td>
<td>239-5</td>
<td>220-7</td>
<td>50-9</td>
</tr>
<tr>
<td>Washing.</td>
<td>130-0</td>
<td>338-4</td>
<td>16-6</td>
</tr>
</tbody>
</table>

To a certain extent the same inverse relation appears here as in England; the places with the smallest proportion of licences—namely, Philadelphia, Boston, Pittsburg and Washington—are conspicuous for drunkenness and disorder, while those with the largest proportion of licences—namely, Detroit, Cincinnati, Milwaukee and New Orleans—are distinguished by the lowest amount, with the exception of New Orleans, which is a special case by reason of the large coloured and Creole population. The exceptional position of Boston is obviously due to exceptional police activity and that of Chicago to the opposite. At Boston and Cleveland, it will be noticed, the police prefer the charge of drunkenness; at Baltimore the opposite. The position of Washington is explained by the very large coloured population and the strength of the police force, which is greater in the capital than elsewhere and very strict in regard to order in the streets. Philadelphia, Pittsburg and Cleveland are great manufacturing centres with a large population of foreign workmen; the vast influx of European immigrants, consisting of men disposed to drink by age, occupation, race and habits, and receiving higher wages than they have been used to, must always be borne in mind with regard to drunkenness in the United States. It is interesting to note the condition of those cities in which there is no licensed trade. There are none such in the first two groups, but 14 in the third and fourth groups. The following are the figures:

<table>
<thead>
<tr>
<th>Cities.</th>
<th>Arrests for Drunkenness and Disorder per 10,000.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 3</td>
<td></td>
</tr>
<tr>
<td>Cambridge (Mass.).</td>
<td>218-9</td>
</tr>
<tr>
<td>Kansas City (Kansas).</td>
<td>178-6</td>
</tr>
<tr>
<td>Somerville (Mass.).</td>
<td>130-8</td>
</tr>
<tr>
<td>Charleston (S. Carolina).</td>
<td>342-7</td>
</tr>
<tr>
<td>Portland (Maine).</td>
<td>605</td>
</tr>
<tr>
<td>Brockton (Mass.).</td>
<td>249-0</td>
</tr>
<tr>
<td>Fitchburg (Mass.).</td>
<td>161-5</td>
</tr>
</tbody>
</table>

The majority are prohibition cities in Massachusetts, the only state in which this measure was applied to any place of considerable size in 1907. In all of them the drunkenness is below the mean for the group and considerably below that of similar and neighbouring towns. For instance, Brockton is a boot-manufacturing town.
comparable with Lynn in the same state; the respective figures are 240-9 and 561-1. The evidence here, so far as it goes, is in favour of local prohibition. On the other hand there are a number of licensed cities with lower figures, and two of those on the list—Chelsea and Salem—are very high up. State prohibition does not make such a good showing in Boston, Cambridge, one of the most drunken places in America—a fact confirmed by many observers—and Wichita in Kansas is above the mean. Kansas City is better. This place is peculiarly situated, being continuous with Kansas City, Missouri; the boundary between the two states passes through the town. Consequently the inhabitants have only to go into the Missouri half to obtain drink. Cambridge is similarly situated in relation to Boston. Charleston, which is above the mean for the group, was under the state dispensary system. In sum, these police figures furnish some argument for prohibition and some against; but they clearly demonstrate the limits of compulsion. Altogether the statistical evidence from the United States, whether of consumption, expenditure or drunkenness, offers no inducement to the United Kingdom to adopt any of the American methods of control in place of its own system.

**Convictions per 1000 in Gothenburg.**

<table>
<thead>
<tr>
<th>Year</th>
<th>Convictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1865</td>
<td>46</td>
</tr>
<tr>
<td>1866</td>
<td>30</td>
</tr>
<tr>
<td>1867</td>
<td>29</td>
</tr>
<tr>
<td>1868</td>
<td>28</td>
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<td>1869</td>
<td>28</td>
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<td>1870</td>
<td>26</td>
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<tr>
<td>1871</td>
<td>22</td>
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<tr>
<td>1872</td>
<td>32</td>
</tr>
<tr>
<td>1873</td>
<td>32</td>
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<tr>
<td>1874</td>
<td>39</td>
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<tr>
<td>1875</td>
<td>40</td>
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<tr>
<td>1876</td>
<td>40</td>
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<tr>
<td>1877</td>
<td>44</td>
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<tr>
<td>1878</td>
<td>49</td>
</tr>
<tr>
<td>1879</td>
<td>36</td>
</tr>
<tr>
<td>1880</td>
<td>34</td>
</tr>
<tr>
<td>1881</td>
<td>32</td>
</tr>
<tr>
<td>1882</td>
<td>29</td>
</tr>
<tr>
<td>1883</td>
<td>29</td>
</tr>
<tr>
<td>1884</td>
<td>30</td>
</tr>
<tr>
<td>1885</td>
<td>45</td>
</tr>
</tbody>
</table>

The principal feature of this table is the much higher level in the second 20 years than in the first, though the police procedure has been the same. In the first 15 years the figure has exceeded that of 1865, which was practically the year before the company system was introduced, as it did not begin operations until October. Once more the influence of trade oscillations is well marked, particularly in the prosperous period of 1891-1900. To convert convictions into arrests for comparison with the following tables about 3 per 1000 should be added; this difference is very evenly maintained in Gothenburg.

**Arrests per 1000 in Bergen.**

<table>
<thead>
<tr>
<th>Year</th>
<th>Arrests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1877</td>
<td>26</td>
</tr>
<tr>
<td>1878</td>
<td>21</td>
</tr>
<tr>
<td>1879</td>
<td>19</td>
</tr>
<tr>
<td>1880</td>
<td>21</td>
</tr>
<tr>
<td>1881</td>
<td>17</td>
</tr>
<tr>
<td>1882</td>
<td>13</td>
</tr>
<tr>
<td>1883</td>
<td>15</td>
</tr>
<tr>
<td>1884</td>
<td>17</td>
</tr>
<tr>
<td>1885</td>
<td>13</td>
</tr>
<tr>
<td>1886</td>
<td>10</td>
</tr>
<tr>
<td>1887</td>
<td>12</td>
</tr>
<tr>
<td>1888</td>
<td>10</td>
</tr>
<tr>
<td>1889</td>
<td>11</td>
</tr>
<tr>
<td>1890</td>
<td>17</td>
</tr>
<tr>
<td>1891</td>
<td>21</td>
</tr>
</tbody>
</table>

**Arrests per 1000 in Christiania.**

<table>
<thead>
<tr>
<th>Year</th>
<th>Arrests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1890</td>
<td>70</td>
</tr>
<tr>
<td>1891</td>
<td>77</td>
</tr>
<tr>
<td>1892</td>
<td>80</td>
</tr>
<tr>
<td>1893</td>
<td>80</td>
</tr>
<tr>
<td>1894</td>
<td>75</td>
</tr>
<tr>
<td>1895</td>
<td>77</td>
</tr>
<tr>
<td>1896</td>
<td>80</td>
</tr>
<tr>
<td>1897</td>
<td>111</td>
</tr>
</tbody>
</table>

Temperance

**Use and Abuse of Alcohol.**

The evils caused by the abuse of alcoholic liquors have always been recognized by mankind; they are too obvious to be ignored. Intoxication produces imbecility, bestiality, violence and crime; continued excess produces incapacity, poverty, misery, disease, delirium, insanity and death. But all these effects are produced by other causes and it is very difficult to estimate the precise share of the particular agent. In modern times scientific investigation has attempted to do this and to give precision to the conclusions drawn from ordinary observation. We will briefly summarize some of the results.

Drinking is associated with crimes against the person, but not with crimes against property, which form in England nineteenth of the whole (Judicial Statistics, 1901). Dr W. C. Sullivan, medical officer in the prison service, calculates that alcoholic intoxication is as accountable for drunkenness as for other crimes. The statistics of convictions for drunkenness are higher than for any other crime, and for a rather higher proportion of minor offences of the same class; and further that "it is probably the cause of the crimes as lust," but it makes no appreciable contribution to crimes of acquisitiveness. He gives the following table:

### Annual Average per 100,000—1891-1900.

<table>
<thead>
<tr>
<th>Areas</th>
<th>Drunkenness</th>
<th>Homicides and Assaults</th>
<th>Attempted Suicide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural</td>
<td>226:3</td>
<td>116:33</td>
<td>3:46</td>
</tr>
<tr>
<td>Mining</td>
<td>1091:2</td>
<td>237:34</td>
<td>2:43</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>479:8</td>
<td>265:73</td>
<td>6:42</td>
</tr>
<tr>
<td>Seaports</td>
<td>990:6</td>
<td>409:73</td>
<td>10:56</td>
</tr>
</tbody>
</table>

This does not show a regular connexion. The mining areas, where the most drunkenness, are only second in violence and lowest of all in suicide. Sullivan explains this discrepancy by the theory that chronic alcoholism is less prevalent among miners, and that this form is chiefly responsible for the crimes in question. It is impossible, however, to establish any constant relation between drink and violent crime; the two do not vary together. It was pointed out in the Judicial Statistics for 1901 that whereas in the year 1899 consumption of drink was 8 per cent. higher than the previous quinquennial period, crimes of violence were 1-62 per cent. lower. These statistics apply only to England. When other countries are taken into consideration it is still clearer that other factors are more important. Mr W. D. Morrison gives the following table of homicides in proportion to population in different countries (Crime and its Causes):

### Persons Tried for Homicide per 100,000.

<table>
<thead>
<tr>
<th>Country</th>
<th>Homicides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>15:40</td>
</tr>
<tr>
<td>Spain</td>
<td>11:91</td>
</tr>
<tr>
<td>Austria</td>
<td>4:09</td>
</tr>
<tr>
<td>Ireland</td>
<td>3:35</td>
</tr>
<tr>
<td>Belgium</td>
<td>3:02</td>
</tr>
<tr>
<td>Germany</td>
<td>2:73</td>
</tr>
<tr>
<td>Scotland</td>
<td>1:11</td>
</tr>
<tr>
<td>England</td>
<td>1:60</td>
</tr>
<tr>
<td>Holland</td>
<td>1:10</td>
</tr>
</tbody>
</table>

Except that England, Scotland and Ireland are in the order of relative drunkenness, the table shows no correspondence between drunkenness and homicide. In Sweden the converse is evidently the case. We have therefore given the following evidence from the United States, whether of consumption, expenditure or drunkenness, offers no inducement to the United Kingdom to adopt any of the American methods of control in place of its own system.

**Poverty.—** Much poverty is undoubtedly caused by drink, but it is not easy to establish a certain connexion between the two than in the case of crime. Pauperism and drink stand to a great extent in inverse relation; in good times the first diminishes and the second increases. But poverty is taken partly for incapacitation in England, which has had a general tendency to fall for many years, rose rapidly in the period of low consumption after 1860, fell still more rapidly in the great drinking years 1870-77, and rose again when they gave place to depression. With falling consumption after 1891 (see the table above) it rose till 1894, when
the opposite movement began; and, during the steady fall of drink since 1909 pauperism has been rising again. The only exception to the 1914-18 period of alcohol and the depression of 1929-33, was the influence of work and wages. Mr Charles Booth's statistical investigation in East London resulted in the following estimates of the percentage of poverty caused by drink: "great poverty" (20 per cent., drunken or thriftless wife, 5 per cent.; "poverty" (two next classes) the figures were—drinking, 7 per cent., drunken or thriftless wife, 6 per cent. These results can hardly be said to confirm the opinion that drink is the chief cause of poverty. Mr Rowntree's investigation in York did not enable him to make any numerical estimate of the percentage of the number of poor or of pauperism due to poverty (the lowest class), but he thought it the "predominant factor" in producing "secondary" poverty. Alderman McDougall's inquiry in Manchester (1883) resulted in the following proportions of drink-pauperism to pauper drink: 24.5 per cent.; females, 4.40 per cent.; widows and children of drunks, 21.84 per cent.

An inquiry conducted in 1894-95 by the Massachusetts Bureau of Statistics of Labour found that 39-44 per cent. of paupers attributed their position to their own intemperance and about 5 per cent. to that of their parents. All these inquiries are on a very small basis, and the last is particularly deceptive. Drink is commonly confessed by those who in the presence of observers do not serve as a plausible excuse for a condition really due to dislike of work. When poverty is examined by local distribution it is found to have very little connexion with drink. In 1901 the average proportion of pauperism to pauper drink in England was 5.2 per cent. The proportion of the pauper drink in the rural districts of Northumberland and Durham were all below it, the sober eastern counties all above it (Blue-book on Public Health, Social Conditions, Col. 481).

Insanity.—Dr Robert Jones finds that 16 per cent. of all the persons (7,182 out of 43,694) admitted into the London asylums during the twelve years 1893-1905 were definitely ascertained to owe their insanity to drink or intoxication. "The proportion in Claybury Asylum during the same period was 17 per cent., being 22 per cent. of the men and 12 per cent. of the women. Dr R. H. Crowley says:—"One may safely assert that from 20 to 25 per cent. of those cases caused by indulgence under the influences of drink are directly due to intemperance." Dr T. B. Hyslop says:—"With regard to insanity there is some difference in experience as to the relative frequency of alcohol in its causation. This difference ranges from being entirely unimpaired to 30 per cent. My own experience is that alcohol is a direct cause or an indirect factor in the causation of at least 50 per cent. of the cases of insanity." Dr T. S. Clouston estimates that alcoholic excess is the cause of about 20 per cent. of all the insanities in Great Britain and Ireland. These are the opinions of experienced medical men in charge of the insane. On the other hand, those in charge of insane hospitals are inclined to assign "irregularities of the alimentary canal" and "deficiency of certain kind." Dr Branthwaite, government inspector under the Inebriates Acts, observes in his Report for 1908, published in 1910, "There is no doubt whatever in detailing and treating persons sent to us under diagnosis as pauperism that we are dealing with a large number of cases under the administration of the act...a class known as 'feebly-minded.'...It would be difficult to find many more than about a third of all persons under detention capable of passing muster under mental capacity." In this statement he gives the following classification of 30.32 cases:

<table>
<thead>
<tr>
<th>Classification</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insane</td>
<td>63</td>
<td>14.51</td>
</tr>
<tr>
<td>Very defective; persons more or less completely imbecile, degenerate or epileptic</td>
<td>377</td>
<td>47.04</td>
</tr>
<tr>
<td>Defective; eccentric, silly, dull, senile, or subject to periodical paroxysms of uncontrollable temper</td>
<td>1497</td>
<td>18.22</td>
</tr>
<tr>
<td>Of management or capacity, on admission or after six months' detention</td>
<td>1105</td>
<td>13.95</td>
</tr>
</tbody>
</table>

Insanity is therefore a cause as well as a consequence of excessive drinking, and the estimates given about it must be qualified accordingly. The following are given for foreign countries. In Italy a report of 1896 gives 26 asylums among 1,000, with a total of 20.6 per cent. of the admissions given as alcoholic. Dr Castelnuovo with regard to the method of classification. In Switzerland, of the admissions in 1900-04, 21·1 per cent. among males and 4·37 per cent. among females were alcoholics. In Denmark, of the admissions in 1899-1904, 19·3 per cent. of the admissions for the same period were alcoholics. In 1903-04, 14·0 per cent. were alcoholics. In France the proportion of all persons in asylums in 1907 with an alcoholic history was 12·5 per cent.

Mortality.—The influence of drink on mortality is an unascertainable quantity, because it may be associated with other causes to an extent which varies in an infinite series of gradations. All attempts to estimate it are more or less plausible guesses. We have however some perceptive data. The Registrar-General's Reports since 1867-8 contain the heading "alcoholism, delirium tremens," as a cause of death. The following are the rates per million recorded in quarterly periods from 1867-8 to 1910-11: 47·5, 42·0, 48·5, 46·8, 47-9, 47-8, 48, 5·7, 7·8, 7-9, 8·5, 7·8. This is unsatisfactory for two reasons: the first is, that alcoholism does not nearly cover all the mortality directly caused by drink; and the second is, that being a very vague term, it is used in certifying the cause of death depends largely on the views of the practitioner and current opinion in the medical profession. The attention paid to the subject has led to a growing recognition of alcoholism, which, indeed, does not appear at all in the older text-books. This accounts for the steady increase of deaths ascribed to it, which is otherwise inexplicable, being quite at variance with the consumption of drink during the same period. The Seventy-first Annual Report of the Registrar-General states that the mortality from alcoholism in the years 1900 and 1901 was materially increased by the transference of deaths that had been originally certified as from neuritis. It is now usual to classify alcoholism and cirrhosis as "delirium tremens." The following are the death-rates for twenty years:

<table>
<thead>
<tr>
<th>Year</th>
<th>Male</th>
<th>Female</th>
<th>Persons</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>1889</td>
<td>72</td>
<td>39</td>
<td>111</td>
<td>103</td>
<td>121</td>
</tr>
<tr>
<td>1890</td>
<td>104</td>
<td>50</td>
<td>154</td>
<td>124</td>
<td>122</td>
</tr>
<tr>
<td>1892</td>
<td>103</td>
<td>51</td>
<td>154</td>
<td>124</td>
<td>122</td>
</tr>
<tr>
<td>1893</td>
<td>93</td>
<td>53</td>
<td>146</td>
<td>113</td>
<td>133</td>
</tr>
<tr>
<td>1894</td>
<td>99</td>
<td>57</td>
<td>156</td>
<td>121</td>
<td>131</td>
</tr>
<tr>
<td>1895</td>
<td>78</td>
<td>45</td>
<td>123</td>
<td>121</td>
<td>131</td>
</tr>
<tr>
<td>1896</td>
<td>98</td>
<td>50</td>
<td>148</td>
<td>124</td>
<td>122</td>
</tr>
<tr>
<td>1897</td>
<td>89</td>
<td>51</td>
<td>140</td>
<td>129</td>
<td>131</td>
</tr>
<tr>
<td>1898</td>
<td>93</td>
<td>51</td>
<td>144</td>
<td>127</td>
<td>131</td>
</tr>
<tr>
<td>1899</td>
<td>113</td>
<td>62</td>
<td>175</td>
<td>143</td>
<td>147</td>
</tr>
<tr>
<td>1900</td>
<td>122</td>
<td>65</td>
<td>187</td>
<td>167</td>
<td>171</td>
</tr>
<tr>
<td>1901</td>
<td>104</td>
<td>55</td>
<td>159</td>
<td>123</td>
<td>122</td>
</tr>
<tr>
<td>1902</td>
<td>105</td>
<td>64</td>
<td>169</td>
<td>144</td>
<td>147</td>
</tr>
<tr>
<td>1903</td>
<td>91</td>
<td>62</td>
<td>153</td>
<td>130</td>
<td>133</td>
</tr>
<tr>
<td>1904</td>
<td>89</td>
<td>55</td>
<td>144</td>
<td>125</td>
<td>127</td>
</tr>
<tr>
<td>1905</td>
<td>92</td>
<td>55</td>
<td>147</td>
<td>129</td>
<td>131</td>
</tr>
<tr>
<td>1906</td>
<td>80</td>
<td>53</td>
<td>133</td>
<td>120</td>
<td>122</td>
</tr>
<tr>
<td>1907</td>
<td>79</td>
<td>48</td>
<td>127</td>
<td>115</td>
<td>118</td>
</tr>
<tr>
<td>1908</td>
<td>65</td>
<td>45</td>
<td>110</td>
<td>100</td>
<td>104</td>
</tr>
</tbody>
</table>

These figures dispose of the current belief in an enormous increase of female intemperance based on the progressive rise of the death-rates. Discussing this question some years ago the present writer pointed out the defects of the statistics and said that the returns of the next few years might upset the whole argument. They have done so.

The statistics of alcoholism and cirrhosis, however, are very far from covering all the mortuary death from drink. It is not safe to calculate by inference from the returns of Denmark and Switzerland that the deaths directly attributed to alcohol in England and Wales should be some six times higher than they appear in the returns, and that they would then amount to 5 per cent. of the total deaths of adults instead of about 0·8 per cent. He adds:—"This percentage probably greatly understates the real facts." It may be so, but the calculation is based on too many assumptions to be accepted with confidence. In addition to the direct mortality there is an unknown score against alcohol in predisposing to other diseases and in accelerating death. Consumption is one of the diseases thought to be particularly associated with alcohol and the same occurs in several others. The following table shows the comparative mortality of males aged 25 to 65 from certain classes of disease in different groups of occupations. They include those with the highest and those with the lowest mortality. The heading "diseases of the circulatory system" includes heart disease and anaemia; diseases of respiratory system include bronchitis, pneumonia and pleurisy, but not phthisis, which is separately given; diseases of urinary system include Bright's disease. The table is compiled from the Supplement to the Fifty-sixth Annual Report of the Registrar-General, published 1908. No other country has similar statistics. In 1890-91 these were 11·8 per cent. per cent. of the deaths of males over 20 years directly or indirectly to alcohol, and for Denmark, where the corresponding figure is 42 per cent.

The consumption of a high degree of alcoholic mortality with weakness of all the organs is clearly shown by the figures for unoccupied males, general labourers, dockers, costermongers, innkeepers and inn-servants. Potters and file-makers, with a comparatively low degree of alcoholic mortality, alone show a similar condition,
Comparative Mortality—England and Wales.

<table>
<thead>
<tr>
<th>All Causes</th>
<th>Alcoholism</th>
<th>Distance of Liver</th>
<th>Phthisis</th>
<th>Distance of Nervous System</th>
<th>Distance of Circulatory System</th>
<th>Distance of Digestive System</th>
<th>Distance of Other Systems</th>
<th>Total Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>All males</td>
<td>1,004</td>
<td>27 156 105 144 174</td>
<td>52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupied and retired males</td>
<td>2,004</td>
<td>27 156 105 144 174</td>
<td>52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unoccupied males</td>
<td>2,584</td>
<td>68 583 879 294 310</td>
<td>52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Clergy  52     2 14 55 64 88 53 38

Agriculturists  26 7 13 96 86 80 38

Railway engine-drivers  610 6 54 74 107 84 36

Civil Service  723 5 40 129 80 102 76 51

Navvies, &c.  740 9 95 63 113 154 29

Shopkeepers  872 10 161 96 124 139 71

Coal-miners  885 15 77 89 134 169 35

Building trades  934 14 21 190 94 163 54

Metals  1,027 11 23 189 109 151 245 36

Textiles  1,055 10 21 190 123 105 193 51

Dockers  1,481 50 22 308 112 198 365 44

Potters  1,453 44 285 107 189 262 323 53

Seamen  1,191 20 24 302 167 202 233 37

File-makers  1,700 14 15 287 225 198 325 160

Inkeepers  1,751 111 201 271 188 207 252 127

Iron-smelters  1,131 49 543 221 227 237 151

Costermongers  2,087 59 40 554 167 276 392 86

General labourers  2,235 40 37 491 233 324 444 96

and it is no doubt due to the inhalation or absorption of irritating or poisonous particles through the nature of their occupation. The clergy, who have the lowest alcoholic mortality, show a remarkably low level of organic disease of all kinds; railway engine-drivers, who come next, suffer more from circulatory and respiratory diseases, navvies and coal-miners still more, while civil servants are more susceptible to phthisis. Agriculturists, though with a higher alcoholic mortality, nearly equal the clergy in general healthiness, which must be attributed to the open-air life. The low alcoholic level of coal-miners and navvies is striking, because both are hard-drinking classes; their position can only be explained by the fact that they drink beer, and it goes far to prove the innocuousness of beer when combined with hard work. The enormous and absurdly disproportionate mortality from diseases of the liver among inkeepers, and in a lesser degree among unoccupied males, is obviously due to a prejudice for stating that cause in place of alcoholism. The condition of unoccupied males revealed by this table is worth a volume of sermons. The mortality among them between the ages of 25 and 65 is higher than that of any other class of the community. It is also worth noting that good health is good for health. The clergy are the poorest of the educated and professional classes; and agricultural labourers, who are the poorest of the manual working classes, are nearly as healthy all round except that they are somewhat more liable to phthisis; their comparative mortality figure from all causes is only 621.

Longevity.—A great deal of statistical information with regard to the comparative longevity or expectation of life at different ages among abstainers and non-abstainers has been collected by life-insurance companies and friendly societies. The table is given in the syllabus of temperance teaching in elementary schools issued in 1909:—

Expectancy of Life.

<table>
<thead>
<tr>
<th>Year</th>
<th>General Expectancy of Total Male Population (Registrar-General)</th>
<th>General Expectancy based on Experience of Insurance Offices</th>
<th>Odd-fellows</th>
<th>Recherbes (Actuaries)</th>
<th>United Kingdom Temperance Institution (Abstainers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>41.0</td>
<td>43.2</td>
<td>41.4</td>
<td>48.8</td>
<td>46.9</td>
</tr>
<tr>
<td>25</td>
<td>37.0</td>
<td>39.1</td>
<td>37.6</td>
<td>44.3</td>
<td>43.0</td>
</tr>
<tr>
<td>30</td>
<td>33.1</td>
<td>35.1</td>
<td>34.9</td>
<td>39.7</td>
<td>38.8</td>
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<td>35</td>
<td>29.8</td>
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<td>30.3</td>
<td>34.2</td>
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<tr>
<td>40</td>
<td>26.5</td>
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<tr>
<td>45</td>
<td>22.2</td>
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<td>50</td>
<td>18.9</td>
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<tr>
<td>55</td>
<td>15.8</td>
<td>16.6</td>
<td>17.2</td>
<td>18.5</td>
<td>15.8</td>
</tr>
</tbody>
</table>

Similar statistics have been prepared showing the relative mortality experience among insured persons. Mr R. M. Moore gives the following proportional figures at different ages for all the societies embraced in the Institute of Actuaries tables, as compared with the abstaining section of the United Kingdom Temperance and Provident Institution, which is taken as 100:

<table>
<thead>
<tr>
<th>Age</th>
<th>Mortality Experience of Non-Abstainers</th>
<th>Mortality Experience of Abstainers</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>55-59</td>
<td>100</td>
</tr>
<tr>
<td>20-24</td>
<td>65-69</td>
<td>100</td>
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<tr>
<td>25-29</td>
<td>70-74</td>
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<td>30-34</td>
<td>75-79</td>
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<td>35-39</td>
<td>80-79</td>
<td>100</td>
</tr>
<tr>
<td>40-44</td>
<td>85-89</td>
<td>100</td>
</tr>
<tr>
<td>45-49</td>
<td>90-94</td>
<td>100</td>
</tr>
</tbody>
</table>

The United Kingdom Temperance Institution has a general as well as an abstaining section. The experience of the twenty-two years 1884-1905 gives the following result: percentage of actual to expected deaths—general section, 79-53; temperance section, 54-25. Other offices having abstaining sections show similar results; thus:—

General Temperance. Sceptre Life Association (25 years) 79-67 53-05
Scottish Temperance Life Assurance Co. (25 years) 64 46

Pathology.—Dr Sims Woodhead thus summarizes the results of experimental investigation into the direct action of alcohol upon living cells and tissues.

Alcohol plays a prominent part in bringing about degeneration of nerves, muscles and epithelial cells; it determines the accumulation of waste products in the tissues by paralysing the tissue cells, interfering with oxidation, with secretion and with excretion; it induces the proliferation of the lower forms of tissue, often at the expense of the more highly developed tissues, which in its presence undergo marked degenerative changes; it interferes directly with the production of immunity against specific infective diseases, and coming from the liver it may cause the inflammation, diarrhea and equally important part in impairing the resistance of tissue to the advance of the active agents in the production of disease that may have already obtained a foothold in the body.

With regard to this aspect of the subject it must be remembered that laboratory experiments by which alcohol is placed in direct contact with cells and tissues are an entirely different thing from the dietetic use of beverages containing dilute alcohol with other things. It would be interesting to know how the tissues would behave when similarly treated with common salt, lemon juice, vinegar, theine, caffeine or other substances in general dietetic use or with ordinary tonics such as quinine, quassia and dilute acids.

Inebriety.—Much study has been devoted to inebriety as a diseased condition. The general tendency is that the continued and excessive indulgence in alcohol is characterized by dyspepsia or a craving for alcohol, which is chronic or periodical and which the subject cannot resist. It is accompanied by organic changes in the interior of the system, probably begin in the stomach, but end in disintegration of the brain cells with the development of alcoholic insanity. The only chance of cure lies in complete abstinence from liquors with, at first, suitable medical treatment.

The recognition of this fact has led to the establishment of special institutions for this purpose, both of a voluntary and a compulsory character. An account of the laws relating to the subject is given under the heading of INEBRIETY. In accordance with the law three classes of institutions have been established in the United Kingdom:— (1) Certified inebriate reformatory, to which patients are committed by the courts for various periods of detention. There are in number, not disclosed in the year report, the committals to them numbered 262 (218 women and 44 men). The total number committed since their establishment in 1897 is 3002 (2948 women and 44 men); the highest number in any one year was 453 (428 women and 65 men) in 1907. (2) State Inebriate Reformatories, more of a penal character, for persons committed but too refractory for the previous class. There are two, one for women and one for men; the average number under detention in 1908 was 74 women and 42 men; the admissions were 27 women and 10 men. (3) Licensed retreats, for voluntary patients. In 1908 they numbered 20, and had under treatment 493 patients (285 men and 208 women). In all about 800 habituees are thus treated. The results cannot be stated with any precision, but they are certainly disappointing. The Inebriates After-Cure Association gives the following analysis of 407 cases treated from reformatories and looked after in the years 1903-8:—Satisfactory result, 82 (59 women, 32 men); unsatisfactory, 114 (78 women, 36 men); not known, 221 (162 women, 49 men). One explanation of the failure of treatment and the frequency of relapses...
TEMPEST, MARIE

We know that they exist by their taste and their effect; they make the difference between port and sherry, between claret and Burgundy; between one vintage and another, between brandy and whisky, between many influences without alcohol, and alcohol, and knows very little about that—but vastly important to the human organism. Another group of experiments are equally fallacious, they are done to a different end. The effect of alcohol in mental operations is tested by the competitive or provoking action of work is done after a dose and without it. The effect has been found to be diminished speed and ease; but these experimenters do not suggest that these are a direct cause for all, nor are the people to work not just before work; after work they find them all, alcohol included, beneficial. The mortality statistics are treated in a similar one-sided way. The case of alcohol the injury done by the abuse of alcohol, but what of its moderate use? Agricultural laborers are the most typical medium drinking class, and are one of the healthiest in spite of exposure, bad housing and poverty. If the unhealthiness of the work done has anything to do with the drink, then the healthiness of those who drink moderately should be referred to it too.

The absolute condemnation of alcoholic drinks has never been endorsed by public opinion or by the medical profession because it is contradicted by their general experience. That many persons are better without any alcohol, and that many more would be better if they were less or not at all, is equally undeniable that many derive benefit from a moderate use. Sir James Paget, than whom no man was more completely master of his appetites or better qualified to judge, drank port wine himself and regarded it as the best of all preventives of tuberculosis. The latter of the medical profession as a whole and of temperate men in general. Attempts to support the case for abolishing the use of alcoholic liquors by denying them any value and by attributing to them effects which spring from many other causes, do not carry conviction or advance the cause of temperance. Much a stronger argument lies in the difficulty of drawing a definite line between use and abuse; then, too, much to men, the moderate use of alcohol is a safeguard against the evils of the latter. It may also be argued that the evils of the latter are sufficiently great to justify the restriction of the former. But the use of most things is open to the same objection, and mankind at large has never consented to forego the great advantages of their use.

Nor is there any sign of an intention to make an exception in favour of alcohol. On the other hand, moderation is attainable by every single individual. It is in fact observed by the great majority and to an increasing extent. There is a line between use and abuse, and every one really knows where it is in his own case. If he cannot draw it let him abstain, as Dr Johnson did for that reason. But society can do much to assist the individual by inculcating moderation, setting a standard, promoting its maintenance by helpful environment, discouraging excess and diminishing temptation. All the evidence points to those means as the most likely to bring about the improvement which has taken place in Great Britain.

This article should be read in conjunction with that on LIQUOR LAWS, and it will therefore be in place here to give some additional information regarding the latter. The policy of prohibition has recently gained ground in several countries. In 1910 nine American states had adopted it—namely, Maine, Kansas, N Dakota, Georgia, Oklahoma, Alabama, New Hampshire, North Carolina and Tennessee; and it was estimated that nearly half the population of the United States were living under state or local prohibition. In Canada the province of Prince Edward Island has adopted complete prohibition in 1906 Ireland by a popular vote resolved to prohibit the manufacture, importation and sale of intoxicating liquor. In Norway nearly half the towns have adopted prohibition under the law of 1906. In Belgium and Switzerland the manufacture of spirits is prohibited. In New Zealand the principle of prohibition has gained ground, and in 1910 was in force over one-seventh of the colony.

BAROMETER—Annual Report (1893); Statistical Tables of Alcoholic Beverages, Board of Trade, 1905; Report of Inspector under Inebriates Acts (annual); Judicial Statistics (annual); Registrar-General's Annual Report; Statistics of Agriculture; Statutes of the Church of England Temperance Society Annual Report; American Prohibition Year Book; Brewers' Almanack; New Encyclopaedia of Social Reform; "The Drink Problem" (New Library of Medical and Social Reform), London; Facts and Figures on Intemperance; Social Causes; Pratt, Licensing and Temperance in Sweden, Norway and Denmark; Rowntree and Sherwell, The Temperance Problem and Social Reform; A. Shadwell, Drink, Temperance and Legislation.

TEMPEST, MARIE (1866-1936), the stage name of the English actress, née Marie Susan Etherington, who in 1898 married Cosmo Gordon-Lennox ("Cosmo Stuart"), a grandson
of the 5th duke of Richmond, and himself an actor and playwright. She had a charming soprano voice and was educated for the operatic and concert stage, but at first appeared in light comic opera, in which she became very popular. Abandoning music, however, for the comedy stage: she made an even greater success as an actress, notably for her performances of non-exceptional characters produced in later years she produced a succession of modern comedies, in which her capacity for rivalling in London the triumphs of Réjane in Paris was conspicuously displayed.

**TEMPIO PAUSANIA**, a town of Sardinia, in the province of Sassari, from which town it is 52 m. E.N.E. by road. It is also reached by rail by a branch line (25 m.) N.W. from the main line from Terranova to Cagliari, leaving the latter at Monti, 14 m. S.W. of Terranova. Pop. (1901) 4521 (town), 14.573 (community). It lies in a mountainous district 139 ft. above sea-level, to the N.N.W. of the Monte Limbara. It is the chief town of the Gallura, and has been an episcopal see since the 9th century (with Ampurias). The cathedral is a modern building. The district is agricultural and pastoral.

The costumes are picturesque, especially those of the women. For the name Pausania see TERRANOVA PAUSANIA.

**TEMPLARS.** The Knights Templars, or Poor Knights of Christ and of the Temple of Solomon (poaerres commiliones Christi templique Salomonici), formed one of the three great military orders of the 12th, and 13th centuries. Unlike the Hospitallers and the Teutonic Knights it was a military order from its very origin. Its founders were a Burgundian knight named Hugues de Payns (Hugo de Paganis and Godefroi de St Omer, a knight from northern France, who in 1129 undertook the pious task of protecting the pilgrims who, after the first crusade, flocked to Jerusalem and the other sacred spots in the Holy Land. They were quickly joined by six other knights and soon afterwards organized themselves as a religious community, taking an oath to the patriarch of Jerusalem to guard the public roads, to forsake worldly chivalry, “of which human favour and Christ was the cause” and in chastity, obedience and poverty, according to the rule of St Benedict, “to fight with a pure mind for the supreme and true King.”

To this nascent order of warrior monks Baldwin I., king of Jerusalem, handed over a part of his royal palace lying next to the former mosque of al-Aksa, the so-called “Temple of Solomon,” whence they took their name. They had at first no distinctive habit, wearing any old clothes that might be given to them. Nor was their community exclusive. Their primitive rule seems to have enjoined them especially upon “chivalry” the mutual assistance which a knight was expected to render another after absolution by the bishop, to their order, and they thus served a useful purpose in at once disciplining and converting the unruly rabble of “rogues and impious men, robbers and committers of sacrilege, murderers, perjurers and adulterers” who streamed to the Holy Land in hope of plunder and salvation. It was this rule which led later to the most important privilege of the order, the immunity from sentences of excommunication pronounced by bishops and parish priests.

This practice, as Prutz points out, might have brought them at once under the suspicion of the Church, and it soon became expedient to obtain the highest sanction for the new order and its rules. In the autumn of 1127 accordingly Hugues de Payns, with certain companions, appeared in Europe, where he was fortunate enough to secure the enthusiastic support of the all-powerful abbot of Clairvaux. Grateful pilgrims had already elected him H.W. (De laude novae militiae, a glowing panegyric of this new holy community, was addressed by Bernard to Hugues de Payns by name, insured the success of his mission. In 1128 the council of Troyes discussed and sanctioned the rule of the order which, if not drawn up by Bernard, was undoubtedly largely inspired by him.4

**Rule of the Temple.**—No MS. of the original French Rule of the Temple (Règle du Temple) exists. Of the three extant MSS, reprinted by recent editions, one is preserved at the Accademia dei Lincei at Rome (Cod.做大一 at one at the city of Troyes (fonds français 1927), the third in the departmental archives at Dijon (H. 111). The last of these, probably intended for the use of the master of a subordinate house, is much abbreviated; it dates, however, from the early part of the 13th century, whereas the others are of the end of the century at earliest. In essentials these copies preserve the matter and spirit of the primitive Rule, and they prove that to the end the order was, in principle at least, submitted to the same strict discipline as at the beginning.

The Règle du Temple in its final form as we now possess it contains four articles for the administration of the order; the duties and privileges of the various officers; the monastic rules, regulations as to costume and as to religious services; rules for the holding of chapters, and a summary of offences and penalties. The order was governed by a titular master and at receptions into the order; a definition of the relations of the order to the pope, and to other religious orders. It must be observed however, that, although the order as described above was only gradually developed, not having its seat fixed at Troyes. At first the master of the Temple at Jerusalem was only one among many; the seneschal and marshal appear not until 1135; and the grand master and his household not till the middle of the century. It was, however, under the aegis of Pope Alexander III. (1163), the great charter of the order, that its organization was definitely centralized.

Constitution.—As finally constituted, the order consisted of (1) knights (chevaliers), (2) chaplains (curaumes), (3) sergeants or esquires (frateres servientes armigeri), (4) menials and craftsmen (frateres servientes famuli et officii). All were bound by the rules of the order and enjoyed its privileges. Women were not admitted to the order.6

1. At the head of the order was the master of the Temple at Jerusalem (in Cyprus after the fall of the Latin Kingdom), known as the grand master. His authority was very great—except in certain reserved cases his word was law—but he was not absolute. Thus in matters of special importance—alienation of the estates of the order, attack on a fortress, declaration of war, conclusion of an armistice—his consent was necessary; but he was only an envoy to the French king, and was bound by the vote of the majority; nor could he modify or abrogate a decree of the council of the order without their consent. He had to act with the consent of the chapter also to the nomination of the grand constable; and to ordain or establish anyHieratical officer. The grand master, however, was alone, and so on till the number of the twelve apostles had been reached. A chaplain, representing Jesus Christ, was then added to complete the ecclesiastical college (see Curzon, Règle du Temple, p. xxxv).7

The grand master was allowed four horses for his ordinary use. His household consisted of a frater capellanus, a cleric, a frater servientes with two horses, a Saracen secretary (écuyer saracinotis) etc.8

Bernard was not present at the council, but the “ humble emissaries of the Règle of the Temple” (un tel des envoys chargés de le commandement dou concile et dou venerable per Bernard abbes de Cleraveus.” Compare the rule also with the chapter (iii,) of the De laude: De millibus Christi.9

4. Of a secret Rule, in so far as the most diligent research, no trace has ever been found. It is now generally held that none ever existed. The legend of its existence, so fatal to the order, is probably traceable to the fact that the complete Rule was hardly known by the commonalty, and, moreover, only fragments being given to the heads of the lesser houses (e.g. the Dijon MS.) and known generally to the knights.

5. Of the origin of the compaignie de feme, que le deable ancien compaignie de feme a depluit plusieurs de droit sentier de paradis. It is interesting to compare this with the more wholesome view of the best of the contemporary chivalrous poets, e.g. Waltharius who urges the knight to win a good name in the world, to hold up true love as the highest earthly incentive to noble deeds.

6. The bull Omne datum optimum (1163) decreed that the master must be a knight of the order who had taken the vows, and vested the election exclusively in the knights.
TEMPLARS

as interpreter, a turcoplie, i.e. a soldier belonging to the light-horse attached to the order, a farrier and a cook, two footmen (gardians de pied) in the special colour of red, and ten servants, only used for horse, only used at the time. He was further attended by two knights of the order of high rank. The ensigns of his presence on campaign were the large red cross of the order, the black and white pennant, charged with the red cross of the order.

2. The second officer of the Temple was the seneschal. He had a right to attend all chapters, even the most secret. His equipage, that of a master of the order, with the great white ensign attached to his person were two squares, a knight companion, a frater servientes, a secretary in deacon’s orders to say the hours, a turcoplie, a Saracen squire, and two foot-servants.

Third in order was the marshal, who was supreme military authority, and had under his charge the horses and arms. In the absence of master and seneschal he acted as locum tenens. His equipage and suite were much the same as those of master and seneschal.

The provincial marshals were absolute in their provinces, but subordinate to the marshal of the order.

The commander of the land and realm of Jerusalem was grand treasurer of the order, administered its estates in the province of Jerusalem, and was responsible for the lodging of the brethren. If a horse had charge of the field, the commander of the part of Acre being his subordinate. His equipage and suite were much the same as those of seneschal and marshal.

The commander of the city of Jerusalem was the hospitaler of the order, and was to go together with the seneschal to the Holy Land, and with the duty of supplying them with food and horses. Ten knights were specially attached to him for this purpose, and to act as guard to the relics of the True Cross. Subordinate to the commander of the Templars for Jerusalem was the seneschal.

The commanders of Tripoli and Antioch enjoyed all the rights of the grand master within their provinces, except when he was present. The master of the chivalry of the order was the seneschal.

Besides these, the rule mentions the commanders of France, England, Poitou, Portugal, Apulia and Hungary, whose rights and privileges are analogous to those of the commanders above mentioned.

Lastly, of the great officers of the order must be mentioned the dropper, who was charged with the supervision of the clothing of the brethren. He was closely associated with the commander of the order, and was called to be a companion of the knights, but his suite included a number of tailors.

Below the great dignitaries there were in the provinces commanders of the orders, knights of the chivalry, and the commanders of the knights, who acted as lieutenants of the marshals.

Turning to the general body of the order: the knights (milites) were entitled to three horses and a squire, or by special favour to four horses and two squires. They had two tents.

Of the sergeants (servientes) five occupied an exceptional position: the deputy marshals (sous-maresschals), who looked after the arms and armour, the gendarmier, who was responsible for the discipline and morals of the brethren, the gendarme of the arms, the seneschal of the tunics, and the seneschal of the copes. These had two horses, a squire and a tent. All the others, even if commanders of houses, had but one horse. At the head of all the sergeants was the second in the order, the squire of the copes. He had four horses in his equipage and certain special prerogatives; in battle he took his orders only from the master or seneschal.

Of particular importance were the chaplains (fratres capitani). These did not originally form part of the order, which was served by priests from outside. The bull Omne datum optimum of 1193 imposed on clerics attaching themselves to the order an oath of life-long obedience to the grand master; by the middle of the 13th century the chaplains took the same oath as the other brothers and were distinguished from them only by their orders and the privileges these implied (they were spared the more humiliating punishments, shaved the face, and had a separate cup to drink out of). The order thus had its own clergy, exempt from the jurisdiction of diocesan bishops and parish priests, owing obedience to the grand master, who had a special position (non episcopus). In 1197, when the Templars were allowed to confess to any save a priest attached to the order, if one were available, and such priest was formally declared to have received from the pope more power to absolve than an archbishop, it remained undisturbed. The order admitted either for life or for a term of years. Married men were also received, but on condition of bequeathing one half of their property to the order (remise).

The chapters of the order were either secret, composed of such brothers as the master might esteem "wise and profitable for giving advice," or general assemblies of the order, at the discretion of the master, who was to listen to the counsel given and do what seemed best to him.

Habit of the Order.—The characteristic habit of the order was the white mantle, symbolic of purity, with the red cross, the ensign of the order. Their geometry was the same as those of the principality of Antioch, except that the Templars imposed their habit on all knights bound by life-long vows, however, were privileged to wear the white mantle, which was also given to chaplains in episcopal orders. The rest wore a black or brown robe with a white mantle. The order had no hooded habits. All the chaplains were distinguished by wearing the mantle closed.

Conduct and Discipline.—The brethren were to attend daily services; but the soldier on war, with his nightly duties might com; he must attend no functions of the church except at Matins and Mass. Two regular meals were allowed for each day; but to these might be added, at the master’s discretion, a light collation, and a supper, but not of other meat. Meat must be eaten twice a week; and in other days there was to be a choice of vegetable fare so as to suit the tenderest stomach. Brethren were to eat by couples, each keeping an eye on his fellow to see that he did not practise an undue austerity. Wine was served at every meal, and at those times silence was strictly enjoined that the words of Holy Writ might be heard with the closest attention. Special care was to be taken of aged and ailing members. Every brother owed the absolute obedience to the master of the order, and was to go wherever his superior bade him without delay, "as if commanded by God." All undue display in arms or harness was forbidden. Party-coloured garments were not allowed; and the rule of the order extended to All Souls a linen shirt might be substituted for one of wool. The hair was to be worn short, and a rough beard became one of the distinguishing marks of the order. Hunting and hawking were prohibited, and the possessor of the order of knighthood was forbidden to keep or carry arms. A lion, however, being the type of the evil one, was legitimate prey. Strict watch was kept by the knights in every enclosure, and their quarters were so out by night to visit the Sepulchre of our Lord. No letter, even from the nearest relative, might be opened except in the master’s presence; nor was any member to feel annoyance if he saw his relative’s gift transferred at the master’s bidding to some other brother. The brethren were to sleep in separate beds in shirts and breeches, with a light always burning in the dormitory. Those who lacked a mattress might place a piece of carpet on the floor; but no Laurier was discarded.

A term of probation was assigned to each candidate before admission; and a special clause discouraged the reception of boys below the age of three years.

For grievous offenses, such as desertion to the Saracens, heresy, losing the gonfanon, murdering a Christian, or failing to account for all the property of the order in his possession, a Templar might be expelled (perdre la maison): for minor offenses, such as disobedience, lowering the banner in battle, or killing a slave or a horse, the punishment was that of servitio, e.g. by the sale of two horses of another religious order was received by the Templars, and no Templar could leave the order without permission of the master, no Templar was to marry, but the order might refuse to grant a dispensation to a Templar’s daughter. The Templars were not to be married to anyone who was not a freeman or a free woman. By mutual agreement the Templars and Hospitaliers, despite their long and deadly feud, were bound not to receive ejected members of the rival order; and the Templar cut off in battle did not commit the sin of rejoining his own ranks which might rally to the cross of St John.

History.—Long before St Bernard’s death (1153) the new order was established in almost every kingdom of Latin Christendom. Henry I. granted them lands in Normandy. They seemed to have been settled in Castile by 1129, in Rochelle by 1131, in Languedoc by 1136, at Rome by 1138, in Brittany by 1141, and in Germany at perhaps a still earlier date. Alphonso I. of Aragon and Navarre, if we may trust the Spanish historians, bequeathed them the third of his kingdom (Mariana, x. c. 9). Raymond Berengar IV., count of Barcelona, and Alphonso’s successor in Aragon, whose father had been admitted to the order, granted them the strong castle of Monzon (1143), and established a new chivalry in imitation of their order. Louis IX. of France bequeathed to them a piece of marsh land outside Paris, which in later times became known as the Temple, and was the headquarters of the order.

The Bible was read in a French translation. A MS. of a Templar rule, existing in the old library of the Inquisition, and published by F. Prutz, is now in the Bibliothèque Nationale in Paris. See Prutz, Tempelorden, p. 116.

This rule was not observed later on, postulants being admitted without any period of novitate, and among the Templars arrested in 1307 were many young boys.

1 The titles varied. The provincial commander is “Master” or Grand Prior. In Flanders, when large territories fell into the order’s hands, they were ruled by Grand Masters, each with a core of major preceptors over large estates, and under them “preceptors” of houses. Preceptors took their name from the mandate of the master issued to them: “Preceptoribus tuis.”

2 Rule 299. Car il en est greignier pori de l’apostolé (i.e. the pope) d’esse assourdre que un arcevesque (Curzon, p. 165).
of the order in Europe. Stephen of England granted them the manors of Cressing and Witham in Essex, and his wife Matilda that of Cowley, near Oxford. Eugenius III., Louis VII., and 130 brethren were present at the Paris chapter (1147) when Louis seemed to have granted the count of Anjou, lord of land near Hitchin; and the list of English benefactors under Stephen and Henry II. includes the noble names of Ferrers, Harcourt, Hastings, Lacy, Clare, Vere and Mowbray. Spiritual privileges were granted to them by the popes as lavishly as temporal possessions by the princes and people. Pope Adrian IV. allowed them to have their own churches; Eugenius III. added to these the right to have churchyards; and churches and churchyards, as in the case of the order generally, were exempted from the operation of ordinary excommunications and interdicts. Thus a person dying excommunicated, refused burial elsewhere, sometimes—like Geoffrey de Mandeville—found a resting-place in the consecrated ground of the Templars. Eugenius III. also granted the Templars the right to have interdicted churches opened twice a year for the purpose of making their collections. They were, moreover, as defenders of the Church, exempted from the payment of tithes. Finally, they were exempted from the action even of general censures and decrees of the popes, unless mentioned in them by name. Very soon the order refused to submit in any way to the ordinary jurisdicions of the civil courts; and in the case of bishops of separate ecclesiastical organization under the pope as supreme bishop. The result was that, scarce twenty-five years after its foundation, the order was at open feud with bishops and parish priests, and the popes found it necessary to issue decree after decree to protect it from violence and spoliation. The complaints of the secular clergy, on the other hand, came to a head in 1179 at the Lateran Council, when even Pope Alexander III. had to consent to a series of decrees directed against the abuse of its privileges by the order (Prutz, p. 41).

So long, however, as the attention of the papacy and of Countess Matilda was fixed on the problem of recovering and safeguarding the Holy Land, the position of the Templars was unassailable, and all efforts to curb the growth of their power were in vain. The order as such had no European policy; the whole of its vast organization was maintained for the purpose of feeding the holy war against the infidels with recruits and with money; and its ultimate fate depended on its success or failure in the East.

(W. A. P.)

After the council of Troyes Hugues de Payns came to England and induced a number of knights to follow him to the Holy Land. Among these was Fulke de Ferrers, count of Nür al-Din, who had been a Templar before assuming the crown of Jerusalem in 1111. Hugues de Payns died about the year 1136 and was succeeded by Robert de Crons, who is said to have been Anselm's nephew. Everard de Bæres, the third master, was conspicuous in the second crusade. In the disastrous march from Lodizica to Attalica his troops alone kept up even the show of discipline; and their success prompted Louis VII. to regulate his whole army after the model of the Templar knights. In the French king's distress for money the Templars lent him large sums, ranging from 2000 silver marks to 30,000 solidi. When Conrad III. of Germany Nür al-Din in Jerusalem he was entertained at his palace (Easter 1145); and in the summer of the same year they took part in the unsuccessful siege of Damascus. The failure of this expedition was ascribed by a contemporary writer to their treachery—a charge to which Conrad would not assent. This is the first note of the accusations which from this time were of constant recurrence.

Henceforward for 140 years the history of the Templars is the history of the Crusades (q.v.). In 1149 the Templars were appointed to guard the fortress of Gaza, the last Christian stronghold on the way towards Egypt. Four years later the new master, Bernard de Tremsilai, and forty of his followers, bursting into Ascalon, were surrounded by the Saracens and cut off to a single man. William of Tyre has preserved the scandal of the day when he hints that they met a merited fate in their eagerness to possess themselves of the city treasure.

Next year the rumour went abroad that they had sold a noble half-converted Egyptian prince, who had fallen into their hands, to chains and certain death for 60,000 aurei. In 1166 Amalric, the Latin king of Jerusalem, hanged twelve Templars on a charge of betraying a fortress beyond the Jordan to an ambassador of Nür al-Din of Damascus. The military power of Nür al-Din (1145-73) was a standing menace to the Christian settlements in the East. Edessa had fallen to the prowess of his father (1144-45); Damascus was conquered by the son (1143), who four years earlier had carried his depredations almost to the walls of Antioch, and in 1157 laid siege to the Christian town of Panias near the sources of the Jordan. In the disastrous fight that followed for the safety of the fortress of the Hospitallers, Bertrand de Blanquefort, the master of the Templars, and Odo de St. Amand were taken prisoners. Bertrand was released later when Manuel was preparing to march against Nür al-Din. The Templars do not seem to have opposed Amalric's early expeditions against Egypt. It was Geoffrey Fulcher, the Templar correspondent of Louis VII., who brought back (1167) to Jerusalem the glowing accounts of the splendour of the caliph's court at Cairo with which Gibbon has enlivened his great work. Nor was the order less active at the northern limits of the Latin kingdom. Two English Templars, Gilbert de Lacy and Robert Mansel, "qui Galensibus praeceperat," starting from Canterbury, met up with the king of Lebanon and of Tripoli and put him barefooted to flight. But jealousy or honour led the Templars to oppose Amalric's Egyptian expedition of 1168; and the wisdom of their advice became apparent when the renewed discord on the Nile led to the conquest of Egypt by Asad al-Din Shirkuh, and thus indirectly to the accession of Saladin, in 1169. In 1170 he beat Saladin back from their frontier fortress of Gaza; and seven years later they shared in Baldwin IV.'s great victory at Ascalon.

Meanwhile Saladin had possessed himself of Emesa and Damascus (1174-75), and, as he was already lord of Egypt, he could afford to neglect the Latin kingdom on every side. In July 1173 Amalric was succeeded by his son Baldwin IV., a boy of twelve. Raymond III., count of Tripoli, a man suspected of being in league with the Saracens, was appointed regent, although in 1176 the masters of the Templars and the Hospitallers united in offering this office to the newly arrived Philip of Flanders. The construction of the Temple fortress at Jacob's ford on the upper Jordan led to a fresh Saracen invasion and the disastrous battle of Panas (1179), in which the young king and the Holy Cross escaped with difficulty, while Odo de St. Amand, the grand master, was carried away captive and never returned.

During Odo's mastership the Old Man of the Mountains sent to Amalric offering to accept the Christian faith if released from the tribute he had paid to the Templars since (according to the History of the Fratres of the Temple, p. 335-336.)
recounting of M. Defrémery) somewhere about 1149. The Templars murdered the envoys on their return (c. 1172). Amalric demanded that the offenders should be given up to justice. Odo refused to yield the chief culprit, though he was well known, and invoked the protection of the pope. Amalric had to vindicate his right by force of arms at Sidon and died while preparing to take stronger measures. The connexion between the Templars and the Old Man was still vital eighty years later when the two grand masters rebuked the insolence of the Assassin envoys in the presence of Louis IX. Odo de St Amanda was succeeded by Arnold de Torroge, who died at Verona on his way to implore European succour for the Holy Land. The power of Saladin was new (1184) increasing daily; Baldwin IV. was a leper, and his realm was a prey to rival factions. There were two claimants for the guardianship of the state—Raymond III. of Tripoli and Guy de Lusignan, who in 1180 had married Sibylia, sister of the young king. Baldwin inclined to the former, against the patriarch and Arnold de Torroge.

There is something Homeric in the story of the fall of the Latin kingdom as related by the historians of the next century. A French knight, Gerard de Riderfort or Bildeford, coming to the East in quest of fortune, attached himself to the service of Raymond of Tripoli, looking for the hand of some wealthy widow in reward. But on his claiming the hand of the lady of Botron he was met with a refusal. Angered at this, Gerard enrolled himself among the Templars, hid his time for revenge, and was elected grand master on the death of Arnold. Baldwin IV. died (1185), leaving the throne to his young nephew Baldwin V., the son of Sibylia, under the guardianship of Raymond, whose office was not of long duration, as the little king died in September 1186. This was Gerard's opportunity. The Templars carried the body of their dead sovereign to Jerusalem for burial; and then, unknown to the barons of the realm, Gerard and the patriarch crowned Sibylia and her husband Guy. The coronation of Guy was the triumph of Raynal of Chatillon, once prince of Antioch, and Saladin's deadlest foe. It was at the same time the downfall of Raymond, who was already, as both Latin and Arabic writers are agreed, that the Christian court and the Mahommedan sultan now entered into an alliance. To break this friendship and so save the kingdom, the two grand masters were sent north to make terms with Raymond. But the rash valour of the Templars provoked a hopeless contest with 7000 Saracens. The grand master of the Hospitalers was slain; but Gerard made his escape with three knights to Nazareth (1st May 1187). In this emergency Raymond became reconciled with Guy; and Gerard placed the Temple treasures of Henry II. at his king's disposal. Once more it was the Templars' rashness that led to the disastrous battle of Hittin (4th July). Gerard and the king fell into the hands of Saladin, but were released about a year later; Raymond of Tripoli made his escape through treachery or fortune; and 230 Templars fell in or after the battle, for the fight was scarcely over before Saladin ordered all the Templars and Hospitalers to be murdered in cold blood. One after another the Christian fortresses of Palestine fell into the hands of Saladin. Jerusalem surrendered on 2nd-3rd October 1187, and the treasures of the Temple coffer were used to purchase the restoration of the poorer Christians, part of whom the Templar warriors guarded on their sad march from the Holy City to Tripoli. Part of their wealth was expended by Conrad of Montfort in the defence of Tyre; but, when this prince refused to admit Guy to his city, both the Templars and the Hospitalers from the neighbouring parts flocked to the banner of their released king and accompanied him to the siege of Acre (22nd August 1189). In his company they bore their part in the two years' siege and the terrible famine of 1190-1; and their grand master died in the great battle of 4th October 1189, refusing to survive the slaughter of his men. On the fall of Acre Philip Augustus established himself in the palace of the Templars, who are, however, stated to have sympathized with Richard. This king sold them the island of Cyprus for 100,000 bezants; but, unable to pay the purchase money, they transferred the debt and the principality to Guy of Lusignan. The English king consulted them before deciding on any great military movement; and in June 1192 they advocated the bold plan of an advance on Egypt rather than on Jerusalem. In the disputes for the Latin kingdom of the East the Templars seem to have supported Guy, and, like Richard, were credited with having had a hand in the murder of Conrad of Montfort (April 1192). It was in the disguise of a Templar and in a Templar galley that Richard left the Holy Land. When Acre was recovered, the Templars, like the Hospitalers, received their own quarters in the town, which from this time became the centre of the order. On the death of Henry of Champagne (1197) they vetoed the election of Raoul de Taharie; after the death of his successor Amalric they refused to renew the truce with Saladin's brother, Saif al-Din, and led an expedition against the Saracens before the arrival of the new king, John de Brienne, at whose coronation in 1210 William de Chartres, the grand master, was present. Seven years later, with the aid of Walter de Avennis and of the Teutonic Knights, they commenced the building of their fortress of Castle Pilgrim, near Acre, on a rocky promontory washed by the Mediterranean on every side except the east. This wonderful structure, whose ruins are still to be seen, was fortified with a strong wall, founded on the substructure of a yet more extensive one running from sea to sea, and was flanked by lofty towers of huge squared stones, surrounded by a moat of pure water, besides fishponds, salt-mines, woods, pastures, orchards, and all things fitted to furnish an abode in which the Templars might await the day of their restoration to Jerusalem.

It was from this castle that in May 1218 the fifth crusade started for the expedition against Egypt. The Templars were the heroes of the siege of Damietta, at which William de Chartres was slain. "First to attack and last to retreat," they saved the Christian army from annihilation on 29th August 1219; and when the city surrendered (5th November) the order numbered 1161 twelve-tower tents that had begun to give way had been shaken by their engines. On the other hand, it was largely owing to their objections that John de Brienne refused the sultan's offer to restore Jerusalem and Palestine.

From the very first the Templars seem to have been opposed to Frederick II. and, when he landed at Acre (7th September 1228) they refused to march under the banners of an excommunicated man, and would only accompany his host from Acre to Joppa in a separate body. They were accused of notifying Frederick's intended pilgrimage to the Jordan to the sultan, and they were stripped of the new castle, of their all their lawful possessions, and of their former position of garrison. Their chief concern was to have peace with the Saracens, and to this end they engaged in the treaty of Jaffa, 1229. On the 3rd May 1229, and on landing in Apulia gave orders to seize the estates of the order and chase all its members from the land.

Long before the expiration of Frederick's European peace Europe was preparing for a fresh crusade against the now divided realm of the Ayyubids. The elder of Navarre and his crusaders, who reached Palestine about August 1239. The Templars shared in the great defeat near Jaffa, an engagement which their temerity had done much to provoke (13th November 1239). If the king ever accepted the overtures of Sahib of Damascus, he was supporting the policy of Hermann of Perigord, the grand master, who, towards the summer of 1244 wrote a triumphant letter to England, telling how he had engaged this sultan and Nâsir of Kerak to make an alliance against the sultan of Egypt and restore the whole of Palestine from the Jordan to the sea. Frederick, however, before leaving the Holy Land (27th September 1240), signed a ten years' truce with Sahib of Egypt. The Hospitalers seem to have been won over to his view, and
when Richard of Cornwall arrived (11th October) he had to decide between the two rival orders and their opposing policies. After some hesitation he concluded a treaty with the sultan of Egypt, much to the annoyance of the Templars, who openly mocked his efforts. On his departure the three orders came to open discord: the Templars laid siege to the Hospitaliters in Acre and drove out the Teutonic Knights "in the form of imperialists." They were successful on all sides. The negotiations with Damascus and Kerak were reopened, and in 1244 Hermann of Pergoìed wrote to the princes of the East that after a "silence of fifty-six years the divine mysteries would once more be celebrated in the Holy City."

It was in this moment of danger that the sultan of Babylon called in the barbarous Khazarins, whom the Mongol invasions had driven from their native lands. These savages, entering from the north, flowed like a tide past the newly built and impregnable Templar fortress of Safed, swept down on Jerusalem, and annihilated the Christian army near Gaza on St Luke’s day (18th October) 1244. From this blow the Latin kingdom of the East never recovered; 600 knights took part in the battle; the whole force of the Templars, 300 in number, was present, but only 18 survived, and of 200 Hospitaliters only 16. The masters of both orders were slain or taken prisoners. Despite the admirable valour of the Templars, their policy had proved the ruin of the land. Jerusalem was lost to Christendom forever; and, though the Khazarins melted away in the course of the next three years, they left the country so weak that all the acquisitions of Theobald and Richard fell an easy prey to the Turks of Babylon.

Recognizing the fact that the true way to Jerusalem lay through Egypt, Louis IX. led his host to the banks of the Nile, being accompanied by the Templars. Their master, William de Sonnac, attempted in vain to restrain the rash advance of the count of Artois at the battle of Mansura (8th February 1250), which only three Templars survived. St Louis, when captured a few weeks later, owed his speedy release to the generosity with which the order advanced his ransom-money. Shortly after his departure from Acre (April 1254) they consented to an eleven years’ truce with the sultans of Egypt and Damascus.

A new enemy was now threatening Mahommedan and Christian alike. For a time the Mongol advance may have been welcomed by the Christian cities, as one after another the Mahommedan principalities of the north fell before the new invaders. But this new danger stimulated the energies of Egypt, which under the Mameluke Bibars encroached year after year on the scantly remains of the Latin kingdom. The great Flemish shipyards, from which all was lost, made haste to sell their lands to the Templars and Hospitaliters before quitting Palestine for ever. In 1260 the former purchased Sidon and Beaufort; next year the Hospitaliters purchased Arsal. In 1267, by a skilful adaptation of the banners of both orders, Bibars nearly surprised Antioch. The Templar fortress of Safed surrendered with its garrison of 600 knights, all of whom preferred death to apostasy (June 1266). Beaufort fell in 1268, Antioch six weeks later; and, though the two orders still made occasional brilliant dashes from their Acre stronghold, such as that to Ascalon in 1264 and the three with Prince Edward of England to destroy Kâkûn in 1277, they became so enfeebled as to welcome the treaty which secured them the plains of Acre and a free road to Nazareth as the result of the English crusade of 1272.

But, though weak against external foes, the Templars were strong enough for internal warfare. In 1277 they espoused the quarrel of the bishop of Tripoli, formerly a member of the order, against his nephew Bohemond, prince of Antioch and Tripoli, and began a war which lasted three years. In 1276 their conduct drove Hugh III., king of Cyprus and Jerusalem, from Acre to Tyre. In the ensuing year, when Mary of Antioch had sold her claim to the crown to Charles of Anjou, they welcomed this prince’s lieutenant to Acre and succeeded for the moment in forcing the knights of that city to do homage to the new king. Thirteen years later (26th April 1290) Tripoli fell, and next year Acre, after a siege of six weeks, at the close of which (16th May) William de Beaujeu, the grand master, was slain. The few surviving Templars elected a new master, and, forcing their way to the seashore, sailed for Cyprus, which now became the headquarters of the order. A last attempt was made in 1300 and 1301 to hold Antioch, but the same time (1300–2) are the closing acts of their long career in the western parts of Asia.

For more than a hundred years the Templars had been one of the wealthiest and most influential factors in European politics. If we confine our attention to the East, we realize but a small part of their enormous power. Two Templars were appointed guardians of the disputed castles on the bosphoral of Prince Henry of England and had the Franks deprived in 1185. Other Templars were almoners of Henry III. of England and of Philip IV. of France. One grand master was godfather to a daughter of Louis IX.; another, despite the prohibition of the order, is said to have been godfather to a child of Philip IV. They were summoned to the great councils of the Church, such as the Lateran of 1215 and the Lyons council of 1274. Frederick II.’s persecution of their order was one of the main causes of his excommunication in 1239; and his last will enjoined the restoration of their estates. Their property was valued every century of Christendom, from Denmark to Spain, from Ireland to Cyprus, their wealth was immense and their influence unbounded. The 14th century Matthew Paris reckons their manors at 9000, Alberic of Trois-fontaines at 7050, whereas the rival order of St John had barely half the latter number. Some fifty years earlier their income from Armenia alone was 20,000 bezants. Both in Paris and in London their houses were used as strongholds for the royal treasure. In the Temple in London Hubert de Burgh and the Poitevin favourites of Henry III. stored their wealth; and the same building was used as a bank into which the debtors of the foreign usurers paid their dues. From the English Templars, and later every country of Christendom, from Denmark to Spain, from Ireland to Cyprus, the Templars made the magnetic centres of all their operations financial. Whereas the Templars were a vivid light on the banking and a magnet as a centre of treasure, while their reputation as monks guaranteed their integrity. Thus they became the predecessors, and later the rivals, of the great Italian banking companies. See L. Delisle, "Mémoire sur les opérations financières des Templiers et des hospitaliers," in "Histoire de la banque nationale de France," t. xxxii. To take interest (usury) was of course unlawful. The method of circumventing this seems to have been that the mortgages paid to the mortgagors a nominal rent which afterwards reduced the deduction of the debt. The difference between this and the real rent represented the interest. See Ancient Charters, Pt. i. (Pipe Roll Soc., London, 1888), edited by J. H. Round, p. 94.

"Abandonment of Pales-

1 The wealth of the Templars was due not so much to their territorial possessions as to the fact that they were the great international financiers and bankers of the age. The Paris Temple was the centre of the world’s money market. In it popes and kings deposited their revenues, and these vast sums were not hoarded but issued as loans on adequate security. Above all, it was the Templars who made the exchange of money with the East possible. It is easy, indeed, to see how they were the ideal bankers of the age; their strongholds were scattered from Armenia to Ireland, their rapacity was abounded and their lease-running and their method of sharing the usury was very simple and adequate. They advanced as much as they would have the bank deposit, and if the debtors paid the interest they could, at any time, demand their capital. In this way the Templars secured a very large portion of the gold and silver which passed from the East to Europe, as well as a large share of the silver and copper which passed from the West to the East. In short, the Templars were the first bankers of the world.

2 The Templars in Aragon and the other kingdoms of the Spanish peninsula were far more subordinate to the crown than elsewhere. None but natives were admitted to their ranks, and there were very few exchanges of knights with foreign commanderies. They were only allowed to become members of the order after confirmation from the king, and were consequently much more dependent on the crown than the crusader kings. In 1217 the last grand master of the Templars of Aragon, who had been attached to the crown, was impeached and deprived of his position. The pope, in 1228, annulled the confirmation of the Templars of Aragon by the king, and this act was followed by a strong declaration against the Templars in the bull "Admirant," which was directed against the Templars of Aragon. The Templars of Aragon were also deprived of the right of holding land and of fighting on the scent of the king, and were obliged to pay the service of noble seigniors. The French, of course, were not so dependent on the crown, and were able to resist the pressure of the king to a much greater extent.
Such were the power and wealth of the Templars at the time when Philip IV. of France accused them of heresy and worse offences, had them arrested (13th October 1307), and forced them to confess by tortures of the most excruciating kinds. Five years later (26th May 1312) the order was suppressed by decree of the council of Vienne and its goods transferred to the hospital of St. John of Jerusalem (T. A. A.).

Doubt had the order of the Temple been to all appearance more powerful than immediately before its ruin. Sovereign power, in the sense of that of the Teutonic Knights in Prussia or the Knights of St. John in Rhodes and later in Malta, it had never possessed; but its privileges and immunities constituted it a church within the church and—in France at least—a state within the state. Philip IV., indeed, in pursuance of his policy of centralizing power in the crown, had from 1287 onwards made tentative efforts to curtail the power and wealth of the order; in 1287 he proclaimed the sequestration of all its property acquired since the confirmation of its privileges by Louis IX. in 1258; in 1289 the ordinance of Ferrières in Gâtinais was directed against its illicit acquisitions and its interference with the jurisdiction of the king and his vassals; in 1290 the parlement decided that the privileges of the order could only be enjoyed by those who actually wore its habit. Soon, however, the king's necessities forced him to change his policy. In January 1303 the privileges of the order in and about Paris were confirmed and extended, and in 1307 Philip borrowed 5200 livres tournaises from the Paris Temple.

'Fier de grandeur et de magnificence,' the Devil of Paris, as we know, directed in 1307 that the order should be present at the reception of a new Templar. 1Yet for some two years past the king had been plotting a treacherous attack on the order. His motives are clear: he had used every expedient to raise money, had robbed and expelled the Jews and the Lombard bankers, had debased the coinage; the suppression of the Templars would at once rescue him from their unwelcome tutelage and replenish his coffers. He cherished also another ambition. The question of an amalgamation of the great military orders had often been mooted; the project had been approved by successive popes in the interests of the Holy Land; it had been formally proposed at the Lyons council of 1274, only to be rejected by the opposition of the Templars and Hospitallers themselves. To Philip this scheme commended itself as an opportunity for bringing the orders under the control of the French crown; there was to be but one order, that of the "Knights of Jerusalem," of which the grand master was always to be a prince of the royal house of France. 2Clearly, it only needed an excuse and a favourable opportunity to make him attack the Templars; and, once having attacked them, nothing short of their entire destruction would have been consistent with his safety. The excuse was found in the denunciation of the order for heresy and unseemly bound to respond to demands of the grand master for consignments of men and money, but their main duty was to assist the king in his wars against the Moors at home (cf. Urraca coronata and Amadis) against the Moors and Saracens or to defend the interests of the Church abroad (cf. the English crusades). 3

1 For details see Lavocat, p. 120.
2 Finke i. 119.
3 He himself was to be its first head, with the title of "King of Jerusalem." See the letter (No. 75) from Leget F. to Bernard F. in Finke ii. 114.

Suppression of the order.

1 The Correspondence of the Grand Masters of the Teutonic Order, p. 265.
2 Die Seele des Templerorden (Berlin, 1886), p. 35.
3 See also Prutz, Templerherrenorden, p. 61 seq. In Portugal the Templars were practically feudatories of the crown, the master taking an oath of fealty to the king and his heirs. (W. A. F. p. 9.)

able immoralities by a venal informer; the opportunity was the election of a pope, Clement V., wholly devoted to the interests of the king of France.

For perhaps half a century there had been strange stories circulating as to the secret rites practised by the order at its midnight meetings, stories which probably had their origin in the extreme precautions taken by the Templars, originally perhaps for military reasons, to secure the secrecy of their proceedings, which excited popular curiosity and suspicion. Among the Templars alone of the religious orders the ceremonies of reception were conducted in strict privacy; chapters were held at daybreak with closely guarded doors, and no one participating was allowed to reveal what had passed, even to a fellow-member of the order, under pain of expulsion. It was inevitable that, considering the temper of the age, all this should lead to stories of rites too repulsive to bear the light. It was said that on his initiation each member had to dissolve his belief in Christ, to spit upon the crucifix, to submit to indecent ceremonies. When the mass was celebrated the consecrating words Hoc est corpus were omitted; on Good Friday the holy cross was trampled under foot; and the Christian duty of alms-giving had ceased to be observed. Even the vaunted chastity of the order towards women had, it was said, been turned into the formal obligation to committing more horrible offences. These evil practices were part of the secret statute law of an order which in its nightly assemblies worshipped an idol named Baphomet or the devil in the shape of a woman, whose name signified "the assimilation to the home" (succubi), with whom the brothers had carnal intercourse.

In England the very children at their play bade one another beware of a Templar's kisses. Stranger stories yet were rife in England and gravely reported before bishops and priests—of children slain by their fathers because they cheated to witness the nightly orgies of the society; of one prior's being spirited away at every meeting of the general chapter; of the great preceptor's declaring that a single hair of a Saracen's beard was worth more than the whole body of a Christian man. In France they were said to roast their illegitimate children and smear their idols with the burning fat.

In the spring of 1304 or 1305 a certain Esquieu de Floyran of Beziers pretended to betray the "secret of the Templars" (factum Templatorum) to James II. of Aragon. The pious king, who had every reason to think well of the order, did not affect to be convinced; but the prospect of spoils was alluring, and he seems to have promised the former a share of the booty if he could make good his charges. 4Esquieu now turned to Philip of France, with more immediate success. For the purpose of collecting additional evidence the king caused twelve spies to find admission to the order, and in the meantime sought to win over the pope to his views. But Bertrand de Got, archbishop of Bordeaux, who on the 5th of June 1305 became pope as Clement V., owed the tiera to the diplomacy of Philip's agents, perhaps to their gold; but though a weak man, and moreover a martyr to ill health, he was not so immediately accommodating as the king might have wished, 4 Two of the Templars examined at Carcassonne spoke of an idol named Baphomet or a piece of wood on which was represented a figure of Baphomet. A Templar at Florence called the idol Mahomet or Magomet. Baphomet was a common mediaeval corruption of Mahomet (Mahom, Mahon, &c.), who was regarded not as a false prophet only, but as a demon, a false god to whom human sacrifices were offered. Hence any unholy or fantastic rites came to be called baphumeres, mahomeres, moheres, i.e. "exercises and stories of the forbidden." Hence the baptism of Metis i.e. the baptism of Metis (the supreme wisdom), has no trustworthy evidence to support it. See Leobserve, Doctrine secrete, p. 97 seq. 5

The Sanchez Minta, p. 85. No. 26. See also系统: en:Esquieu publishes a letter of Esquieu to the king, dated 21st January 1308, claiming his reward. Esquieu is the Squin de Florian of Villani; the other informer mentioned by him, Nofilo Del (Deghi) of Florence, had, however, nothing to do with the Templars; he was a merchant in the service of the Montforti, a branch of the Montfort, of Paris, and was hanged for swindling. Nor was Esquieu's motive to save himself from execution, but purely mercenary. The existence of an informer, doubted by Lea (Inquisition ii. 255) and others, is now proved.
expressing his disbelief in the charges against the order, and, though promising an inquiry, doing his best to procrastinate. Philip determined to force his hand. All France was at this time under the jurisdiction of the Inquisition, and the Inquisition could act without consulting the pope. The grand inquisitor of France, William of Paris, was Philip's confessor and creature. The way was thus open for the king to carry out his plan by a perfectly legal method. His informers denounced the Templars to the Inquisition, and the grand inquisitor—as was customary in the procedure in the case of persons accused of heresy—demanded their arrest by the civil power. On the 14th of September 1307, accordingly, Philip issued writs to his baillis and seneschals throughout the kingdom, directing them to arrest the members of the order on the following 13th of October.

The Templars had for some time past been aware of the charges against them. On the 6th of June 1306 Pope Clement had summoned Jacques de Molay, the grand master, from Cyprus to France, in order to consult him on the projected crusade. He had obeyed the call, and, in an interview with the pope, had taken the opportunity to demand a full inquiry. They had, however, taken no measures to defend themselves; the sudden action of the king took them wholly by surprise; and, though they were placed in a strong position, their arrest was effected without difficulty. Jacques de Molay himself with sixty of his brethren being seized in Paris. Next day they were haled before the universite of Paris, to hear the recital of their crimes; and Sunday the populace was collected in the royal gardens, where preachers inveighed against the iniquities of the order.

The Templars were caught in toils from which there was no escape. To force them to confess, they were first tortured by the royal officials, before being handed over to the inquisitors to be, if need were, tortured again. In Paris almost thirty-six died under process. The reason was, as it was, the outset, all that the king could desire. Of 136 Templars examined in Paris between the 19th of October and the 24th of November, some of them old men who had been in the order the greater part of their lives, 123 confessed to spitting on (or "near") the crucifix at their reception. Many of the prisoners, on the other hand, confessed to all the charges, however grotesque. But the most damning confession was that of the grand master himself, publicly made with tears and protestations of contrition and embodied in a letter (October 25) sent to all the Templars in France. He had been guilty, he said, of denying Christ and spitting on the cross; the greater charges he indignantly repudiated.1

To the pope, meanwhile, the proceedings in France were to the highest degree unpromising. He had, indeed, become convinced, if not of the general guilt of the order, at least of the guilt of some of its members. But the affair was one which he desired to reserve for his own judgment; Philip's action he interpreted, rightly, as an encroachment of the civil power on the privileges and property of the Church, and his fears were increased when the French king, without consulting him, sent letters to King James of Aragon, Edward II, of England, the German emperor, the king of France and other princes, calling upon them to imitate his example. On the 27th of October Clement issued letters suspending the powers of the Inquisition in France. What followed is not clear, for the documentary evidence for these months is very defective. On the 17th of November James of Aragon wrote to Philip, in answer to his letter and the report of the proceedings in Paris forwarded to him, expressing his surprise at the charges against the Templars, who had done himself and his forefathers great service against the infidel, but promising to proceed against them since required to do so by the Church.2 In Portugal no action was taken at all. Edward II. of England replied that he must first receive information as to the charges from his officials in Agen (whence the charges had originated), and on the 6th of December he wrote to the kings of Aragon, Castile, Portugal and Sicily begging them not to believe the evil reports against the order (Pruitz, p. 159). But meanwhile, on the 22nd of November, Pope Clement had issued a bull calling on all kings and princes to arrest the Templars everywhere, his motive probably being (according to Finke) to forestall the probable action of the grand inquisitors and his seneschals in his own kingdom.

Scruples and hesitations now vanished. In England the Templars were arrested on the 10th of January 1308, in Sicily on the 24th of the same month, in Cyprus on the 27th of May; in Aragon and Castile the process was less easy, for the knights, forewarned, had put their fortresses into a state of defence, notably their strong castle of Monzon, which was only taken after a long siege on the 17th of May, while the last of the Templars' strongholds, Castellat, did not fall until the 2nd of November.3 Meanwhile, on the 26th of May, Philip had made his solemn entry into Paris, and the inquisitors and cardinals had already assembled for the purpose of conferring with the king on the matter. The debates that followed were protracted and stormy; but Philip was in a position to back his argument for the suppression of the order by pressing other and more dangerous claims: the canonization of Celestine V., the condemnation of Boniface VIII. for heresy, the absolution of Guillaume de Nogaret, the executor of the outrage at Anagni, the summoning of a general council, the settlement of the papacy at Avignon. At last, on the 27th of June, an arrangement was come to. The king agreed to hand over to the papal inquisitors in France the grand master, Jacques de Molay, for his part, withdrew the sentence of suspension against the grand inquisitor of France (July 5) and ordered an inquisition into the charges against individual Templars by the diocesan bishops with assessors nominated by himself. The examination of the grand master, of the grand visitor of France, and of the grand preceptors of Cyprus, Normandy and Aquitaine he reserved to himself. Inquisition was to be made into the conduct of the order in each country by special papal commissions; and the fate of the order as a whole was to be decided by an international general council.

These decisions were at once acted on. At Poitiers Clement had already heard the confessions of seventy-two Templars, carefully selected from the royal prisons (June 29 to July 1).4 The grand master and the three preceptors were re-examined at Chion, and renewed their old confessions (20th August). Lastly, the bull Regiones in Coelo summoned a great council at Vienne for the 1st of October 1311, when the question of the guilt of the order might be considered. Meanwhile the pope and cardinals had elaborated the organization of the new inquisition. In this the actual inquisitors, though admitted, played a quite subordinate part: the commissions centered around the diocesan bishops, who had as assessors prelates, abbots, priors and canonists. These commissions were two-fold, usually—though erroneously—distinguished as papal and episcopal (both were in fact papal); the first were charged with the inquisition into the accusations against the order itself and the grand preceptors of the various countries, the second with

1 Michelet, Proces, i. 36.
2 Jacques de Molay's confession was partly due to fear of torture, partly to secure the withdrawal of a specific charge of unnatural crime brought against him by the Templar Guillaume de Gasci (Gmelin ii., Tab. i. No. 12). But he continued to demand access to the pope, declaring that he could satisfactorily explain the practices of the order.
3 Text in Finke ii. 55.
4 Finke i. 302 ff. Some of the Spanish Templars turned Moslem (Manuel of Lepanto, and joined the sack of Granada in an invasion of Aragon (Finke ii. 188, No. 105).
5 This was to be devoted to the cause of the Holy Land. In fact its administration fell into the hands of Philip's confidants and the greater part remained in his possession (Finke i. 227).
6 For a detailed account of the negotiations see Finke i. 200 ff. He holds that Clement, though now convinced of the Templars' guilt, was anxious to treat them leniently and, if possible, to save the order (p. 215).
7 See Gmelin ii., Tab. vii. and viii.
that into the accusations against individual Templars. The papal commission in Paris began its sessions on the 9th of August 1309; on the 12th, citations were issued to those Templars who "of their own free will" were prepared to come and defend the order. There was much confusion and delay, however, and the actual public trial did not begin till the 11th of April 1312. Many Templars, in the meantime, had volunteered to defend the order and withdrew their previous confessions. They were soon undeceived; the commission, presided over by the "garde des seaux" of the king, the archbishop of Narbonne, was packed with creatures of the crown. The evidence given in Paris for or against the order was, it was soon found, used against the individual Templars on their return to the provinces; the retraction of a confession, under the rules set up for the diocesan inquisition, was punished with death by fire. On Tuesday the 12th of May, fifty-four Templars who had retracted their confessions before the commission were burnt in Paris by order of the archbishop of Sens; a few days later four were burnt at Senlis, and towards the end of May nine more, by order of the archbishop of Reims. Forty-six Templars now withdrew their defence, and the commissioners in Paris decided (30th May) to adjourn till November. The second examination lasted from the 17th of December 1310 to the 16th of May 1311. Meanwhile (c. April 1311) Clement and Philip had come to terms. The pope condemned the Templars. The council of Vienne met in October 1311 to consider the charge, and on May 1, 1312, it was adopted as a whole, and the order was declared to be heretical in their own defence. Clement, it is said, broke up the session to avoid compliance; and when seven Templars offered themselves as deputies for the defence he had them cast into prison. Towards the beginning of March Philip came to Vienne, and he was seated at the pope's right hand when that pontiff delivered his sermon against the Templars (3rd April 1312), whose order had just been abolished, not at the general council, but in private consistory (22nd March). On 2nd May 1312 he published the bull Ad Providam, transferring the goods of the society, except for the king's share, to Aragon, and Majorca, to the Knights of St. John. The order was never formally pronounced guilty of the crimes laid to its charge; its abolition was distinctly, in the terms of Clement's bull Considerantes Dudum, "non per modum definitivae sententiae, cum eam super hoc secundum inquisitiones et processus super sui habitos non possemus ferre de jure sed per viam provisionis et ordinations apostolicae" (6th May 1312).

The final act of the stupendous tragedy came early in 1314. Jacques de Molay, the grand master, had not hitherto risen to the height of the king's expectations. Philip, c. April 1314, was sufficiently enraged to make him confess, and this confession had been used to extract avowals from his brethren, subject as they were to unspeakable sufferings and accustomed to yield to the military chief. Humiliation on humiliation had been heaped on the wretched man, public recantations, reiterated confessions. Before the papal commission he had flamed into anger, protested, equivocated—only in the end to repeat his confession once more. The same had happened before the commission of cardinals at Chinon; the audience with the pope, which he demanded, he had never obtained. On the 6th of May, in the pope's presence, at the time of the Templars in general; that of the five great offices of the order he reserved in his own hand. With this a silence falls over the history of the Templars; the fate of the order had been decided, that of the individuals still under trial was of little interest to contemporary chroniclers. Then the veil is suddenly lifted. Jacques de Molay has found his wonted courage at last, and with him Gautier de Charney, the preceptor of Normandy; on the 14th of March 1314 they were brought out on to a scaffolding erected by order of the archbishop of Sens, and there, in the presence of all legates and of the people to repeat their confessions and to receive their sentence of perpetual imprisonment. Instead, they seized the opportunity to withdraw their confessions and to protest to the assembled thousands the innocence of the order. King Philip the Fair did not wait to consult the church as to what he should do; he had them burnt "in the little island" of the Seine "between the Augustinians and the royal garden"; with them perished Guy (the Guido Delphini of the trials), the youthful son of the dauphin of Auvergne. After the deaths of the popular Flemings, who had contributed to the new order of Carthusian people remembered that the grand master had summoned them with his dying breath before the judgment seat of God; but the sole recorded contemporary protest is that of the Augustinians at the trespass committed by the royal officers on their land!

On the question of the guilt or innocence of the Templars in recent times, the emphasis has, in large part, been on which the order was condemned opinion has long been divided. Their innocence was maintained by the greatest of all their contemporaries, Dante, and among others by the historian Villani and by the sainted Antoninus, who, for a time, placed the charge of heresy of the order into the discussion of the question owing to its having been for centuries brought into the arena of party controversy, and finally by the inquisitors, Gardini and Guglielmo, the Swiss, who, after having published his Historia Templaria (Amsterdam, 1691, 2nd ed. 1703) to show, as a good Protestant, that the Templars had the usual vices of Roman Catholics, while, according to Louiseleur, the Great Council of Dublin (which, later published at Brussels) were Freemasons who, under false names, gambled the old material and inserted new in the interests of the suppressed origin of their own order in that of the Templars. Several Roman Catholic champions of the order now entered the field, e.g., the Benedictine historian Languedoc, Dom Dominique Joseph Vallisse, and notably the Premonstratensian canon R. P. M. Jeune, prior of Etival, who in 1790 published at Paris his Histoire critique et apologétique de l'ordre des chevaliers... des Templiers, a valuable work directed specifically against Gurtler and Dru Puy. In the 19th century a fresh impetus was given to the discussion by the publication in 1813 of Raynouard's brilliant defence of the property was nominally handed over to the Hospitals, but most of it actually remained in the hands of the sovereigns or their financial agents. The king of Portugal, for instance (in suppressing the order and torturing its members), in the Spanish peninsula the Temple castles and estates were in some cases handed to other military orders, and, in others, to the new order of Carthusian monks. In 1319 the castle to those of Ucles and Calatrava; in Aragon one frontier castle with its domain, Montasia, was given to the knights of Calatrava; the rest—so far as they had not been annexed by the king and the riones krombers—to the Hospitaliers. As to the Templars: they were granted in most cases generous pensions; some continued to live in groups, though without organization, on their old property; others joined various orders; many married, on the plea that the suppression of the order had released them from their vows; while others, again, took service with the Moors in Africa. (Finke, l. c., p. 12.)

Raggio il nuovo, Pazzo si cruderele
Che cie col nasia, ma, senza decreto,
Porta nel tempio le cupide vele.—(Purg, xx, 92.)

1 History of the order military of the templars, &c. The titles of the various editions differ.

2 There is, of course, no foundation whatever for this claim. It is examined and refuted, inter alios, by Wilcke, iii. 353 seq. A delightfully absurd attempt to assert the continuity of the "Templars" as a driving force of Protestantism in the United States, with the suppressed order, is made by Jeremy L. Cross in The Templars Chart (New York, 1845); he actually gives a list of our "Templars" under the names of Sidney Smith (1838), and asserts that "the Encampment of Baldwin which was established at Bristol by the Templars who returned with Richard I. from Palestine, still continues to exist, and that members of it have preserved the ancient costume and ceremonies of the order."

3 Finke devotes an interesting chapter to tracing what became of the property of the order and of the individual Templars. The

4 This was, of course, only one of some twenty-five separate commissions in different countries. It was, however, the most important and is the best known. It was issued at the instance of Philip of Castile, brother of Enguerrand de Marigny, the king's minister, who had already been appointed archbishop of Sens at Philip IV.'s instance in April, and was naturally full of zeal for the royal cause. The condemned Templars appealed to the papal commission which was represented by the pope's legates, but refused to accept their authority to interfere with the archbishop's ordinary jurisdiction. (Raynouard, p. 92.)
In the opinion of the present writer, the defenders of the order have proved their case. Even the late Mr Archer, who took the order up as a cause célèbre, was forced to admit of the following: "The opinion that the monstrous charges brought against the Templars were false," he wrote (Encyc. Brit., 9th ed. xii, 164), "and that the confessions were only extracted by torture is supported by the evidence already referred to, and which we have given elsewhere (outside France), as we have them collected in Raynouard, Labbe, and Du Puy. In Castile, where the king flung them into prison, they were never acquired, or at least, not pronounced the order blameless. At Treves, at Messina, and at Bologna, in Romagna and in Cyprus, they were either acquitted or not pronounced the order blameless. At the council of Ravenna the question as to whether the order was answered in the negative except by two Dominicans; all the Templars were absolved—even those who had confessed through fear of torture being pronounced innocent (15th June 1010). Six Templars were examined at Florence, and their evidence is for its length the most remarkable of all that is still extant. Roughly speaking, they confess with the most elaborate detail to every charge—even the most loathsome; and the perusal of their evidence induces a constant suspicion that their answers were practically dictated to them in the process of the examination or invented by the examiners. Evidence, however, was throughout the trials, was not used, out of eighty Templars examined only four confessed to the charge of denying Christ, and of these four two were apostate knights. But some English Templars would only guarantee the truth of their confessions and the results of their examinations, and the charges held to be not absolutely proved seems evident from the form of confession to be used before absolution, in which the Templars were thus led to abjure themselves to be defamed in the matter of certain articles that were published in England. Nearly all the worst evidence comes at second or third hand, or through the depositions of Franciscans and Dominicans," i.e. the rivals and enemies of the order. But what is the nature of the evidence "too strong to be explained away" on which Mr Archer bases his opinion that certain of the charges were proved at least in France? The modern practice of the English courts tends to eliminate the larger elements of confession in cases of heresy, and it is now freely made. What is the value of these confessions of the Templars which lie before us in the Tables published by Gmelin? The proof of the Templars is more authentic than any other to those accused on a "vehement suspicion" of heresy, by confession or death under lingering torture; to withdraw a confession meant instant death by fire. The Templars, for the most part simple and illiterate men, were suddenly arrested, cast separately into dark dungeons, loaded with chains, starved, terrorized, and tortured. They were told the charges to which their leaders had confessed, or were said to have confessed; to repeat the monotonous formula admitting their guilt, under torture, and to seal it at the cost of a comparatively mild pence. The wonder is not that so many confessed, but that so many persisted in their denial, for the charge was of heinous and monstrous crimes, new, wholly worthless, as even some contemporaries suspected it to be.

A word must be added as to the significance of the work of the Templars and of the manner of their fall in the history of the world. Two great things the order had done for European civilization: in the East and in Spain it had successfully checked the advance of Islam; it had deepened and given a religious sanction to the idea of the chivalrous man, the homo legatus, and so opened up, to a class of people who for centuries to come were to exercise enormous influence, spheres of activity which—what effects of which are still recognizable in the world in the advancing tide of Turkish conquest in the East? Or in Spain against the Moorish powers? If not, why did the Hospitalers survive? Froude's contribution is but a popular lecture, however, and, for all its beauty of style, characteristically careless (e.g. such mistakes as Hugh von Peyraud, Esquin von Florian).
TEMPLE, FREDERICK

popular belief in witchcraft and personal intercourse with the devil, sanctioned the expeditious of wringing confessions of such intercourse from the accused by unspeakable tortures, and so made possible the hideous witch-persecutions which darkened the later middle ages and, even in Protestant countries, long survived the Bible with a vengeance. If I were to name a day in the whole history of the world," said Döllinger at the conclusion of his last public lecture, "which appears to me in the truest sense as a dies nefastus, I should be able to name no other than the 13th of October 1597."

Authorities.—A great mass of original sources has now been published. Those given by Du Puy, though often valuable, were selected by the Edel with a view to point out the departure was made with the publication of Michelet’s Proces des Templiers (t. i. 1851, t. ii. 1861), an edition of the original minutes of the trial preserved at the Bibliothèque Nationale (it is especially interesting as the earliest complete and detailed record of a criminal trial in existence). This is elaborately analysed and the results tabulated in vol. ii. of Gmelin. Of documents published in other works the most important collections are those in Schottmüller (mainly from the Vatican Archives) and Finke (Aragonese Archives). The Rule of the Temple has been several times published; the most accessible edition, giving the various Rules with critical commentary, is that of H. de Curzon, La Règle du Temple (Paris, 1886); see also Maillard de Chambure, Règle et statuts secrets des Templiers, préc. de l’histoire de cette ordre (Dijon—Paris, 1840).


TEMPLE, FREDERICK (1821-1902), English divine, archbishop of Canterbury, was born in Santa Maura, one of the Ionian Islands, in 1821. He was the son of Thomas Frederick Temple, M.P. and was subsequently appointed lieutenant-governor of Sierra Leone. On his retirement he settled in Devonshire as a small landowner, and contemplated a farming life for his son Frederick, giving him a practical training to that end. But the boy was sent to Blundell’s School, Tiverton, and soon exhibited abilities which marked him out for a different career. He retained through life a warm affection for the school, where he did well both in the classes and the games, and was famous as a walker. His father’s means were narrow, and the boy knew how to make the most of his opportunities. He took an important step in that way by winning a scholarship at Balliol College, Oxford, before he was quite seventeen years old. The “Tractarian Movement” had set in five years earlier, but the memorable tract, No. 90, had not yet been written, and Temple entered a university which was vibrating with intellectual and religious excitement. After much discussion and reflection he drew closer to the camp of “the Oxford Liberal Movement.” In 1842 he took a “double-first” and was elected fellow of Balliol, and lecturer in mathematics and logic. Four years later he took orders, and with the aim of helping forward the education of churchmen the bishop of Kensington, a scholar and a generous man, in 1845, gave to Temple a living more suitable to the calling. He took as his subject “the election of bishops” and wrote a brilliant paper, which was accepted by the prime minister.” At the confirmation of his election counsel was instructed to object to it, and in the voting the chapter was divided. But Gloucester stood firm, and Temple was duly consecrated on the 21st of December 1860. There were at first murmurings among his clergy against what they deemed his harsh control, but his real kindness soon made itself felt, and, during the sixteen years of his tenure of the see, his sound and vigorous rule dissipated the prejudices against him, so that when, on the death of Dr John Jackson in 1885, he was appointed to London, the clergy accepted the appointment with satisfaction. In 1884 he was Bampton Lecturer, taking for his subject “The Relations between Religion and Science.” In 1885 he was elected honorary fellow of Exeter College, Oxford. Dr Temple’s tenancy of the bishopric of London was marked, if possible, by more strenuous labours than ever. His normal working day at this time was one of fourteen or fifteen hours, and he refused to spare himself one hour of toil, though under the strain blindness was rapidly coming on. He was still felt by many of his clergy and by candidates for ordination to be a rather terrifying person, and to entertain almost impossible standards of diligence, accuracy, and preserving efficiency, but his manifest devotion to his work and his zeal for the good of the people rooted him deeply in the general confidence. In London he was not less conspicuous as a temple of righteousness than he had been in Exeter, and the artisan classes instinctively

Whilst making the school a strong one on the classical side, he instituted scholarships in natural science, built a laboratory, and gave importance to that side of the school work. He had the courage also to reform the games, in spite of all the traditions of the playing fields. His own tremendous powers of work and his rugged masculinity was the most frightful enemy ever, but his popularity was soon undoubted, and he brought up the school to a very high level. His school sermons were deeply impressive: they rooted religion in the loyalties of the heart and the conscience, and taught that faith might dwell secure amid all the bewildlements of the intellect, if only the life remained rooted in pure affections and a loyalty to the sense of duty. It was two years after he had taken up his work at Rugby that the volume entitled Essays and Reviews gave rise to an extraordinary storm. The first essay in the book, “The Education of the World,” was by Dr Temple. It was declared in a preface to the volume that the authors were responsible only for their respective articles, but some of these were deemed so destructive that many people banned the whole book, and a noisy demand, led by Samuel Wilberforce, then bishop of Oxford, called on the headmaster of Rugby to dissociate himself from his comrades. Temple’s essay had treated of the intellectual and spiritual growth of the race, and had pointed out the contributions made respectively by the Hebrews, the Egyptians, the Greeks, the Romans, and others. It was generally declared to be a text-book of the boys at first, but it was claimed as found in bad company. Temple refused, so long as the storm lasted, to comply with the request that he would repudiate his associates, and it was only at a much later date (1870) that he saw fit quietly to withdraw his essay. In the meantime, however, he printed a volume of his Rugby sermons, to show definitely what his own religious positions were.

In politics Temple was a follower of Mr Gladstone, and he approved of the disestablishment of the Irish Church. He also refused to be a candidate for the Canterbury see in 1866, when the Act, which made him an active member of the Endowed Schools Commission. In 1869 Mr Gladstone offered him the deanship of Durham, but this he declined on the ground of his strong interest in Rugby. When later in the same year, however, Henry Phillpotts, bishop of Exeter, died, the prime minister turned again to Temple, and he accepted the bishopric of that city so dear to him from boyhood, and left Rugby for a home amongst his own people. The appointment, however, raised a fresh storm.

G. A. Denison, archdeacon of Taunton, Lord Shaftesbury, and others formed a strong committee of protest, whilst Pusey declared that “the election of bishops should be perpetrated by a prime minister.” At the confirmation of his election counsel was instructed to object to it, and in the voting the chapter was divided. But Gloucester stood firm, and Temple was duly consecrated on the 21st of December 1860. There were at first murmurings among his clergy against what they deemed his harsh control, but his real kindness soon made itself felt, and, during the sixteen years of his tenure of the see, his sound and vigorous rule dissipated the prejudices against him, so that when, on the death of Dr John Jackson in 1885, he was appointed to London, the clergy accepted the appointment with satisfaction. In 1884 he was Bampton Lecturer, taking for his subject “The Relations between Religion and Science.” In 1885 he was elected honorary fellow of Exeter College, Oxford.

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1 Döllinger, Akademische Vorträge (Munich, 1891), ix, “Der Untergang des Tempelordens.”
recognized him as their friend. When, in view of his growing blindness, he offered to resign the bishopric, he was induced to reconsider his proposal, and on the sudden death of Archbishop Benson in 1866, though now seventy-six years of age, he accepted the see of Canterbury.

As archbishop he presided in 1897 over the decennial Lambeth Conference. In the same year Dr Temple and his brother archbishop issued an able reply to an encyclical of the pope which denied the validity of Anglican orders. In 1900 the archbishops again acted together, when an appeal was addressed to them by the united episcopate, to decide the vexed questions of the use of incense in divine service and of the reservation of the elements. After full hearing of arguments they gave their decision against both the practices in question. During his archbishopric Dr Temple was deeply distressed by the divisions which were weakening the Anglican Church, and many of his most memorable sermons were calls for unity. His first charge as primate on "Disputes in the Church" was felt to be a most powerful plea for a more catholic and a more charitable temper, and again and again during the closing years of his life he came back to this same theme. He was zealous also in the cause of foreign missions, and in a sermon preached at the opening of the new century he urged that a supreme obligation rested upon Britain at this epoch in the world's history to seek to evangelize all nations. In 1900 he presided over, and later World Temple as primate was a conspicuous figure in several and on one occasion preached in the interests of women's education. In 1902 he discharged the important duties of his office at the coronation of King Edward VII., but the strain at his advanced age told upon his health. During a speech which he delivered in the House of Lords on the 2nd of December 1902 on the Education Bill of that year, he was seized with sudden illness, and, though he revived sufficiently to finish his speech, he never fully recovered, and died on the 23rd of December 1902. He was interred in Canterbury cathedral four days later. His second son, the late Lord Temple's youngest son, who had succeeded his father at Oxford, was in 1910 appointed headmaster of Repton.


TEMPLE, SIR RICHARD, BART. (1826-1902). English administrator, a descendant in the female line of the Temples of Stowe, was born on the 8th of March 1826, and after being educated at Rugby and Haileybury, joined the Bengal Civil Service. His industry and ready pen soon obtained appreciation, and in 1849 he was appointed to the Indian civil service in India, first to the India Office, then to John Lawrence in the Punjab, and gaining useful financial experience under James Wilson, he was appointed Resident at Haidarabad. In 1866 he was made K.C.S.I. In 1868 he became a member of the supreme government, first as foreign secretary and then as finance minister; and he did admirable work during the famine of 1874, in the course of which he was made lieutenant-governor of Bengal. His services were recognized by the bestowal of a baronetcy in 1876. In 1877 he was made governor of Bombay, and his activity during the Afghan war of 1878-79 was so successful that he was induced to enter on a political career in England, but it was not till 1885 that he was returned as a conservative for the Evesham division of Worcestershire. Meanwhile he produced several books on Indian subjects. In parliament he was assiduous in his attendance, and he spoke on Indian subjects with admitted authority; but he was not otherwise a parliamentary success, and to the public he was best known by the caricatures in Punch, which exaggerated his physical peculiarities and made him look like a lean and hungry tiger. In 1885 he became vice-chairman of the London School Board, and as chairman of its finance committee he did useful and congenial work. In 1892 he changed his constituency for the Kingston division, but in 1895 he retired from parliament, being in 1896 made a Privy Councillor. He had kept a careful journal of his parliamentary experiences, intended for posthumous publication; and he himself published a short volume of reminiscences. He died at Hampstead on the 15th of March 1902. He was twice married, and left a daughter and three sons, all of the latter distinguishing themselves in the public service.

TEMPLE, RICHARD GRENVILLE-TEMPLE, 1st Earl (1711-1754). English statesman, eldest son of Richard Grenville (d. 1727) of Wootton, Buckinghamshire, was born on the 9th of September 1711. His mother was Hester (c. 1692-1752), daughter, and ultimately heiress, of Sir Richard Temple, Bart. (1634-1697), of Stowe, Buckinghamshire, and sister of Richard Temple, Viscount Cobham, whose title she inherited under a special remainder in 1749; in the same year, her husband having been long dead, she was created Countess Temple. Her son, Richard Grenville, was educated at Eton, and in 1734 was returned to parliament as member for the borough of Buckingham. In 1735, on the death of his mother, he inherited her titles together with the rich estates of Stowe and Wootton, and he then took the name of Temple in addition to his own surname of Grenville. The turning point in his political fortunes was the marriage of his sister Hester in 1752 to William Pitt, afterwards earl of Chatham. Although Lord Temple was a man of little ability and indifferent character, Pitt persistently linked his own career with that of his brother-in-law. In November 1756 Temple became first lord of the admiralty in the ministry of Devonshire and Pitt. He was intensely disliked by George II., who detested both his Pitt and office in April 1757. But when the memorable coalition between the Pitts and Newcastle and Pitt was formed in June of the same year, Temple received the office of privy seal. He alone in the cabinet supported Pitt's proposal to declare war with Spain in 1761, and they resigned together on the 5th of October. From this time Temple became one of the most violent and factious of politicians, and it is difficult to account for the influence, wholly evil, which he exerted over his illustrious brother-in-law. He himself is said to have avowed that "he loved faction, and never distrusted Pitt." He was at variance with his younger brother, George Grenville, when the latter became first lord of the treasury in April 1765, and he had no place in that ministry; but the brothers were reconciled before 1765, when Temple, who probably aimed at forming a ministry mainly confined to his own family connexions, refused to join the government, and persuaded Pitt to refuse likewise. A few weeks later the king offered the most liberal terms to induce Pitt to form or join an administration; and "a ministry directed by that great statesman," says Lecky, "would have been beyond all comparison the most advantageous to the country; it had no serious difficulty to encounter, and Pitt himself was now ready to undertake the task, but the evil genius of Lord Temple again prevailed. Without his co-operation Pitt could not, or would not proceed, and Temple absolutely refused to take office even in the foremost place." Pitt's continued refusal to join the Rockingham administration was no doubt partly due to the same disastrous influence, though before the close of 1765 the old friendship between the brothers-in-law was dissolving; and when at last in July 1766 Pitt consented to form a government, Temple refused to join; being bitterly offended because, although offered the head of the treasury, he was not to be allowed an equal share with Pitt in nominating to other offices. Temple forthwith began to inspire the most virulent libels against Pitt; and in conjunction with his brother George he concentrated the whole Grenville connexion in hostility to the government. After George Grenville's death in 1770 Lord Temple retired almost completely from public life. He died on the 12th of September 1779.

1 The Temple family belonged originally to Leicestershire, where, at Temple Hall, the elder line had resided since the 14th century. Peter Temple (1600-1663), the recusant, was a member of this elder line; a younger branch had settled in Oxfordshire and passed thence to Buckinghamshire, where John Temple purchased Stowe in 1589. This John was brother of Anthony, who was great-grandfather of Sir William Temple, the famous statesman. John Temple, son Thomas, who was created a baronet in 1611, was the great-grandfather of Earl Temple.
Lord Temple was entirely without statesmanship; he possessed an insatiable appetite for intrigue, and is said to have been the author of several anonymous libels, and the inspirer of many of them. Mr. Macaulay's well-known comparison of him with a mole working below "in some foul, twinkled labyrinth, whenever a heap of dirt was flung up," which perverts the spleen of Horace Walpole, perhaps exceeds the justice of the case; but there can be no question that Temple's character as a public man was rated very low by his contemporaries. In private life he used his great wealth with generosity to his relations, friends and dependents. Pitt was under pecuniary obligation to him. He paid the costs incurred by Wilkes in litigation, and he provided the agitator with the freehold qualification which enabled him to stand for Middlesex in the famous election of 1768.

In addition to the estates he inherited, Temple gained a considerable fortune by his marriage in 1737 with Anne, daughter and co-heiress of Thomas Chambers of Hanworth, Middlesex; a volume of poems by her was printed at the Strawberry Hill press in 1764. The only issue of the marriage being a daughter who died in infancy, Temple was succeeded in the earldom by his nephew George (1753-1813), second son of George Grenville the prime minister, who then assumed in addition to the name of Grenville not only the name of Temple, but also that of Nugent, his wife being daughter and co-heiress of Robert, Viscount Clare, afterwards Earl Nagent. The 2nd Earl of Temple was lord-lieutenant of Ireland in 1783-4; in 1784 was created marquess of Buckingham; and was again lord-lieutenant of Ireland in 1787-9.

His son and successor, Richard Temple-Nugent-Brydges-Chandos-Grenville (1776-1839), was created duke of Buckingham and Chandos in 1822, his wife being only daughter of the 3rd duke of Chandos; he was in the same patent created Earl Temple of Stowe, with special remainder as regards this title, in virtue of which, on the death without male issue in 1809 of the 1st earl of Buckingham and Chandos and the consequent extinction of the original earldom of Temple, the title of Earl Temple of Stowe devolved upon William Stephen Gore-Langton (1847-1902), whose mother was granddaughter of the 1st duke of Buckingham, grantee of this earldom. In 1902 Algernon William Stephen Temple-Gore-Langton (b. 1871) became 5th Earl Temple.


(2nd Earl Temple was lord-lieutenant of Ireland in 1783-4; in 1784 was created marquess of Buckingham; and was again lord-lieutenant of Ireland in 1787-9.)

TEMPLE, SIR WILLIAM, BART. (1628-1699), English statesman, diplomatist, and author, was born in London, and came of an old English family, but of the younger branch of it, which had for some time been settled in Ireland. He was the eldest son of Sir John Temple (1600-1677), Irish master of the rolls, whose grandfather Sir William Temple (1555-1627), provost of Trinity College, Dublin. His mother was Mary Hammond. Temple received a liberal education, calculated to produce that moderation of judgment for which he was afterwards remarkable. He was first a pupil of his uncle Dr Henry Hammond, the divine, after which he went to the grammar-school at Bishop Stortford, and then to the Puritan college of Emmanuel at Cambridge, where he came under the influence of Cudworth. At the commencement of the civil troubles his father embraced the popular cause and was deprived of his office. Coming to England, he sat in the Long Parliament as member for Chichester, and was one of the recalcitrant members turned out by Colonel Pride. Before this event happened his son had left Cambridge, without taking a degree, and in 1647 started to travel abroad. In the Isle of Wight, while on his way to France, he fell in with Dorothy Osborne, and won her affections. Her father, Sir Peter Osborne, was governor of Guernsey and a Royalist. Her family were opposed to the match, and threw difficulties in the way, which hindered its consummation for seven years. During this period Temple travelled in France, Spain, Holland, and other countries, gaining knowledge of the world and keeping up a constant correspondence with his betrothed. At last, apparently in 1654, the difficulties were surmounted and the marriage took place. In 1655 Temple and his wife went to Ireland. The next five years were spent in the house of Sir John Temple, who had made his peace with Cromwell, and had resumed his official position. His son took no part in politics, but lived the life of a student and a country gentleman.

The accession of Charles II. rescued Temple, like many others, from obscurity. In 1660 he sat in the convention parliament at Dublin as member for Carlow, and he represented the same constituency along with his father in the regular 4th Saini, which followed. After a short visit to England in 1661, as commissioner from the Irish parliament, he finally removed thither in 1663. There he attached himself to Arlington, secretary of state, and two years later received his first employment abroad. It was in March 1665 that the disastrous war with the United Netherlands began. Charles II. was anxious to obtain allies, especially as Louis XIV. was taking up a hostile attitude. At this juncture Christoph Bernhard van Galen, bishop of Münster, sent an envoy to England, offering to attack the Dutch if the English government would supply him the means. Temple was sent over to negotiate a treaty, and in this business he succeeded not only of the diplomatic skill but of the peculiar candour and frankness for which he was afterwards so distinguished. He was successful in making the treaty, but it was rendered ineffectual by the declaration of war by France, the threats of Louis, and the double-dealing of the prelate, who, after receiving a great part of the subsidy, made a separate peace with the Netherlands. As a reward for his services Temple was created a baronet, and in October 1665 became the English representative at the viceregal court at Brussels. While the war continued, Temple's duties became chiefly in cultivating good relations with Spain, which was a neutral in the quarrel between England and the Dutch, but was threatened by the claims of Louis XIV. on the Spanish Netherlands. Louis's designs became apparent in the spring of 1667, when he marched an army into Flanders. This event was one of those which led to the peace of Breda, and to the subsequent negotiations, which are Temple's chief title to fame. The French conquests were made at the expense of Spain, but were almost equally dangerous to the United Netherlands, whose independence would have been forfeited had Louis succeeded in annexing Flanders. While the French were taking towns after towns, Temple made a journey into Holland, where he visited De Witt. The friendship established and the community of views discovered during this interview facilitated the subsequent negotiations. Temple had for some time pressed on his government the necessity of stopping the French advance, and had pointed out the way to do so, but it was not till December 1667 that he received instructions to act as he had suggested. He at once set out for The Hague, and in January 1668 a treaty was made between England and the United Netherlands, which, being joined shortly afterwards by Sweden, became known as the Triple Alliance, which was made against the encroachments of France. Whether we regard the skill and celerity with which the negotiations were conducted or the results of the treaty, the transaction reflects great credit on the Temple. The French king was checked in mid-career, and, without a blow being struck, was obliged to surrender almost all his conquests. Pepys records public opinion on the treaty by saying that it was "the only good public thing that hath been done since the king came into England." Unfortunately the policy thus indicated was but short-lived. In taking up a hostile attitude towards France Charles's object had apparently been only to raise his price. Louis took the hint, increased his offers, and two years later the secret treaty of Dover reversed the policy of the Triple Alliance. Meanwhile Temple had developed the good understanding with the Dutch
by contracting a commercial treaty with them (February 1668),
and had acted as English plenipotentiary at Aix-la-Chapelle,
where peace between France and Spain was made in May 1668.
Shortly afterwards he was appointed ambassador at The Hague.
Here he lived for three years. Parliament was under De Witt
and with the young prince of Orange, afterwards William III.
The treaty of Dover led to Temple's recall; but the plot was
not yet ripe, and Temple nominally held his post for another
year. He perceived, however, that his day was over and retired
to his house at Sheen. In June 1671 he received his formal
dismissal. The war with the Netherlands broke out next year,
and was almost as discreditable to England as that of 1665.
Want of success and the growing strength of the opposition in
parliament forced Charles to make peace, and Temple was
brought out of his retirement to carry through the change of
front. After a negotiation of three days, carried on through
the medium of the Spanish ambassador, the treaty of West-
minster was made (February 1674). As a recognition of his
services Temple was now offered the embassy to Spain. This
he declined, as well as the offer of a far more important post,
that of secretary of state, but accepted instead a renewal of his
embassy to The Hague, whither he went in July 1674. In the
March following he was nominated ambassador to the congress
at Nijmegen; but, owing to the tortuousness of Charles's
dealings, it was not till July 1676 that he entered that town.
The negotiations dragged on for two years longer, for Charles
still receiving money from France, and English mediation
was no more a ruse. In the summer of 1677 Temple was
summoned to England and received a second offer of the
secretaryship of state, which he again declined. In the autumn
of the same year he had the satisfaction of removing the last
difficulties which hindered the marriage of William and Mary,
an event which seemed to complete the work of 1668 and 1674.
Louis still remaining obstinate in his demands, Temple was
commissioned in July 1678 to make an alliance with the states
of the Netherlands, and to bring their military and financial
resources to bear upon the Stuart plan. This treaty was instrumen-
tal in bringing about the general pacifica-
tion which was concluded in January 1679.
This was Temple's last appearance in the field of diplomacy;
but his public life was not yet over. A third offer of the
secretaryship was made to him; but, unwilling as ever to mix
himself up with faction and intrigue, he again declined. He
did not, however, withdraw from politics; on the contrary, he
was for a short time more prominent than ever. The state
was passing through a grave crisis. Political passion was
om-
mented by religious fanaticism. The Protestant settlement was
under the royal head and was pressing on the Exclusion Bill. The
root of all the mischief lay in the irresponsibility of the cabinet
to parliament and its complete subservience to the crown. To
remedy this, Temple brought forward his plan for a reform of
the privy council. This body was to consist of thirty members,
half of whom were to be the chief officers of the crown, the other
half being persons of importance, lords and commons, chosen
without reference to party. Special care was taken to select
men of wealth, which Temple considered as the chief source of
political influence. By the advice of this council the king
promised to consult his parliaments; and the crown was sup-
posed would trust such a body, and would cease to dictate to the
king. The scheme was accepted by the king, but was a failure from
the outset. Intended to combine the advantages of a parliament
and a council, it created a board which was neither the one
nor the other. The conduct of affairs fell at once into the hands
of a junta of four, of whom Temple was at first one, and the king
violated his promise by dissolving parliament without asking
the advice of the council. Temple retired in disgust to his
villa at Sheen, and appeared only occasionally at the council,
where he soon ceased to exercise any influence. In 1680 he was
nominated ambassador to Spain, but stayed in England in
order to take his seat in parliament as member for the university
of Cambridge. He took no part in the debates on the great
question of the day, and acting on the king's advice declined
to sit in the parliament of 1681. Early in that year his name
was struck off the list of the council, and henceforward he dis-
appeared from public life. He continued to live at Sheen till
1686, when he handed over his estate there to his son, the only
survivor of seven children, and retired to Moor Park in Surrey.
Here he lived until his death. William III. came to the throne Temple was pressed to
take office, but he declined. He married a second time, but
committed suicide immediately afterwards. Sir William,
though occasionally consulted by the king, took no further part
in public affairs, but occupied himself in literature, gardening
and other pursuits. It should not be omitted that Swift lived
with him as secretary during the last ten years (with one short
interval) of his life. Temple died at Moor Park on the 27th of
January 1699.

Temple's literary works are mostly political, and are of consider-
able importance. Among them may be mentioned An Essay on the
Present State and Settlement of Ireland (1668); The Empire,
Sweden, &c., a survey of the different Governments of Europe and
their relations to England (1671); Observations upon the United
Provinces (1672); Essay upon the Original and Nature of Govern-
ment (1672); Essay upon the Advancement of Trade in Ireland
(1673). Some of these were published in the first part of his Miscel-
nanea (1679). In the same year apparently his Poems were privately
printed. In 1683 he published for the first time his famous
letters of correspondence, extending from 1665 to 1671, he destroyed unpublishd;
the second, from 1672 to 1679, was published without his authority in
1690. The third, which was completed by a new editor, was published by Swift in
1709. In 1692 he published the second part of his Miscellanea,
containing among other subjects the essay Upon the Ancient and
Modern Learning, which is remarkable only as having given rise to the
controversy about "Letters to the Contemporaries of Particular
Persons." An Introduction to the History of England, a short sketch of English history
to 1687, was published in 1695. Several collections of his letters
were published by Swift and others after his death.

His fame rests, however, far more on his diplomatic triumphs
than on his literary work. His connexion with domestic affairs
was slight and unsuccessful. He was debarred both by his virtues
and his defects—by his impartiality, his honesty, and his want of
ambition—from taking an active part in the disgraceful politics of
his time. But in the foreign relations of his country he was
intimately concerned for a period of fourteen years, and in all that
his country combined a deep interest and a zeal. It may be
called great, but he will be remembered as one of the ablest
negotiators that England has produced, and as a public servant
who, in an unprincipled age and in circumstances peculiarly open
to corruption, preserved a blameless record.

See Life and Works of Sir William Temple (2 vols., 1720; 2nd ed.,
with Life by Lady Giffard, 1731); a more complete edition, including
the Letters, was published in 4 vols. in 1814; Burnet, History of his
own Time; T. P. Courtenay, Memoirs of the Life, &c., of Sir William
Temple (2 vols., 1836); Macaulay, Essay on Sir William Temple;
A. F. Sieveking, Sir W. Temple and other Carolean Garden Essays,
(1869); H. F. E. von Moltke, Sir William Temple (Somerset his-

TEMPLE, a city of Bell county, Texas, U.S.A., about 35 m.
S.S.W. of Waco. Pop. (1890) 4047; (1900) 7065 (1423 being
negros and 360 foreign-born) (1910) 10,993. It is served by
the Gulf, Colorado & Santa Fé, and the Missouri, Kansas &
Texas railways (the former has repair shops here), and is
connected with Belton (pop. in 1910, 4164), the county seat,
about 10 m. W., by an electric railway. In the city are a Carnegie
library, a King's Daughters' Hospital, the Temple Sanitarium,
and a hospital of the Gulf, Colorado & Santa Fé railway.
T. E. is situated in a rich farming country; cotton is ginned
and baled here, and there are various manufactures. The city
owns the water supply. Temple was founded in 1881-82 by
the Gulf, Colorado & Santa Fé railway, and was chartered as
a city in 1884.

TEMPLE, a term derived from the Lat. templum (Gr. ἱερά),
which originally denoted a space marked off by the augurs
for the purpose of observing the flight of birds or other
 ceremonies; later it was applied to the dwelling-place, the
auses sacrar, of the gods. In this latter sense it is the equivalent
of the Hebrew ḫelū (Gk. ἱερός), literally "a
god's seat," and of the foreign ḥēkal, palace, temple, a loan-word
from Sumerian through the medium of the Babylonian Ṛ-kālu
(lit. great house). A temple or "god-house," however, repre-
sents a comparatively advanced stage in the development of
Semitic religion. At first the Semite recognized the abodes
of his deities in certain outstanding and impressive natural
TEMPLE

objects, a spreading tree, a bubbling spring, a conspicuous rock or stone, a lofty mountain peak and the like. Besides these he met and held converse with his gods. The native rock was the first altar.

It was a distinct step in advance when it was recognized that a deity might take up his abode, elsewhere than in such natural sactuary, as in the massēbah or stone pillar and the ashērah or sacred post of wood, reared not by nature but by the hand of man (cf. Gen. xxviii. 18, 22, the origin of the sacred pillar at Beth-el).

The further advance to a real house or temple may be traced to the influence of at least two factors in the social and religious life of a people. One such factor came into play when men began to represent the deity by means of an image, or even when some object, whether natural, like the black stone of Moza, or manufactured, like the ark of the Hebrews, came to be regarded as spiritually sacred from its association with the deity. Such objects or images required a house to shelter and guard them. Another factor is to be found in the advance in material comfort which follows the transition from the nomadic to the agricultural mode of life. Among the settled Semites there arose the feeling that the gods of the community ought also to share in this advance (cf. 2 Sam. vii. 2). Accordingly they were invited to take up their abode in a bēth 'elōhim or temple. The dignity and comfort of the god's abode pari passu with those of their worshippers.

It must be kept in mind, however, that the altar remained as before the centre of the sacrificial worship. Around it or before it, under the open sky, the worshippers assembled. To the temple the priests alone, or the head of the sacral community in his priestly capacity, had access. In this respect the worship associated with altar and temple offers a striking contrast to the more spiritual worship of the Jewish synagogue and the Christian Church.

At the date of the Hebrew invasion of Canaan its numerous city-states had reached a fairly high level of civilization. Alongside of the typical Canaanite sanctuary, as known to us from the Old Testament references and from excavations in Ugarit, with its altar of earth or stone and its stately massēbah, a temple was probably to be found in all the more important centres. In an early Hebrew document there is a reference to the temple of El-berith at Shechem, which was large enough and strong enough to serve as a place of refuge in time of war (Judges ix. 46 ff.). The Philistines also had their temples in this period: thus we hear of a "house" of Dagon at Gaza (ib. xvi. 23 ff.) and also at Ashdod (1 Sam. v. 2), while a temple of Ashhtar (Iṣhtar-Aṣstar) is mentioned in 1 Sam. xxxxi. 10, predating that of Jerusalem (ib. i. 16).

The earliest reference to a temple built by Hebrew hands is to "an house of gods" reared by Micah to shelter an ephod and other sacred images which he had made (Judges xvii. 5). Micah's images were soon transported to Dan, where doubtless another house was built for their protection (xviii. 18, 30 f.). Somewhat later we find the ark of Yahweh installed in "the house of Yahweh" at Shiloh, which house was not a mere tent but a real temple (keleton, 1 Sam. i. 9, iii. 3) with doors (iii. 15) and doorposts (i. 9), and a hall in which the worshippers partook of the sacred meal (2 Sam. vi. 18, Greek text; cf. iv. 22 the guest-chamber," Heb. lohḥāh). After the destruction of Shiloh and the hands of the Philistines, its priesthood migrated to Nob, where also the incidents recorded in 1 Sam. xxi., note especially the presence of the shew-bread and the ephod—imply the existence of a temple.

The Temple of Solomon.—The primary source of our information regarding the erection of Solomon's temple is the account contained in 1 Kings vi.—vi. i., the details of which must have been derived ultimately from the temple archives. On this earlier narrative the chronicler (2 Chron. iii.—iv.) and Josephus (Antiq., VIII. iii. 1 ff.) are alike dependent. Unfortunately these two chapters of Kings are among the most difficult in the Old Testament, partly by reason of our ignorance of the precise meaning of several of the technical terms employed, partly owing to the unsatisfactory state of the received text, which has been overlaid with later additions and glosses. As regards the foundation of the temple, most writers have adhered to the main results of Stade's epoch-making essay in his Zeitschr. f. d. alttest. Wissenschaft, iii. (1883), 129—177, reprinted in his Akademische Rede, &c., with which compare Stade and Schwally's critical edition of Kings in Hermann's Sacred Books of the Old Test. See also, in addition to the standard commentaries, Burney, Notes on the Heb. Text of ... Kings, Vincent's critical appendices, and Stade's Die Heilige Stätte (Oct. 1907), and the literature cited at the end of this article.

(a) The Site of the Temple.—On this important point our earliest authority is silent. It is now universally acknowledged, however, that the whole complex of buildings erected by Solomon stood along the crest of the eastern hill, crowned by the temple at the highest point, as Josephus expressly testifies (Bell. Jud.; V. v. 1, with which compare the letter of (Pseudo) Aristeas, sect. 84). This at once brings to the site of the temple into proximity to the world-famous sacred rock, the sakkra, over which now stands the building known as the Mosque of Omar, and, more correctly, as the Dome of the Rock. Here an other important consideration comes to our aid. From the recognized persistence of sacred sites in the East through all the changes in the dominant religion, it is well-nigh certain that the sanctity of the sakkra rock goes back to the days of David and Solomon, or even, it may be, to prehistoric times. On it, or over it, the angel was believed to have been seen by David, and there David built his altar (2 Sam. xxiv. 18—25; cf. Judges vi. 20 f., 24; xiii. 19 ff.). This is undoubtedly the site assigned to the temple by the oldest extant tradition (see Chron. xii. 1; cf. 2 Sam. xxivv.). By every token, then, Solomon's temple of the sakkra rock was no lighter idea than the sakkra (see below), at least stood upon it. Since the altar necessarily stood in front, i.e. to the east, of the temple, the site of the latter was a short distance to the west of, and in line with, the sacred rock (see Jerusalem).

The alternative view, associated in recent times with the names of Schick and Conder, which places the most holy place, or innermost shrine of the temple, over the sakkra, has now few advocates (e.g. Col. Wallis in the Quarterly Statement of the Palestine Exploration Fund for 1896 and 1910). Apart from difficulties of space towards the east, which this location involves, it cannot be accepted in face of the fact that the sakkra still bears the marks of its former use as altar (see esp. Kittel, Studien zur k. Altertumskunde, 12 ff.). Moreover the rock, measuring as it does some 55 ft. by 40, could not have been contained within the "holy of holies," which was less than 20 ft. square.

A third site, still within the present Haram area, but towards its south-west angle, favoured by Fergusson (The Temple of the Jews), Robertson Smith (Encyc. Brit., 9th ed., art. "Temple") and others, was that of a "house" of Shiloh, near by, and also in the time of Solomon (Stade, op. cit., 12 ff.).

(b) The Temple Building.—In the fourth year of his reign Solomon "began to build the house of the Lord" with the laying of a massive foundation of "great stones," as required by the rapid fall of the ground to the west of the sakkra. Architecturally the temple consisted of three distinct parts: (1) the naos or temple proper, (2) a porch or pylion in front of the naos, and (3) a lower and narrower building which surrounded the naos on its other three sides (see fig. 1).

(1) The first of these, the "house of the Lord" in the strict sense, in which alone He was worshipped, was oblong in plan, and was divided into two compartments by a partition wall 2 : 1 by a partition wall. The room next the porch was 40 cubits in length by 20 in breadth, with a height of 30 cubits, 1

1 The length of the cubit at this period cannot be determined with absolute certainty. From the fact that Herod's naos was an exact replica of Zerubbabel's as regards inside measurements, coupled with the presumption that Zerubbabel built upon Solomon's foundations, it is possible to suppose that the same standard of length was used throughout. Now the present writer has shown from an inductive study of the height of the courses in the walls of the Haram and of other existing remains of the Hebrew temples that the cubit used by Herod's builders was exactly 17.6 in. or 447 millimetres (see Expository Times, xx. [1908—09] 24 ff.). There is therefore good reason for believing that this was also the cubit of Solomon's temple, notwithstanding the statement of 2 Chron. iii. 3 that the latter was a cubit "after
 The beams forming the floors and ceilings of the several storeroys being let into the wall of the hēkāl, three successive rebates of one and a half cubits in depth were cut into it (see fig. 2), consequently the width of the chambers was 5, 6 and 7 cubits in the three storeroys respectively (vi. 6). The total height, allowing for floors and roof, of the lateral building cannot have been less than 17 cubits. Entrance to the side-chambers was provided by a single door on the south side (see ground-plan, fig. 1).

So far there is no difficulty as regards the general plan and dimensions of the temple, provided it is kept in mind that the figures given must necessarily be placed in the upper third of the side walls, as will presently be seen. Adjoining the hēkāl on the west lay the dēbir or sanctuary, later termed "the most holy place" (lit. "holy of holies"). The inside space formed a perfect cube of 20 cubits, say 30 ft., in length, breadth and height (vi. 20), symbolizing the perfection of the Deity, for whose abode this part of the naos was specially designed. The dēbir, as has been said, was separated from the hēkāl by a transverse wall, whose existence we are left to infer from the obscure description of the door between the two compartments (vi. 31, see next section).

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**Fig. 1.** Ground Plan of Solomon's Temple.

**Fig. 2.** Section of Temple along a-b of Ground Plan.

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1. If the view presented below as to the height of the various parts of the temple is accepted, this wall becomes a structural necessity, being required to support the back wall of the hēkāl.
it may reasonably be inferred, was the height of the porch in the first temple, from which, in that case, the figure was derived. The probable outside measurements for the porch are thus 32 cubits for the breadth across “the house,” 15 for the depth including the front wall, and 60 cubits or 88 ft. for the height. As to the later height.

Still following the Egyptian model, the hēkāl will have had its separate roof of massive cedar beams, covered probably by heavy laterite blocks forming which 11-2 cubits may be allowed, giving a total of 32 cubits (42 ft.), equal to the outside width of the temple. In the same way the roof of the δēbrō will have had to 10 cubits lower, or circa 22 ft. in all, that of the lateral building about 4 cubits lower. According to the text (see下面的section on the temple from W. to E. in fig. 2). While the measurements given are, as they must necessarily be, in part conjectural, it is claimed for them that they introduce the element of proportion between the parts to an extent not attempted hitherto.

(c) The Interior of the Temple and its Furniture.—The entrance to the temple was through a wide and lofty opening in the front wall of the porch. Crossing the vestibule one entered the hēkāl by a large folding-door of cypress wood (vi. 34)—probably to 30 cubits wide as in Ezekiel’s temple—each of its four la-\n\nIt is 105 feet high above the ground level, or 10 cubits lower, or circa 22 ft. in all, that of the lateral building about 4 cubits lower. According to the text (see above on the temple from W. to E. in fig. 2). While the measurements given are, as they must necessarily be, in part conjectural, it is claimed for them that they introduce the element of proportion between the parts to an extent not attempted hitherto.

By the way, the width of the temple was about the same as that of the porch, or 10 cubits. The hēkāl was divided into two sections: the “greater court” and the “inner court.”

While the eastern (vi. 7-26) was for the sanctuary, the western (vi. 18-27) was for the holy of holies, the “holiest of holies.” The entrance to the hēkāl was through a large, folding-door (c. 34) of cypress wood, 10 cubits wide, each of its four leaves being ornamented with carved figures of chereubim, palms and flowers, all overlaid with gold. The inner walls of the hēkāl and the δēbrō were lined with boards of cedar from floor to ceiling, while the floor was covered with planks of cypress wood. From the hēkāl, a door in the partition wall gave entrance to the δēbrō. The doorway was not rectangular but apparently pentagonal in form (see the commentary on vi. 31), the lintel consisting of a boss of stone meeting at an angle, a feature “introduced to distribute the pressure of the superincumbent wall” (W. R. Smith). The walls of the δēbrō were ornamented with “pure gold” according to our present text (vi. 20); an enhancement of the dignity of the edifice as the earthly dwelling-place of the heavenly King is not so incredible as the profuse application of gold decoration to other interior and inferior parts of the house, even, as we have seen, to its floor (on this question see the critical works cited above).

As regards the furniture of the house, it is probable that the original text of 1 Kings introduced only the altar of cedar now found in the LXX text of vi. 20, and to be identified with the table of shewbread, as the sole furniture of the holy place. The ten golden candlesticks, properly lampstands, of vi. 23 are generally believed to have been introduced at a later date (cf. Jer. lii. 18 f.). In the most holy place stood the palaudium of Israel’s religion, the sacred ark of Yahweh. On either side of this venerable relic of the past were two cherubim, sculptured from olive wood and overlaid with gold, each 12 cubits high, their outstretched wings reaching right across the δēbrō, and forming a baldachin over the ark (vi. 23-28).

Although a part of the interior furniture of the temple, the remarkable twin pillars, either side of the entrance to the porch may be mentioned here, since they belonged rather to the temple than to its court. These pillars, which in the received text bear the enigmatical names of “Jachin and Boaz,” were hollow columns—the bronze metal being about 3 in. in thickness—over 26 ft. in height and 6 ft. in diameter, surmounted by elaborate capitals about 7½ ft. high. The latter were globular in form, ornamented by a specially cast network of bronze, over which were hung festoon-\n
1 The overlying of the floor with gold (1 Kings vi. 30) is a later interpolation; the same is probably true of the statues. The sculptures on the walls, which may have been added at a later date (cf. Ezek. xli. 18).

2 This partition and altar, if it can be remembered, had to support the back wall of the hēkāl according to the view of the temple archi
tecture advocated above.

3 The two “banners” of iii. 14 will be remembered, had to support the back wall of the δēbrō according to the view of the temple archi
tecture advocated above.

4 The various forms which the latter name assumes, in the Greek text, suggest an intentional disguise of an original Baa!, applied of course to Yahweh (Barnes, Jorn. of Thoel. Studies, v. 447 ff.).
TEMPLE

contemporary art. Where, it has often been asked, shall we look for the model or prototype of the temple edifice? Whence were derived the motif's to be seen in its decoration? What influences can be detected in the elaborate apparatus above described? Now it has long since been recognized that Syria, including Phoenicia and Palestine, was from the earliest times the meeting-place of streams of influence, religious, artistic and other, issuing from the two great fountains of civilization and culture in the ancient world, Egypt and Babylonia. To these must now be added the early civilization of the Aegean as revealed by the excavations in Crete, and the later but highly developed culture of the Hittites. As a result the art of Phoenicia and Syria, originally borrowed from Egypt mainly, had by the 10th century become thoroughly eclectic. Of this synthesis of traditions three great masters of contemporary art, for which Solomon was indebted to Phoenician architects and Phoenician artists. Thus the general disposition of the temple with its walled court, porch or vestibule and naos has been shown by modern excavation, and by later representations on coins, to be characteristic of Phoenician and North Syrian temple architecture. Here, however, we have an adaptation of the earlier temple architecture of Egypt. Egyptian influence is most clearly seen in the gradual decrease in the illumination of the several parts. In the temple court, as in its Egyptian counterpart, men worshipped under the bright sunlight; in the covered porch there was still a door to exclude the light which streamed in through the lofty entrance. But in the holy place only a dim light was admitted through latticed windows high up in the side walls, while the holy of holies, like the Egyptian cella, was completely dark.1

The sculptured panels of the interior were shown by Robertson Smith (Encyc. Brit., 9th ed., art. "Temple") to reveal familiar Phoenician motives, although Babylonia is probably the ultimate home of the cherubim. Excavations at Sinjirli in Northern Syria and at Megiddo have, further, solved the problem of the "tree of life" in the cedars of Lebanon. Within the temple were two rows of delicate "false beams" which were the architectural feature of the walls of the various courts (1 Kings vii. 12).2 The use of wooden beams alternately with courses of stone was a familiar expedient in early times. The practice of building walls with recurring rebates has also been illustrated by the recent excavations. While the prototype of the temple itself is to be sought, as has been said, in Egypt, Babylonian influence is clearly traceable in the symbolical "brazen sea," the apse of contemporary Babylonian, and doubtless also Phoenician, temples. The bronze lavers, finally, have been found to be dependent, both in their construction and in the motifs and iconography, on the art of the Aegean. From Crete and Cyprus they passed through Phoenician intermediaries to Syria and Palestine. The temple of Solomon, in short, is a product of the best Syro-Phoenician art of the period, itself the product of ideas which had their source in other lands.

The Temple of Zerubbabel.—In the year 536 B.C. the temple of Solomon was committed to the flames by order of Nebuchadrezzar (2 Kings xxv. 8; Jer. lii. 12 f.). Seventy years later its successor was finished and dedicated, the foundation having been laid in the second year of the reign of Cyrus (520 B.C.) by the governorship of Zerubbabel (Hag. ii. 18). There is every reason for assuming that the massive foundation courses of the earlier temple were still in situ, and available for the new building.3 The latter's inferiority, attested by Hag. ii. 3, was rather in respect of its decoration and equipment, as compared with the magnificence of the first temple, than as regards the size of the building. The dimensions given in the royal decree (Ezra vi. 3)—60 cubits for height and the same for breadth—probably refer, as was pointed out in a previous section, to the extremes of height and breadth applicable to the porch and temple respectively. In these and most other respects it may be supposed both temples followed the lines of Solomon's temple. It is probable, however, that the walls of the naos, including both the holy and the most holy place, were now raised to a uniform height, the separate back wall of the former having been abolished and the naos covered by a single roof. This seems a legitimate inference from the absence in the second and third temples of a supporting partition wall within the naos. Its place, as separating the two compartments, was taken by a magnificent curtain or "veil," which is mentioned among the spoils carried off by Antiochus Epiphanes (1 Macc. i. 21).4

In the matter of the sacred furniture, the holy place contained from the first the table of shewbread, and one golden "candlestick" or lampstand in place of the ten which illuminated the hêkâl in the later days, at least, of the first temple (Jer. lii. 19). The golden altar of incense, which fell a prey with the rest of the furniture to Antiochus (1 Macc. i. xxii. f.) was probably introduced later than the time of Zerubbabel, since a Jewish author, writing in the 3rd century B.C. under the name of Hecataeus of Aldera, mentions only "an altar and a candlestick both of gold," and it is natural to identify the former with the gold-plated table of shewbread.5 In one important respect the glory of the second house was less than that of the first. The holy of holies was now an empty shrine, for no one had dared to construct a second ark.

The second temple also differed from the first in having two courts, an outer and an inner, as prescribed by Ezekiel for his temple of the future. The outer court formed a square, each side of which was 500 cubits in length, also as prescribed by Ezekiel, with the sâbêra rock in the centre (see Exp. Times, XI, 257). Within the temple were two courts, one for the temple outer building, and one for the temple inner temple. The former, as described by Hecataeus, was composed of white unhewn stones (cf. Exod. xx. 25), "having each side 20 cubits long, and its height 10 cubits" (Josephus, Contra Apion, i. § 198), dimensions which agree with those assigned by the chronicler to the earlier altar of bronze (2 Chron. iv. 1).

In 165 B.C., three years after the spoliation of the temple and the desecration of its altar by Antiochus IV., Judas Maccabaeus rededicated the holy house, made sacred furniture, and erected a new altar of burnt-offering (1 Macc. iv. 41 f.). But long before this date the temple had assumed a character which it retained to the end of the Jewish state. It had become a fortress as well as a place of public worship, and existing records tell of the repetitive strengthening of its defences. "At the time of Pompey's siege (63 B.C.) it constituted an almost impregnable fastness, strengthened on its weakest or northern side by great towers and a deep ditch (Annal. xiv. 4, § 2). Twenty-six years later the temple was again besieged by Herod, who, attacking like Pompey from the north, had to force three lines of defence—the city wall, and the outer and inner temple," i.e. the walls of the outer and inner courts (W. R. Smith).

The Temple of Herod.—In the 18th year of his reign (20-19 B.C.), Herod obtained the reluctant consent of his subjects to his rebuilding scheme for enlarging the temple and beautifying its courts. The former was finished in eighteen months by a thousand priests trained for this special purpose, the courts in eight years, but the complete reconstruction occupied more than eighty years, lasting almost till the final breach with Rome, which culminated in the destruction of the sacred edifice by the soldiers of Titus in A.D. 70.

1 M. Clermont-Ganneau has put forward the interesting conjecture that the veil presented by Antiochus to the temple of Zeus at Olympia (Pausanias, V. xii. 4) was that taken from the temple at Jerusalem (see "Le Dieu sacré," Rec. du Journ. asiatique, 1904, 156). But long before this date the temple had assumed a character which it retained to the end of the Jewish state. Its size, as described by Hecataeus, was composed of white unhewn stones (cf. Exod. xx. 25), "having each side 20 cubits long, and its height 10 cubits" (Josephus, Contra Apion, i. § 198), dimensions which agree with those assigned by the chronicler to the earlier altar of bronze (2 Chron. iv. 1).

2 The witness of the Pseudo-Hecataeus and of another Jewish Hellenist, the Pseudo-Aristeas, regarding the second temple has recently been examined by G. A. Smith in his volumes on Jerusalem (see esp. index to vol. ii., and cf. Vincent. "Jérusalem d'après la lettre d'Aristée," Rev. bibliographie, 1908, 520 ff. (1909), 555 ff.).
(a) The Outer Court, its Gates and Colonnades.—The outer court of Zerubbabel's temple (900×300 cubits) was doubled in area according to Josephus (Bell. Jud. I. xxi. 1). The extension was principally on the south, which involved enormous subtractions on both sides of the hill, in order to secure the necessary level surface. There can be little doubt that this part of the present Haram area with its containing walls is essentially the work of Herod. The northern boundary of this great court, termed "the mountain of the house" in the Mishnah, and now generally known as "the court of the Gentiles," remained as before, and is represented by a line of scarped rock immediately to the north of the present inner platform of the Haram. This line of scarp, when prolonged east and west for about 1000 ft. in all, meets the east wall of the Haram a little to the north of the Golden Gate, at a point 300 yds. (800 cubits) from the S.E. angle, and the west wall at the same distance from the S.W. angle.1

The principal entrance to the temple enclosure, and the only one on a level with it, was on its western side by a bridge or viaduct which spanned the Tyropoeon at the spot marked by Wilson's arch. It is first mentioned in connexion with the siege of Pompey in 63 B.C., and according to the Mishnah it bore the name of the Gate of Kiponos (probably Coponius, the first procurator of Judea). Of the other three gates which Josephus assigns to this side (Ant. XV. xi. 5), the two leading to "the suburb" necessarily lay further north; one is represented by the old entrance now named Warren's gate, the other has not been identified. Josephus' third gate which led to the other, or lower city was undoubtedly Barclay's gate, and not, as is usually maintained, an entrance from Robinson's arch. In the south wall were two gates—the Huldah or "mole" gates of the Mishnah (Midr. i. 3)—represented by the present "double" and "triple" gates. Like the three last mentioned they had to be placed at the foot of the lofty retaining wall. From either gate a double ramp, which passed under the royal porch, led into the court in the direction shown on the accompanying plan. The Mishnah also names the "Shushan gate" on the east and the "Tadi gate" on the north.

Round the four sides of the great court ran a succession of magnificent porticoes in the style of contemporary Hellenistic architecture (Ant. XV. xi. 5). Those on the E., N., and W. sides had each three rows of columns forming a double walk or aisle; the eastern colonnade bore the old name of "Solomon's Porch" (John x. 23; Acts iii. 11). The southern portico was still more imposing and magnificent.

It had three aisles formed by four rows of monolithic marble columns of the Corinthian order,2 the first row engaged in the south wall of the court. The two side aisles were 30 ft. in width, the central aisle half as wide again (45 ft.); the columns of the former may be estimated at circa 60 ft., that of the latter at 100 ft. (Exp. Times, xx. 68 f.). The roofs were formed of deeply coffered cedar beams, that of the centre aisle being supported on pillars partly engaged in an ornamental stone balustrade. The "royal porch," as it was termed, worthily represents the high-water mark of Herod's architectural achievements in connexion with the reconstruction of the temple.

(b) The Inner Courts and Gates.—To the outer court Jew and Gentile, under certain conditions, had alike access. The sanctuary proper, from which the Gentile was rigidly excluded, began when one reached the series of walls, courts and buildings which rose on successive terraces in the northern half of the great enclosure. Its limits were distinguished by an artistic stone balustrade, named the sekera, which bore at intervals notices in the Greek tongue warning all Gentiles against advancing further on pain of death. Beyond the zôrg a narrow stone terrace, approached by flights of steps, was carried round all sides of the sanctuary save the west (see Bell. Jud. i. 5 [§ 38]), and extended to the foot of the lofty fortified walls of the temple enclosure (see X Y Z on plan, fig. 3).

The walls, over 35 ft. in height (25 cubits), were pierced by nine gateways, marked HÎ to HÎ on the accompanying plan, of which four were in the north and south walls respectively, and one in the east wall. These nine gates opened into massive two-storied towers, each 30 cubits deep (Bell. Jud. v. v. 3). Eight were "covered over with gold and silver, as were also the jambs and lintels" (ibid.), while the ninth, the principal entrance to the sanctuary, in the east wall (HÎ) was composed entirely of Corinthian brass, the gift of a certain Nicoran. Hence it was variously named "the Corinthian gate," "the gate of Nicoran" and "the beautiful gate" (Acts iii. 2, 10).4

Entering the sacrosanct area by this gate one found oneself in a colonnaded court, known as the court of the women (A) since women as well as men were admitted to this court, and at that epoch were engaged in the various arts of domestic worship. The four corners of the women's court were occupied by large chambers for various ceremonial purposes, while between these and the gate-houses were smaller chambers, one set being known as "the treasury" (Mark xii. 42). The western side was bounded by a high wall, beyond which, on a higher level, lay the inner or priests' court. The entrance to the latter was by an enormous gateway, 50 cubits by 40, through which an uninterrupted view was obtained of the altar and of the temple beyond it. To this "upper gate" 5

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1 Which see for key to the several parts.
2 The area of the "court of the Gentiles," including the walls, was thus 800 cubits in length from N. to S., with an average width of circa 650 cubits of 17-6 in.—the present south wall measures 922 ft.—i.e., circa 520,000 sq. cubits as compared with the former area of 250,000, a remarkable confirmation of Josephus' statement as to the doubling of the temple courts. For the statements and measurements in this and the following sections differing from those of previous writers, reference may be made to the series of preliminary studies entitled "Some Problems of Herod's Temple," by the present writer, which appeared in The Expository Times, vol. xx (1908-1909), pp. 24 ff., 66 ff., 181 ff., 270 ff.
3 Such one gigantic monolith was discovered a few years ago in a disused quarry (see Exp. Times, xx. 69).
4 For this triple identification see Schürer's essay, Zeits. f. neuter. Wiss. (1906), 57–89; Berto, Rev. des études juives, ix. (1910), 30 f.; also Exp. Times, xx. 270 f.
(H1) a flight of fifteen semicircular steps led up from the court of the women. On a level with the entrance and running round three sides of the inner court (so Josephus) was a narrow strip (B), about 18 ft. broad, called the "court of the men of Israel." The rest of the oblong area, however, was not open to the public, but the priests and such of the laity as might require admission for the offering of their sacrifices. As in the lower court, the spaces between the gates were occupied by chambers, as to the purpose of which details are given in the Mishnah.

With regard to the more precise location of these temple courts, the present writer in the series of essays above referred to (see esp. Exp. Times, xx. 182 ff.),1 has endeavoured to prove that the whole fortress-sanctuary within the great walls stood on what is now the inner platform of the Haram, the present extended area of which is indicated by the double dotted line on the plan. According to the Mishnah (Middoth, ii. 5, 6) the upper and lower courts together formed a rectangle measuring 322 cubits from west to east by 135 cubits from north to south. The upper court 137 by 135, the lower 135 by 135. But, on the one hand, no account is taken of the gate-towers and priests' chambers which lined the courts, and on the other, the frequent recurrence of the number 11 and its multiples in the details which make up the above totals awakens suspicion as to their accuracy. The measurements of the accompanying plan are based on a critical comparison of the data of the Mishnah and those of Josephus with the relation of the whole to the altar on the sakhra (see next section). The total area covered by the sanctuary, including the terrace or khal, is entered as 315 cubits (462 ft.) across the rock from west to east, and 280 cubits (367 ft.) from north to south (for the detailed measurements see Exp. Times, xx. 181 ff., 271 ff.). The upper court shows an area of 170 cubits by 160, the lower court has a free space between the colonnades of 135 cubits (the Mishnah figure) by an average width of 110 cubits.

(c) The Altar of Burnt-offering.—Herod's great altar (D on the plan) was formed of unhewn stones, like that which preceded it. Its size, however, was increased till it formed a square, each side of which measured 32 cubits or 47 ft. at the base, thus occupying almost the whole of the exposed surface of the sakhra. The sides of the square decreased upwards by three stages until the altar-hearth was only 24 cubits square. The priests went up by an inclined approach on the south side (cf. Exod. xx. 26). To the north was the place where the sacrificial victims were slaughtered and prepared for the altar (cf. Levit. i. 11). It was provided with rings, pillars, hooks and tables. A laver (O on the plan) for the priests' ablutions stood on the west of the altar ramp.

(d) The Temple Building.—A few yards to the west of the altar rose the temple itself, a glittering mass of white marble and gold. Twelve steps, corresponding to the height (12 cubits) of the platform, led up to the entrance to the porch. In the disposition of its parts Herod's temple was in all essential respects a replica of its two predecessors. But there were differences in details. Thus the porch was increased in width and height until its front elevation measured, according to our authorities, Josephus and the Mishnah, 100 cubits by 100. This, however, probably includes the platform, as the principles of design both in relation to the other dimensions suggest 96 cubits by 96 (over 160 ft.) for the actual building. In shape the porch may be supposed to have retained its original likeness to an Egyptian pylon, as suggested in the accompanying diagram (fig. 4).

The holy place (F) retained its former area (40×20 cubits), but was raised in height to 40 cubits. A magnificent double curtain, embroidered in colours, screened off the most holy place. A richly bound a period, a shrine was made by cutting a passage-way giving access to the side-chambers and requiring an extra outer wall. Herod increased the width of the temple building to at least 60 cubits (70 according to the Mishnah). The problem of the height of the naves remains almost as perplexing as before. Josephus, it is true, agrees with the Mishnah (Middoth, lv. 6) in giving it a height of 100 cubits. It may be that Herod, "if he was forbidden to extend the House, would at least make it soar!" (G. A. Smith.) But the details given by the Jewish doctors do not inspire confidence, for, as Fergusson long ago perceived, "one storey is merely an ill-understood duplication of the other. A more modest height of 66 cubits (88 1/2 ft.), reduced to the extreme width, gives at least an element of proportion to the edifice which is altogether wanting in the traditional figures (compare the accompanying reconstruction, fig. 4)."

The entrance to the porch now measured 40 by 20, equal to the section of the holy place. The "great door of the house," 20 cubits high and 10 wide, was covered with gold; in it was suspended a richly embroidered Babylonian veil, while above the lintel was fixed a huge golden vine.

(e) The Temple Furniture.—This remained as before. In the holy place in front of the holy of holies, still a dark and empty shrine, stood the altar of incense, against the south wall the seven-branched golden lampstand, and opposite to it the table of shewbread. The two latter, as every one knows, were carried to Rome by Titus, and representations of them may still be seen among the sculptures adorning the arch which bears his name.

When one considers the extraordinary height and strength of the outer walls of the temple area, parts of which excite the wonder of every visitor to the holy city, the wealth of art lavished upon the wide-extended cloisters, the imposing character of the temple façade, and the impression produced by the marble-paved terraces and courts rising in succession, each above and within the other, one is not surprised that the temple of Herod was reckoned among the architectural wonders of the ancient world. There is for once no exaggeration in the words of Josephus when he records that from a distance the whole resembled a snow-covered mountain, and that the light reflected from the gilded porch dazzled the spectator like "the sun's own rays" (Bell. Jud. v. 6).

LITERATURE.—In addition to the primary sources, the Bible, Josephus, and the Mishnah treatise Middoth (ed. Surenhusius with commentaries), the commentaries and notes on Kings by Benzinger, Kittel, Stade, Burney and Skinner, the articles on the temples in the recent Bible Dictionary and the "Archaeologies" of Benzinger and Nowack, the following should be consulted: Le Temple de Jérusalem (1868); J. Fergusson, The Temples of the Jews (1878); Perrot et Chipiez, Le Temple de Jérusalem (1889); C. Schick, Die Stützhauste, der Tempel, &c. (1896); W. Shaw Caldecott, Solomon's Temple (1906), and The Second Temple (1908); R. Kittel, "Tempel" and "Tempelgeräte" in Herzog-Hauck, Realencyklopädie, 3rd ed. (1907), vol. xix.; G. A. Smith, Jerusalem, 2 vols. (1906, see index to each vol.); also W. R. Smith's article "Temple" in Encyclopaedia Britannica. For Herod's temple especially see Malmonides' treatise Beth Ha-bekhem (the chosen house), trans. in Quart. Statement of Pal. Explor. Fund (1888); and the recent studies by Watson, ibid. (1906 and 1910); Waterhouse, in Sunday's Sacred Sites of the Gospels (1903); A. R. S. Kennedy, "Some Problems of Herod's Temple," Expository Times, vol. xx. (1908-1909); G. Dalman, "Der zweite Tempel zu Jerusalem," in Jerusaleminhabrbuch (1900); P. Bletterman, "Ein Tempel in Jeru- salem," Rev. des études juives, lix.-lx. (Jan.-July 1910), and the articles in the Jewish Encyclopedia. For the study of the site the works of the English surveyors (see Jerusalem), including Sir C. Wilson's large-scale map of the Haram, are indispensable.

A. R. S. K.)

XXVI. 20

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1 A summary of the results is given in the article "Temple" in Hastings' Dict. of the Bible (1909).

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5
Egyptian Temples.—In the architectural sense the earliest temples in Egypt probably consisted only of a small cella, or sanctuary, with a portico, such as are represented in the models of soul-houses found in 1907 by Flinders Petrie at Rifeh; in front of these various additions were made, so that eventually the temple assumed far greater importance than was at first contemplated. This custom is at variance with that which takes place in the development of other architectural styles, where the older buildings are constantly taken down and rebuilt in accordance with the increased knowledge acquired in construction and design. It follows from this that although the Egyptian temples vary in their dimensions and extent, as a rule they present the same disposition of plan. The principal exceptions to this rule are the sepulchral temples, such as those of Deir el Bahri, and the more ancient example adjoining it, discovered in 1906, in which there are no enclosed halls of columns or sanctuary, and the Mammeisi temples (Fig. 5), which in plan resemble the Greek peristylar temples and might have been suggested by them, had not the example at Elephantine (destroyed in 1852) been of much earlier date, having been built by Amenophis III. (1414-1379).

The earliest example of which remains have been found is the temple built by Cephen in front of his pyramid at Memphis, and this consisted only of a sanctuary of small size without any architectural perfections. The next in date would be the sepulchral temple built by Mentuhotep (2832-2796) adjoining Deir el Bahri at Thebes; then follows the sanctuary of Karnak, built by Senwosri (Usertesen I.) (2758-2714), which formed the nucleus of that immense temple, which covered an area of 400,000 sq. ft. This temple may be taken as an extreme type of the accumulation which is found in nearly all the Egyptian temples, owing to the additional perfections to the original structure by successive monarchs, instead of rebuilding, as was the general custom in all other styles. To a certain extent the same conservative principle seems to have governed the design of all other temples, and even the temple at Edfr, which was set out on a plan conceived from the first, has the appearance of having been added to at various periods, the fronts of the inner halls showing inside those built in front. It is not only in the plan that the close resemblance of one building to another is shown; the architectural design is repeated in the earliest and latest temples; the raking sides of the pylons and walls with the torus-moulding of the quoins and the cavetto cornice are identical, so that it is only by the inscriptions that one is able to ascribe the buildings to the kings of the 18th or following dynasties and distinguish them from those erected by the Ptolemies, or even under Roman rule. The only differences are those exhibited in the great halls of columns, which, in the earlier temples, were built in between the pylons and side walls, receiving their light through clerestory windows, as at Karnak (Fig. 6), the other temples in its vicinity and the Ramesseum; whereas in the later temples on one side of the walls a screen was built between the columns, over which the interior was lighted. The second change was that made in the capitals of the columns, which are of wonderful diversity of design, some on the same hall, including every variety of river plant, in addition to the papyrus and lily flowers; in the later temples also the columns are more slender in their proportions and not set so closely one to the other.

Although generally the temples are built symmetrically on a central axis, with walls at right angles to one another, there are some special exceptions; thus the axial line of the great entrance court of the temple at Luxor is at an angle of about 15° with that of the temple in its rear, and in the island of Philae no two buildings are on the same axis or are parallel to or at right angles to one another, thus conforming to the irregular site on which they were built.

Assyrian.—The temple in Chaldaea or Assyria (known as a zigurart) was of an entirely different class, and took the form of a many-storeyed structure, of which the typical example is the Birs Nimrud. This originally consisted of six storeys, each one set behind the other, so as to admit of a terrace round each, the upper storey being crowned by a shrine.

Access to the several storeys was obtained by flights of steps, either lying parallel with the front or in one continuous flight in centre of same, or again as at Khorsabad by a ramp winding round the tower; the architectural design consisted of sunk panels on the various storeys with battlement parapets, and, like the Birs Nimrud, the several storeys were dedicated to the seven planets, the walls being enriched with the colours sacred to each.

Greek and Roman.—In Greece the earliest example of a temple is that of the Heraeum at Olympia, ascribed by Dr Dörpfeld to the 10th century B.C. The Heraeum (fig. 7) consisted of

a central naos or sanctuary with pronaoi in front and opisthodomus in the rear, the whole enclosed by a peristyle, thus presenting the characteristics of the fully developed temple of the 5th century. As, however, the description of the several types would be rendered clearer if they were taken from the simplest plan to the more elaborate, adopting to a certain extent the definitions given by Vitruvius, they are as follows:—
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**DISTYLE-IN-ANTIS**, a cella or naos preceded by a portico of two columns placed between the prolongation of the cella wall. Fig. 8.

The Temple of Themis Rhamnus.

**Fig. 8.**

**Fig. 9.**

**Fig. 10.**

**Amphidistyle-in-antis**, similar to the foregoing but with a second portico in the rear. Fig. 9.

The Temple of Diana Propylaea, Eleusis.

**Tetrastyle prostyle**, with a portico of four columns in front. Fig. 10. The Temple B. Selinus, Sicily.

**Tetrastyle amphiprostyle**, with an additional portico of four columns in the rear. Fig. 11. The Temple of Nike Apteros, Athens.

**Hexastyle peripteral**, six columns in front and rear and a peristyle round the cella forming a covered passage round. Fig. 12. The Temple of Theseus, Athens.

**Octostyle peripteral**, eight columns in front and rear and a peristyle round. Fig. 13. The Parthenon, Athens.

**Octostyle dipteral**, eight columns in front and rear and a double row in the peristyle. Fig. 14. The Temple of Jupiter Olympus, Athens.

**Octostyle pseudo-dipteral**, similar to the last, except that the inner row of columns is omitted, thus giving a passage round of twice the ordinary width. Fig. 15. The Temple of Apollo (Sminthis), Troad.

**Decastyle dipteral**, ten columns in front and rear and a double row in the peristyle. Fig. 16. The Temple of Apollo Didymaeus, at Branchidae, near Miletus.

The above definitions apply to Greek temples, whether of the Doric, Ionic or Corinthian orders. The Romans in some of their temples adopted the same disposition, but with this important difference, that, instead of the temple resting on a stylobate of three steps, it was raised on a podium with a flight of steps in front. In some of their temples, requiring a larger cella wherein to store their works of art, it occupied in the rear the full width of the portico in front; they retained, however, the semblance of the peristyle, the columns of which became semi-attached to the cella wall. If the portico had four columns, the temple was known as **tetrasyle pseudo-peripteral**, of which the so-called temple of Fortuna Virilis at Rome is an example; and if six columns, **hexastyle pseudo-peripteral**, as in the Maison Carrée at Nîmes.

In front of the naos or cella of the Greek temple there was always a pronaos, viz. a vestibule with two or more columns in antis, and in the rear a similar feature known as the epistheodos or treasury; in a few cases, as in the Parthenon, this formed a separate chamber, which was entered through a similar vestibule to that in front of the naos; this same vestibule in the absence of the separate chamber was sometimes enclosed with bronze grilles and used as the epistheodos; the Latin term posticum is frequently given to this rear vestibule, for which the Germans and Americans have adopted the term epinaos when speaking of Greek temples. In Roman temples the posticum is rarely found; the portico, on the other hand, was increased in importance, being frequently the depth of three bays or columnisations. In most of the early Greek temples the cellas were comparatively narrow, owing to the difficulty of roofing them over, as the Greeks could not seem to have been acquainted with the principle of the trussed beam. When therefore more than the usual width was required it became necessary to introduce columns on each side within the cella to carry the ceiling and roof, the earliest example of which existed in the Heraeum at Olympia. There are two other temples in which some of these internal columns still exist, as in the temples at Aegina and Paestum. At Aegina there were five columns on each side, carrying an architrave with five smaller columns superposed; in the temple of Neptune at Paestum there were seven on each side; and in the Parthenon nine columns and a square pier at the end with three columns in the rear, thus constituting an aisle on three sides, round which privileged visitors, like Pausanias, were allowed to pass, there being bronze rails between the columns. In the temple of Zeus at Olympia traces of the barriers have been found, as also of an upper gallery, access to which was given by a wooden staircase. The question of the lighting of these temples has never been definitely settled; it is probable that as a rule the only direct light received was that through the open doorway (see **HYPOTECHOS**).

In the earliest temples, those of the Heraeum at Olympia, of Apollo at Thermon, and the arched temple at Argos, the columns of the peristyle were in wood and carried a wooden architrave; in the Heraeum the wooden columns were replaced by columns in stone when they showed signs of deterioration; the earliest stone columns which were introduced date from the 5th century, and in the Heraeum in the 2nd century saw one wood column still in situ in the epistheodos. From about the middle of the 7th century...
the columns were always in stone, and were generally built in several courses with drums or frusta, there being very few instances of monolithic columns in Greek temples; the Romans, on the other hand, in their principal columns considered the monolith to be more monumental, and not only employed the finest Greek marbles to that end, but used granite and porphyry.

The favourite type of Greek temple was that known as hexastyle peripteral, of which the temple of Aphaea at Aegina, of the

![Fig. 20.](image)

Doric order, is one of the best-preserved examples; on account of the width of its naos it was necessary to provide columns inside it to carry the ceiling and the roof, so that it represents the fully developed type of a Greek temple. The plan of the temple is shown in fig. 18; the elevation is given in fig. 19, representing the west front, the columns of which rest on a stylobate of three steps, and carry the entablature and pediment. Fig. 20 shows the three first columns of the flank elevation, the entablature carried by them, and the tiled roof with antefixa and crested ridge.

![Fig. 21.](image)

Fig. 21 gives the section through the stylobate, peristyle and pronaos, and half of the naos, showing the superposed columns, ceiling and roof, all based on the conjectural restoration by Cockerell. The temple of Aegina is supposed to have been erected about 500 B.C., the magnificent sculpture with which it is enriched being added c. 480 B.C. The temple was built of a fine calcareous stone from quarries close by, which was coated over with a thin layer of stucco of lime and marble dust; this enabled the masons to give finer profiles to the mouldings, and afforded a field for colour, of which the restoration is shown in Cockerell's Temple of Aegina, from which the illustrations are taken; the cymatium and the tiles covering the roof were in Parian marble.

The Greek Temples were always enclosed in a temenos, in which were other shrines, altars and treasuries; in Athens the temenos was the Acropolis, on which the temples were built; at Delphi it was in a valley on inclined ground; and in Grgenti the temples were raised on the ridge of a hill; in all these cases the Greeks accepted the inequalities of the site, and, adding art to nature,

![Fig. 22.](image)

united their work with that of the Creator, so that it seemed to form part of the same design. Some of the sites of the temples, such as those at Olympia, Epidaurus and Delos, were practically level, but even in those the temples and other structures were arranged in groups, thus producing a much more picturesque effect than in those of the Romans, which, when enclosed, were always

![Fig. 23.](image)

planned on axial lines and raised on artificial platforms or terraces, as at Baalbek, Palmyra and Aizani, with peristyles round the raised court. The best-preserved Roman temple is that known as the Maison Carrée at Nîmes in the south of France, a hexastyle pseudo-peripteral temple, of which the elevation is given in fig. 22 and the plan in fig. 23. It was of the Corinthian order, and instead of a stylobate of three steps was raised on a podium 11 ft. high with a flight of steps in front. For further descriptions of both the Greek and Roman temples see Architecture.

(R. P. S.)
TEMPLE BAR, an historic site in London, England. In more than one of the main roads converging upon the city of London a bar or chain marked the extra-mural jurisdiction of the Corporation. Temple Bar stood at the junction of the present Strand and Fleet Street, over against the Law Courts. A bar is first mentioned here in 1301, but the name is most familiar in its application to the gateway designed by Sir Christopher Wren, which replaced an older structure here in 1673. This was removed in 1878, and set up in 1888 at the entrance to Theobalds Park near Cheshunt, Hertfordshire. A pedestal surmounted by a dragon or "griffin" marks the old site. When the sovereign is about to enter the city in state, whether by Temple Bar or elsewhere, the Lord Mayor, in accordance with ancient custom, presents the sword of the city to him, and he at once returns it. Formerly the bar or gate was closed against the sovereign until this ceremony was carried out.

TEMRYUK, a seaport of Russia, in northern Caucasus, and in the government of Kuban, on the Sea of Azov, 81 m. W.N.W. of Ekaterinodar. Pop. (1897) 14,476. Here was a Turkish fortress, Abas, till 1774. The place is now a growing seaport for the export of grain, and has many flour-mills.

TENASSERIM, a division of Lower Burma, bordering on Siam. Area, 36,976 sq. m. Pop. (1901) 1,159,558, including 38,269 Christians, the great majority of whom are Karens. The headquarters of the commissioner are at Moulmein. It is divided into six districts: Tungoo, Salween, Thaton, Amherst, Tauyoy and Mergui. It formed the tract south of Pegu conquered from Burma in 1826, which for many years known as the Tenasserim province. The southern extremity of the division approaches the insular region of Malaysia, and it is fringed along its entire western boundary by a number of islands, forming in the north the Moscos and in the south the Mergui Archipelago. The eastern frontier is formed by a mountain range 7000 ft. high, which acts as a water-parting between the Tenasserim and the Siamese river systems.

TEN BRINK, BERNHARD EUGENIUS KONRAD (1841-1892), German philologist, of Dutch origin, was born at Amsterdam on the 13th of January 1841, but was sent to school at Düsseldorf, and afterwards studied at Münster, and later under Diez and Delius at Bonn. In 1866 he began to lecture at the Münster Academy on the philology of the English and Romance languages. In 1870 he became professor of modern languages at Marburg, and after the reconstitution of Strassburg University was appointed professor of English there in 1873. In 1878 he began to edit, in conjunction with W. Scherer, E. Martin and E. Schmitz, Quellen und Forschungen zur Sprache und Kulturgeschichte der germanischen Völker. He devoted himself for many years to the study of Chaucer. In 1877 he published Chaucer: Studien zur Geschichte seiner Entwicklung und zur Chronologie seiner Schriften; in 1884, Chaucers Sprache und Verskunst. He also published critical editions of the Prologue and the Complaynt of Pity. Ten Brink's work in this direction stimulated a revival of Chaucer study in the United Kingdom as well as in Germany, and to him was indirectly due the foundation of the English Chaucer Society. His Bewußt-Untersuchungen (1888) proved a hardly less valuable contribution to the study of Early English literature. His best known work is his Geschichte der englischen Literatur (1889-93), (English by H. Kennedy in Bohn's Standard Library), which was unfortunately never completed, and broke off just before the Elizabethan period. It was his intense admiration of Shakespeare that first attracted him to the study of English, and five lectures on Shakespeare delivered at Frankfurt were published after his death (1893). Ten Brink's collections and good collection of books died in 1892.

TENBURY, a market town in the Bewdley parliamentary division of Worcestershire, England, on the Kidderminster-Woofferton branch of the Great Western railway, 153 m. W.N.W. of London. Pop. (1901) 2080. It is pleasantly situated on the right bank of the Teme, here the boundary with Shropshire. The town has a spa, whose waters are efficacious in rheumatic affections and diseases of the skin. The church of St Mary the Virgin has Norman remains in the tower and chancel. The district produces hops and fruit, and there is trade in cider. The Teme abounds in trout and grayling, and Tenbury is in favour with anglers. At Old Wood, 2 m. S.W. of Tenbury, are St Michael's church and college (1858), founded and partially endowed by the Rev. Sir Frederick Gore Ouseley, in which the ordinary preparatory education of boys is combined with a school for choristers and instruction in ecclesiastical music.

TENBY, a market town, seaside resort, a municipal and contributory parliamentary borough of Pembrokeshire, Wales, finely situated on a long narrow promontory of limestone rock washed on three sides by the sea on the west shore of Carmarthen Bay. Pop. (1901) 4400. Tenby is a station on the Whitland-Pembroke Dock branch of the South Wales system of the Great Western railway. Its chief attractions as a watering-place are its picturesque appearance and surroundings, its extensive antiquarian remains, its mild climate and its two excellent beaches known as the North and South Sands. The ancient town walls survive almost intact on the north and west sides, and retain the fine St George's gateway, locally called the "Five Archers." These walls, which were largely rebuilt by Jasper Tudor, earl of Pembroke, during the Wars of the Roses, were again repaired under Elizabeth during the alarm of the Spanish invasion, as is shown by a contemporary tablet bearing the queen's cipher and the date 1588. The inconceivable ruins of the castle, presenting a portion of the keep and outer walls, occupy a rocky peninsula to the S.E. of the town known as the Castle Hill, which also contains the Welsh national monument to Albert, prince consort, an immense statue and pedestal of white marble erected in 1865. Upon the Castle Hill is a small museum, containing several antiquities of the local tribe and marine fauna, for which last Tenby has long been celebrated. Opposite the Castle Hill, about 100 yds. distant, but only accessible to foot passengers at low tide, is St Catherine's Rock with a fort constructed in 1815. Facing the Esplanade and South Sands, about 2½ m. from the shore, stretches Caldy Island, 1 m. in length and 3rd m. in breadth, with a population of seventy persons and containing a ruined priory, which was a subsidiary house to St Dogmell's Abbey. To the west, between Caldy Island and Gilar Point on the mainland, lies St Margaret's Rock. The parish church of St Mary, situated at the northern extremity of the island, where the principal open space in the town, is one of the largest churches in South Wales, and exhibits all varieties of architecture from the 12th to the 16th centuries. Its massive tower, crowned with a spire, is 152 ft. high, and forms a prominent object in all views of the town. The handsome interior is remarkably rich in early tombs and monuments, the most important of them being the elaborate altar-tomb of John and Thomas White (c. 1483), members of an opulent family of merchants long seated in Tenby. In the adjoining churchyard are some remains of the Carmelite friary founded by John de Woofferton in 1399. The harbour on the northern beach is protected by an ancient stone pier, and in 1805 an iron pier was erected below
TENCH—TENDER

the Castle Hill for the convenience of the steamboats which ply between the town and Bristol, Ilfracombe, &c. The trade of Tenby is inconsiderable, but the fisheries, for which the place was noted at an early period and which gave it its Welsh name of Dibnych y Pygdrd, are of great value.

The name of Tenby is undoubtedly a corrupted form of Daneby, recalling the Scandinavian origin of the place. The real importance of Tenby dates from the 13th century, when walls, castle and church were erected for the convenience of the Flemish colonists, who were then being planted in Dyfed. On more than one occasion the newly-founded town was captured, sacked and destroyed by marauding bands of Welshmen, notably in 1152; but on each occasion the place was rebuilt and refortified by the earls-patine of Pembroke, who greatly favoured this important settlement. The first earl of Pembroke to grant a charter of incorporation was William de Valence, 9th earl (temp. Henry III.), and these privileges were extended by his successor, Earl Aylmer. Henry IV., by a charter obtained in 1402, vested the government of the town in a mayor and two bailiffs to be elected annually. Elizabeth in 1580 confirmed all previous charters and incorporated the freeholders under the designation of "the mayor, bailiffs and burgesses of the borough of Tenby." During the 15th and under the Tudors the town grew extremely prosperous, and contained many wealthy mercantile families, of which that of White offers the most striking example. A member of this house, Thomas White, whilst mayor of Tenby, did signal service to the Lancastrian cause in 1471 by harbouring Jasper Tudor, earl of Pembroke, and his nephew Henry Tudor, earl of Richmond (afterwards King Henry VII.), prior to the conquest, to France. John Leland (c. 1540) described Tenby as being "very wealthy by merchandize," and noted its stone pier and well-built walls. The town suffered severely during the Civil Wars, undergoing two sieges, firstly in 1644 when the parliamentarian, Colonel Laughrane, took the place by storm, and secondly in 1648 when it capitulated to Colonel Horton. After the Restoration the importance and wealth of Tenby showed a constant tendency to decline, but towards the close of the 18th century it rose into great popularity as a watering-place, and it has since maintained its reputation as the most picturesque seaside resort of South Wales. Since 1536 Tenby has been a contributory borough to the Pembroke (now Pembroke and Haverfordwest) parliamentary district.

TENCH (Tinca vulgaris), a small fish of the Cyprinid family, which is one of the commonest and most widely spread fresh-water fishes of Europe. It is generally distributed in all suitable localities throughout England, but is limited to a few lakes and ponds in the south of Scotland and in Ireland. As the tench is of comparatively uncommon occurrence in unenclosed waters, its place among the indigenous fishes of Great Britain has been denied, and it has been supposed to have been introduced from the Continent; a view which, however, is not supported by any evidence, and is practically disposed of by the fact that fossil remains of the fish are found in the Pleistocene deposits of Great Britain. In central Europe it thrives best in enclosed, preserved waters, with a clayey or muddy bottom and with an abundant vegetation; it avoids clear waters with stony ground, and is altogether absent from rapid streams. The tench is distinguished by its very small scales, which are deeply imbedded in a thick skin, whose surface is as slippery as that of an eel.

All the fins have a rounded outline; the short dorsal fin is without a spine, but the males possess a very thick and flattened outer ray in the ventral fins. The mouth is rather narrow and provided at each corner with a very small barbel. Tench if kept in suitable waters are extremely prolific, and as they grow within a few years to a weight of 3 or 4 lb, and are then fit for the table, they may be profitably introduced into ponds which are already stocked with other fishes, such as carp and pike. They live on small animals or soft vegetable substances, which they dig out from the bottom. The tench or "golden tench," as it is known, is often kept in ponds or aviaries, and is recommended for ornamental waters, as its bright orange colours render it visible for some distance below the surface of the water. This variety, which seems to have been originally bred in Silesia, is not less well-flavoured than the normally coloured tench, and grows to the same size, viz., to 6 and even 8 ft.

The tench is really an excellent fish for the table, if kept in cool, clear water for a few days, as it is the custom to do in Germany, in order to rid it of the muddy flavour imparted to it by its favourite abode.

TENCIN, CLAUDINE ALEXANDRINE GUÉRIN DE (1681–1749), French courtesan and author, was born at Grenoble. Her father, Antoine Guérin, sieur de Tencin, was president of the parlement of Grenoble. Claudine was brought up at a convent near Grenoble and, at the wish of her parents, took the veil, but broke her vows and succeeded, in 1714, in gaining formal permission from the pope for her secularization. She joined her sister Mme. de Ferriol in Paris, where she soon established a salon, frequented by wits and roverseaux. Among her numerous lovers were the Chevalier Le Camus Destouches, the due de Chandos, and according to her biographer many other persons of distinction. The last of her liaisons had a tragic ending. M. de la Fresnaye committed suicide in her house, and Mme. de Tencin spent some time in the Châtelet in consequence, but was soon liberated as the result of a declaration of her innocence by the Grand Conseil. From this time she devoted herself to political intrigue, especially for the preferment of her brother the abbé Tencin, who became archbishop of Embrun and received a cardinal's hat. Eventually she formed a literary salon, which had among its habitants Fontenelle, de St. Conté, Mme. de la Condamine, and many others. Hers was the first of the Parisian literary salons to which distinguished foreigners were admitted, and among her English guests were Bolingbroke and Chesterfield. By the good sense with which she conducted what she called her "menagerie," she almost succeeded in effacing the record of her early disgrace. She was a novelist of considerable merit. Her novels have been highly praised for their simplicity and charm, the last qualities the circumstances of the writer's life would lead one to expect in her work. The best of them is Mémoires du comte de Comminges (1735), which appeared, as did the other two, under the name of her nephews, MM. d'Argentat and Pont de Veyl, the real authorship being carefully concealed. Mme. de Tencin died on the 4th of December 1749.

Her works, with those of Mme. de la Fayette, were edited by Etienne and Jay (Paris, 1825); her novels were reprinted, with introductory matter by Lescure, in 1885; and her correspondence in the Lettres de Mmes. de Villars, de La Fayette et de Tencin (Paris, 1869–1892). See P. Masson, Madame de Tencin (Paris, 1909).

TENCIN, PIERS GUÉRIN DE (1679–1758), French ecclesiastic, archbishop of Embrun and Lyons, and cardinal, was born at Grenoble on the 22nd of August 1679. He owed his quick advance to power to his sister Claudine (see above). He was a strong opponent of the Jansenists, and in 1742 was appointed a minister of state to Louis XV., though he held no portfolio. He died on the 2nd of March 1758.

TENDER. (1) An adjective meaning soft, either physically or figuratively, derived from Fr. tendre, Lat. tener, soft, allied to tensis, thin, and ultimately to be referred to the root, tan-, to stretch out, as in Lat. tendere. (2) A legal term meaning an offer for acceptance, particularly an offer in money for the satisfaction of a debt or liability or an offer to pay or deliver
according to the terms of a contract; for "legal tender," the currency which can legally be offered and must be accepted in payment, see Payment. The term is also applied specifically to an offer to do a specified piece of work or to supply certain goods for a certain sum or at a certain rate or to purchase goods at a certain rate. Contracts for large or important works or for the supply of large amounts of goods are usually put out to tender in order to secure the lowest price. In this sense the word is from 14th to 17th century, from G. tendern, to see the new edition of the dictionary.

Between Tenebrae and the modern term the Tenebrae, a form of the word *tendere* (Lat. tendere, to stretch out); (a) a "tender" is also one who "attends" (Lat. *attendere*, to stretch towards, to give heed to), and so is applied particularly to a small vessel which brings supplies, passengers, &c., to a larger vessel, or which is used to take or bring messages from or to her, and similarly to a carriage attached to a locomotive engine on a railway which carries coal or other fuel and water.

**Tenebrae** (Lat. for "shadows," "darkness"), the name for an office sung in Roman Catholic churches on the afternoon or evening of Wednesday, Thursday, and Friday of Holy Week. The name is derived, according to Durandus (Ration., lib. vi. cap. 72, n. 2), from the fact that the "light of the world" or the Messiah cultivates darkness (tenebras colit): firstly because it is in sorrow and grief on account of the Lord's Passion, and because for three days it celebrates his exequies since for three days he was dead; secondly, the office of Tenebrae symbolizes the darkness that fell on the face of the earth while the Sun of justice was hung upon the cross," &c. The falling darkness is symbolized by a peculiar and singularly impressive ceremony (see LIGHTS, CEREMONIAL).

**Tenement** (Med. Lat. *tenementum*, from *teneo*, to hold), in law, a term which, according to Coke, "includes not only all corporate inheritances which are or may be held, but also all inheritances issuing out of those inheritances, or concerning, or annexed to, or exercisable within the same" (Co. Litt. 203). In its more general legal sense it is applied to reality, as opposed to personality. In its popular sense tenement is used as meaning a house or dwelling, and, more particularly in large cities, tenement houses are buildings occupied by several families living independently of one another, but having a common right in the hall, staircases and outhouses. In the heart of great towns the problem of housing is a difficult one, and it is only of recent years that attention has been directed to the unsuitable and insanitary condition of many houses occupied on the tenement system as defined above, but in many cases never built with the conveniences necessary for joint occupation. In most of the large cities in Great Britain and the United States tenement houses are now built on the most modern plans (see HOUSING), and it is to be noted that the municipality of New York has a special Tenement-House Department, under charge of a commissioner, with wide authority to supervise the structure of tenement houses and their occupancy in the interest of health and general welfare.

**Teneriffe** [Tenerife], the largest of the Canary Islands; in the Atlantic Ocean, and belonging to Spain. Pop. (1890) 138,008; area, 782 sq. m. Tenerife lies a little west of the centre of the archipelago, between the islands of Grand Canary and Gomera. It is of irregular shape, 60 m. long, with an extreme breadth of 30 m. A chain of mountains traverses the island in the direction of its greatest length (east to west), and in the middle of the broadest part rises the celebrated peak, locally known as the Pico de Teyde (or Teide), which, with its summit and spurs, occupies nearly one-third of the whole island. It has a double top: the highest point, El Pito, is 12,200 ft. above the sea; the other, Chahorra, connected with the first by a short narrow ridge, has a height of 9880 ft. They are both oriches in the same grand dome of trachyte. Neither reaches the line of perpetual snow. There is, however, a natural cavern, 11,050 ft. above the sea, where snow is preserved all the year. Snow remains for about four months on the upper part of the peak.

For more than one-half of its circumference the base of the true peak rises from an elevated but comparatively level tract, called by the Spaniards El Llano de la Retama (retama being the name of the *Cytisus subinclusus* which abounds there), and by the English the Pumice-Stone Plains. On the south-east, south and south-west are a high curved ridge overlooking the Pumice-Stone Plains, and presenting a very steep aspect; and on the north-west the sea the slope is more gradual, and there are intervening tablelands. Peaks rise from the ridge, one of which (Guajara) attains 9000 ft., and the modern volcanic cone resembles in aspect a fortress with circular massifs and a fosse. The rapamarts are about 8 m. in diameter, and tower in some places more than 1500 ft. above the fosse. On the north-west there are particularly steep, and even of sulphur-waves, and the modern cone is a pile of lava, pumice and ashes, thrown up in an ancient crater which had become greatly enlarged either by a falling in of the escarpment, or by the sea. Both El Pito and Chahorra are craters which issue steam and a little sulphurious vapour. The crater on El Pito is partly surrounded by a wall of lava, which has been made white by the action of sulphur-vapour, and even contain small crystals of sulphur. The thermometer rises considerably when thrust into the ground. The crater is about 300 ft. across, with a depth of 70 ft. The crater on Chahorra has a diameter of 4000 ft.; its depth is scarcely 150 ft. The view from the highest point, when no clouds intervene, is very extensive. All the islands of the archipelago are visible, and the horizon is 140 m. distant. North of the coast of Africa nor the island of Madeira is within the range of vision.

The ascent of the peak is usually made from Orotava, on the northern side of the island. After the cultivated grounds are left, the road is crossed by an arborescent forest, in places covered with codos (Adencaphus frankenioides), and this extends to the region of retama, the first bushes of which are found at the foot of the traveller into the Llano de la Retama. The scenery here is in strong contrast with the barren volcanic bases. Instead of a steep and rugged asent among black basaltic rocks, the traveller enters upon gently sloping ground, covered to a considerable depth with a mantle of retama. One of the most impressive sights of the peak is the shower of retama. The tender shoots of this shrub serve the wild goats for food, and the flowers yield a rich honey. The entrance to the Llano at a sort of natural gateway (called Porillo) between two basaltic hills, is about 7000 ft. above the sea. Between two and three hours are consumed in crossing the Llano to the base of the cone, the lower part of which (Mamón de Trigo) is ascended to a height of 9750 ft. For the ascent of the whole, the mules are usually left, and travellers frequently pass the night. Then comes the Malpais, 1000 ft. in altitude, consisting of rough black lava streams broken up into blocks and stones. These cease at the Ramblea, the lip of an older crater over which the lava poured before the sugar-loaf cone of pumice and ashes was thrown up. The pumice is in such quantity that at a distance it has the appearance of snow covering the peak. From twenty to twenty-four hours are consumed in ascending the peak. The ascent is extremely steep.

To the north-west of the grand cone, some thousands of feet below Chahorra, there are many small cones of eruption, showing that abundant eruptions of volcanic matter have recently taken place. The view from the ridge bounding the Pumice-Stone Plains extends a chain of mountains to the north-eastern extremity of the island. The highest peaks are Izana (3734 ft.), Pereumel (6027), and Cuchillo (5674). There is no record of eruptions from either crater of the peak. In 1705 a great quantity of lava was poured out from three vents on the eastern side; and in the same year lava streams issued from a crater near Guimar, half-way between Santa Cruz and the peak. In the year 1706 a vent on the north-western side of the peak discharged a copious stream, which flowed down to the sea, and nearly reached the town of Garachico. For three months in 1768 much lava and other volcanic matter were ejected from orifices to the west of Chahorra.

Santa Cruz, the capital of Tenerife and of the Canaries (pop. 15,000), and La Laguna (13,074), the former capital, are described in separate articles. A good road connects Santa Cruz and Orotava, a town on the north coast 25 m. W.N.W. It passes through Laguncrete Matanzas—a place deriving its name from the old fort and barrack, and 7000 ft. above sea level—then adjoins the harbour of Garachico. For Guanches in 1494. All travellers speak in terms of warm admiration of the scenery in this part of the island. Date-palms form a striking feature in the landscapes. The town of Orotava (pop. 9192) is 1040 ft. above the sea. The houses are solidly built, but it has a deserted aspect. A stream of water is conducted through every street. The famous dragon-tree, which so many travellers have described, no longer exists. Port Orotava, 3 m. N. of the town, is a clean place, with about 4500 inhabitants. The streets are broad and the houses well built. The roadstead, protected by a fort and some batteries, affords little or no shelter against wind. At Icod de los Vinos, a pretty town of
TENIERS, the name of a family of Flemish artists who flourished at Antwerp and Brussels during the 17th century. Teniers the Elder (1610-1690), the most famous and successful of the Teniers family, was born in Antwerp, near the town of Laken, and grew up near the sea, the south of the town. He was the son of a baker, and his father was a member of the Antwerp guild of painters in 1606. Though his ambition led him at times to try his skill in large religious, historical and mythological compositions, his claim to fame depends chiefly on his landscapes and paintings of peasants carousing, of nervous scenes and the like, which are marked by a healthy sense of humour, and which are not infrequently confused with the work of his brother, David Teniers the Younger. David Teniers the Younger (1610-1690), the elder Teniers at St Paul's church in Antwerp, representing the “Works of Charity.” At the Vienna Gallery are four landscapes painted by Teniers under the influence of Elsheimer, and four small mythological subjects, among them “Vertumnus and Pomona,” and “Juno, Jupiter and Io.” The National Gallery has a characteristic scene of village life, “Playing at Bowls,” a “Conversation” of three men and a woman, and a large “Rocky Landscape.” Other examples of his work are to be found at the galleries of St Petersburg, Madrid, Brussels, Munich, Dresden and Berlin (“The Temptation of St Anthony”). Teniers also achieved success as a picture dealer, and is known to have attended the fair of St Germain in Paris in 1615, with a large number of paintings by himself and by his four sons. He died at Antwerp in 1690.

David Teniers the Younger, the younger (1610-1690), the more celebrated son of the last-named, almost ranking in celebrity with Rubens and Van Dyck, was born in Antwerp on the 15th of December 1610. Through his father, he was indirectly influenced by Elsheimer and by Rubens. We can also trace the influence of Adrian Brouwer at the outset of his career. There is no evidence that either Rubens or Brouwer interfered in any way with Teniers’s education, and Smith (Catalogue Raisonné) may be correct in supposing that the ambition which Brouwer’s pictures at one time excited alone suggested to the younger artist his imitation of them. The only trace of personal relations having existed between Teniers and Rubens is the fact that the ward of the latter, Anne Breughel, the daughter of John (Velvet) Breughel, married Teniers in 1637. Admitted as a “master” in the guild of St Luke in 1632, Teniers had even before this made the public acquainted with his works. The Berlin Museum possesses a group of ladies and gentlemen dated 1630. No special signature positively distinguishes these first productions from those of his father, and we do not think it correct to admit with some writers that he first painted religious subjects. Dr Bode, in a remarkable study of Brouwer and his works, expresses the opinion that Teniers’s earliest pictures are those found under the signature “Tenier.” Tenier is a Flemish version of a thoroughly Walloon name, “Taisnier,” which the painter’s grandfather, a mercer, brought with him when he came from Ath in 1598; and Dr Bode’s supposition is greatly strengthened by the circumstance that not only David the elder, but his brother Abraham and his four sons were all inscribed as “Tenier” in the ledgers of the Antwerp guild of St Luke. Some really first-rate works—the “Prodigal Son” and a group of “Topers” in the Munich Gallery, as well as a party of gentlemen and ladies at dinner, termed the “Five Senses,” in the Brussels Museum—with the above signature are remarkable instances of the perfection attained by the artist when he may be supposed to have been scarcely twenty. His touch is of the rarest delicacy, his colour at once gay and harmonious. Waagen and Smith agree that the works painted from 1645 to 1650 testify most highly to the master’s abilities; there is no doubt that a considerable number of earlier productions would have been sufficient to immortalize his name. He was little over thirty when the Antwerp gild of St George enabled him to paint the marvellous picture which ultimately found its way to the Hermitage Gallery in St Petersburg—the “Meeting of the Civic Guards.” Correct to the minutest detail, yet striking in effect, the scene, under the rays of glorious sunshine, displays an astonishing amount of acquired knowledge and natural good taste. This painting leads us to mention that in the same year (1645), the then Count of Aranjuez acquired a very fine picture of “The Village Fete” (or “La fete aux chaudrons”) (No. 952), an equally beautiful repetition of which, dated 1646, belongs to the duke of Bedford. Truth in physiognomy, distribution of groups, the beautiful effect of light and shade, command our warmest admiration. A work like this, says Waagen, stamps its author as the greatest among painters of his class. Frankness in expression and freedom in attitude guided his preference in the choice of a model, but we may suppose him occasionally to have exaggerated both. He painted too, occasionally, a number of large pictures, in the coarse amusements of the boors he is fond of painting, he himself lives in good style, looks like a gentleman, and behaves as such. He never seems tired or showing the turrets of his chateau of Perck, and in the midst, of rustic merry-making we often see his family and himself received in hand by the joyous peasants. We may also observe that he has a certain number of favourite models, the constant recurrence of whom is a special feature of his works. We have even met them in a series of life-size portrait-like figures in the Doria Pamphilj Gallery in Rome.

Teniers was chosen by the common council of Antwerp to preside over the gild of painters in 1644. The archduke Leopold William, who had assumed the government of the Spanish Netherlands, being a great lover of art, employed Teniers not only as a painter but as keeper of the collection of pictures he was then forming. With the rank and title of “ayuda de camara,” Teniers took up his abode in Brussels shortly after 1647. Immense sums were spent in the acquisition of paintings for the archduke. A number of valuable works of the Italian masters, now in the Vienna Museum, came from Leopold’s gift, one of the having belonged to Charles I, and the duke of Buckingham. De Bie (1661) states that Teniers was some time in London, collecting pictures for the duke of Fuensaldana, then acting as Leopold’s lieutenant in the Netherlands. Paintings in Madrid, Munich, Vienna and Brussels have enabled art critics to form an opinion of what the imperial residence was at the time of Leopold, who is represented as conducted by Teniers and admiring some recent acquisition. No picture in the gallery is omitted, every one being inscribed with a number and the name of its author, so that the ensemble of these paintings might serve as an illustrated inventory of the collection. Still more interesting is a canvas, now in the Munich Gallery, where we see Teniers at work in a room of the palace, with an old peasant as a model and several gentlemen looking on. When Leopold returned to Vienna, Teniers’s task ceased; in fact, the pictures also travelled to Austria, and a Flemish priest, himself a first-rate flower painter, Van der Baren, became keeper of the archducal gallery. Teniers nevertheless remained in high favour with the new governor-general, Don Juan, a natural son of Philip IV. The prince was his pupil, and de Bie tells us he painted the likeness of the painter’s son. Honoured as one of the greatest painters in Europe, Teniers seems to have made himself extremely miserable through his aristocratic indulgence.

1 Under the name of Wessius.

2 It was not until recent years that the MS. inventory of this collection was discovered among the papers of Prince Schwerzenberg in Vienna. It was published in 1883 by Adolf Berger. In 1648 Teniers published 243 etchings after the best Italian works of Leopold William’s collection, which, with the portraits of the archduke and Teniers, were brought together as a volume in 1660, under the title El Teatro de Pinturas.
TENISON

leans. Shortly after the death of his wife in 1656 he married Isabella de Fren, daughter of the secretary of the council of Brabant, and strove his utmost to prove his right to armorial bearings. In a petition to the king he reminded him that the honour of knighthood had been bestowed upon Rubens and Van Dyck. The king at last declared his readiness to grant the request, but on the express condition that Teniers should give up painting his pictures. The condition was not complied with, but it may perhaps account for the master's activity in favour of the foundation in Antwerp of an academy of fine arts to which only painters and sculptors should be admitted, whereas the venerable gild of St Luke made no difference between art and handicraft: carvers, gilders, bookbinders, stood on an even footing with painters and sculptors; the separation was not obtained till 1773.

There were great rejoicings in Antwerp when, on the 26th of January 1663, Teniers came from Brussels with the royal charter of the academy, the existence of which was due entirely to his personal initiative.

Teniers died in Brussels on the 23rd of April 1690. The date is often wrongly given as 1694 or 1695. A picture in the Munich Gallery (No. 906), dated 1680, represents him as an alchemist, oppressed with a burden of age beyond his years. From this date we hear more of his doings as a picture-dealer than as a painter, which most probably gave birth to the legend of his having given himself out as deceased in order to get higher prices for his works. David, his eldest son, a painter of talent and reputation, died in 1685. One of this Teniers's pictures, "David, Kneeling before the Blessed Virgin," dated 1666, is still to be found in the church at Freck. As well as his father, he contributed many patterns to the celebrated Brussels tapestry looms.

Smith's Catalogue raisonné gives descriptions of over 900 paintings accepted as original productions of Teniers. Few artists ever worked with greater ease, and some of his smaller pictures—landscapes with figures—have been termed "afternoons," not from the time they were produced, but from the productions of museums in Madrid, St Petersburg, Vienna, Munich, Dresden, Paris, London and Brussels have more than 200 pictures by Teniers. In the United Kingdom 150 may be found in private hands, and many other examples are to be met with in private collections throughout Europe. Although the spirit of many of these works is as a whole marvellous, their conscientiousness must be regarded as questionable. Especially in the later productions, from 1664 onwards, we often detect a lack of earnestness and of the calm and concentrated study of nature which alone prevent expression from degenerating into grimace in situations like those generally depicted by Teniers. He was perhaps the last of his race; he left no such high position to a great degree account for this. Brouwer knew more of taverns; Oostade was more thoroughly at home in cottages and humble dwellings; Teniers, throughout, triumphs in broad daylight, and, though man may not be justly compared to the CBD, still he is on an equal open-air, scenes where he has, without constraint, given full play to the bright resources of his luminous palette. In this respect he often suggests comparisons with Watteau, but his subjects taken from the Gospels or sacred legend are absurd. An admirable picture in the Louvre shows "Peter Denying his Master" next to a table where soldiers are smoking and having a game at cards. A similar example is the "Deliverance of St Peter from Prison" of which two versions, curiously altered, are in the Dresden Gallery and the Wallace Collection. He likes going back to subjects illustrated two centuries before by Jerome Bosch—the "Temptation of Our Lord" and "Dance in the Mosque"—for the simple purpose of assembling the most comic arabications. His villagers drink, play bowls, dance and sing; they seldom quarrel or fight, and, if they do, seem to be laughing. This much may be said of Teniers, that no painter shows a more enviable ability to render a conception to his own and other people's satisfaction. His works have a technical freshness, a straightforwardness in means and intent, which make the study of them the closest attention of any painter who desires to excel in the mechanical knowledge of his art.

As a portrait painter he compares very unfavourably with Ostade, Cornelia, Bega and Dusart. More than 500 plates were made from his pictures; and, if it be true that Louis XIV, judged his "baboons (magots) unworthy of a place in the royal collections, they found adequate appreciation in the same—both his contemporaries and his successors. The duke of Bedford's admirable specimen was sold for 18,930 livres (f1800) in 1768. The "Prodigal Son," now in the Louvre, fetched 30,000 livres (£3098) in 1776. Smith's highest estimates have long since been greatly exceeded. The "Archers" in St Petersburg he gives as worth £2000. The Belgian government gave £5000 in 1867 for the "Village Pastoral" in the Louvre, which is now in the Brussels Museum; and a picture of the "Prodigal Son," scarcely 16 by 28 inches, fetched £5280 in 1876.

Although van Tilborgh, who was a scholar of Teniers in Brussels, found his style, with some success, and later painters often excelled in figure-painting on a small scale, Teniers cannot be said to have formed a school. Properly speaking, he is in the last representative of the Flemish traditions of the 17th century.

His character, a most Eminent Dutch and French Painters; John Vermeers, Notice historique sur David Teniers et sa famille; L. Gallelot, Quelques renseignements sur la famille; F. H. Van der Linden, le dees of David Teniers and Un procès de David Teniers et la corruption des peintres à Bruxelles; Alph. Wauters, Histoire des enviroons de Bruxelles et Les topographies bruxelloises; F. T. Van der Branden, Notices sur les peintres de l'histoire de l'archiepiscopat de Bruxelles; A. de Hulst, The Malerische Antwerpsens; W. Bode, Adriaen Brouwer, ein Bild seines Lebens und seines Schaffens.

TENISON, THOMAS (1636-1719), English archbishop, was born at Cottenham, Cambridgeshire, on the 29th of September 1636. He was educated at the free school, Norwich, whence he entered Christ's College, Cambridge, as a scholar on Archbishop Parker's foundation. He graduated in 1657, and was chosen fellow in 1659. For a short time he studied medicine, but in 1659 was privately ordained. As vicar of St Andrew-the-Great, Cambridge, he was conspicuous for his devoted attention to the sufferers from the plague. In 1667 he was presented to the living of Holywell-cum-Needingworth, Huntingdonshire, by the earl of Manchester, to whose son he had been tutor, and in 1670 to that of St Peter's Mancroft, Norwich. In 1672 he received the degree of D.D., and was presented by Charlemagne, vicar of the parish, to the rectory of St John the Baptist, Ipswich. Tenison, according to Gilbert Burnet, "endowed schools, set up a public library, and kept many curates to assist him in his indefatigable labours." Being a strenuous opponent of the Church of Rome, and "Whitehall lying within that parish, he stood as in the front of the battle all King James's reign." In 1678, in a Discourse of Idolatry, he had endeavoured to fasten the practices of heathenish idolatry on the Church of Rome, and in a sermon which he published in 1687 on Discretion in Giving Alms was attacked by Andrew Fulton, head of the Jesuits in the Savoy. Tenison's reputation as an enemy of Romanism led the duke of Monmouth to send for him before the execution in 1685, when Bishops Ken and Turner refused to administer the Eucharist; but, although Tenison spoke to him in a "softer and less peremptory manner" than the two bishops, he was, like them, not satisfied with the sufficiency of Monmouth's penitence. Under William III., Tenison was in 1689 named a member of the ecclesiastical commission appointed to prepare matters towards a reconciliation of the Dissenters, the revision of the liturgy being specially entrusted to him. A sermon which he preached on the commission was published the same year. He preached a funeral sermon on Nell Gwyn (d. 1687) in which he represented her as truly penitent—a charitable judgment which did not meet with universal approval.

The general liberality of Tenison's religious views commended him to the royal favour, and, after being made bishop of Lincoln in 1691, he was promoted to the primacy in December 1694. He attended Queen Mary during her last illness and preached her funeral sermon in Westminster Abbey. When William in 1695 went to take command of the army in the Netherlands, Tenison was appointed one of the seven lords justices to whom his authority was delegated. Along with Berkeley, he attended the king's court with some success, and later painters often attacked him during her reign was not in much favour at court. He was a commissioner for the Union with Scotland in 1706. A strong supporter of the Hanoverian succession, he was one of the three officers of state to whom on the death of Anne was entrusted the duty of appointing a regent till the arrival of George I., whom he crowned on the 31st of October 1714. Tenison died at London on the 14th of December 1715.

Besides the sermons and tracts above mentioned, and various others on the "Papish" controversy, Tenison was the author of The Creed of Mr Hobbes Examined (1670) and Baconia, or Certain
TEN KATE, JAN JACOB LODEWIJK (1819–1889), Dutch divine, prose writer and poet, was born at The Hague on the 23rd of December 1819. He started in life as a lawyer’s clerk. It was his friend, Dr Heldring, pastor at Hemmen, in Gelderland, who discovered in him the poetical gift of which he was conscious, encouraged him to study theology at the university of Utrecht (1838–43). Having completed his studies, Ten Kate became pastor at Middelburg, Amsterdam, and other places, meanwhile developing well-nigh ceaseless activity, both in prose and lyric poetry. Among his prose works may be mentioned the travel papers (Rhome, 1816; Italy, 1857–62), Christelijke Overdenkingen ("Thoughts of a Christian," 1849–52), and other religious studies. His early poetry was in the main original. The best known of his poems were—Ahauerus op de Grimsel ("Ahauerus on the Grimsel," 1849); Zangen de Tijds ("Songs of the Times," 1851); Legenden en Mengelgootje ("Legends and Detached Poems," 1856); In den Bloemhof ("In the Flower Garden," 1851); De Schepping ("The Creation," 1866); De Planeten ("The Planets," 1869); De Jaargeijden ("The Seasons," 1871); De Psalmen ("The Psalms," 1874); De Vrouw in het Nederlandsch Lied ("Woman in Dutch Song," 1883); Palm-takken en Dichtbloemen ("Palm-branches and Flowers of Poetry," 1884). Ten Kate reached the pinnacle of his poetic fame in The Creation, The Planets, and The Seasons. These poems certainly show a masterly grasp of his mother tongue and a wonderful facility of expression, coupled with graceful vigour and fertile fancy. These qualities he also plentifully displayed in the innumerable translations he made of many of the masterpieces of foreign poetry in nearly every European language. He had not only an extraordinary aptitude for learning alien idioms, but also the gift of translating foreign lyrics into clear, fluent and beautiful Dutch verse. Ten Kate’s versatility in this respect has never been equaled; it extended from Tasso and Andersen to Dante, Schiller, Victor Hugo, Milton, Tennyson and Longfellow. Ten Kate died at Amsterdam on the 24th of December 1889.

His complete Poetic Works were published after his death in 12 volumes (Leiden, 1891).

TENNANT, CHARLES (1768–1838), Scottish industrial chemist, was born at Ochiltree, Ayrshire, on the 3rd of May 1768. He started in business as a bleacher at Darnley, and in 1798 took out a patent for a bleach liquor formed by passing chlorine into a mixture of lime and water. This product had the advantage, as compared with the Eau de Javelles, then generally used, that a cheaper base, lime, was substituted for potash in its preparation; but when he attempted to protect his rights against infringement his patent was held invalid on the double ground that the specification was incomplete and that the invention had been anticipated at some bleach-works near Nottingham. In 1799 he patented a more convenient material in bleaching powder or "chloride of lime," formed by the action of chlorine on slaked lime, and for its manufacture founded at Glasgow in 1800 the well-known St Rollox chemical works, now merged in the United Alkali Company. He died at Glasgow on the 1st of October 1838.

His grandson the iron-master, Sir Charles Tennant (1823–1906), was M.P. for Glasgow from 1876 to 1880 and for Peebles and Selkirk from 1880 to 1886; he was created a baronet in 1885.

TENNANT, SMITHSON (1761–1813), English chemist, was born at Selby, Yorkshire, on the 30th of November 1761. He began to study medicine at Edinburgh in 1781, but in a few months moved to Cambridge, where he devoted himself to botany and chemistry. He graduated M.D. at Cambridge in 1790, and about the same time purchased an estate near Cheddar, where he carried out agricultural experiments. He was appointed professor of chemistry at Cambridge in 1813, but lived to deliver only one course of lectures, being killed near Boulougne on the 22nd of February 1815 by the fall of a bridge over which he was riding. He was a man of more promise than performance, and his chief achievement was the discovery of the elements iridium and osmium, which he found in the residues from the solution of platinum ores (1804). He also contributed to the proof of the identity of diamond and charcoal.

TENNANT, WILLIAM (1784–1845), Scottish scholar and poet, was born in the 13th of May 1784 at Anstruther, Fife, Scotland. He was late from childhood. His father sent him to the university of St Andrews, where he remained for two years, and on his return he became clerk to one of his brothers, a corn factor. In his leisure time he mastered Hebrew as well as German and Italian. His study of Italian verse bore fruit in the mock-heroic poem of Anster Fair (1812), which gave an amusing account of the marriage of "Maggie Lauder," the heroine of the popular Scottish ballad. It was written in the ottava rima adopted a few years later by the ingenious brothers Whistlecraft (John Hookham Frere), and turned to such brilliant account by Byron in Don Juan. The poem, unhampered in form, full of fantastic classical allusions applied to the simple story, and brimming over with humour, had an immediate success. Tennant’s brother, meanwhile, had failed in business, and the poet became in 1812 schoolmaster of the parish of Dunino, near St Andrews. From this he was promoted (1816) to the school of Lasswade, near Edinburgh; from that (1819) to a mastership in Dollar academy; from that (1834), by Lord Jeffrey, to the professorship of oriental languages in St Andrews. The Thane of Fife (1822), shows the same humorous imagination as Anster Fair, but the subject was more remote from general interest, and the poem fell flat. He also wrote a poem in the Scottish dialect, Papsy Stormed (1827), two historical dramas, Cardinal Beaton (1832) and John B abol (1825); and a series of Hebrew Dramas (1845), founded on incidents in Bible history. He died at Devon Grove, on the 14th of February 1848.

A Memoir of Tennant by M. F. Connolly was published in 1861.

TENNEMANN, WILHELM GOTTLIEB (1761–1819), German historian of philosophy, was born at Erfurt. Educated at his native town, he became lecturer on the history of philosophy at Jena in 1788. Ten years later he became professor at the same university, where he resided till 1815. His principal work is an encyclopaedic history of philosophy, which he began at Jena and finished at Marburg, where he was professor of philosophy from 1804 till his death. He was one of the numerous German philosophers who accepted the Kantian theory as a revelation.

In 1812 he published a shorter history of philosophy, which was translated into English in 1852 under the title Manual of the History of Philosophy.

TENNANT, SIR JAMES EMERSON, Bart. (1804–1869), English politician and traveller, the third son of William Tennant, a merchant of Belfast, was born there on the 7th of April 1804. He was educated at Trinity College, Dublin, of which he afterwards became LL.D. He took up the cause of Greek independence, and travelled in Greece, publishing a Picture of Greece (1820), Letters from the Aegean (1829), and a History of Modern Greece (1830); and he was called to the English bar at Lincoln’s Inn in 1831. In this year he married the daughter and co-heiress (with her cousin, Robert James Tennent, M.P. for Belfast, 1845–52) of William Tennant, a wealthy merchant at Belfast. He soon left the Bar, and adopted by royal licence the name of his wife in addition to his own. He entered parliament in 1832 as member for Belfast. In 1841 he became secretary to the India Board, and in 1845 he was knighted and appointed colonial secretary of Ceylon, where he remained till 1850. The result of his residence there appeared in Christianity in Ceylon (1850) and Ceylon, Physical, Historical and Topographical (2 vols., 1859). On his return, he became member for Lisburn, and under Lord Derby was secretary to the Poor Law Board in 1852. From 1852 till 1867 he was permanent secretary to the Board of Trade, and on his
retirement he received a baronetcy from Lord Palmerston. In his early years his political views had a Radical tinge, and, although he subsequently joined the Tories, his Conservatism was of a mild type. He withdrew from the Whigs along with Lord Stanley and Sir James Graham, and afterwards adhered to Peel. He died in London on the 6th of March 1869. His family consisted of two daughters and a son, Sir William Emerson Tennent, and baronet (1835-1879), who was an official in the Board of Trade, and at whose death the baronetcy became extinct.

Besides the books above mentioned, Emerson Tennent wrote Belgium in 1840 (1841), and Wines; its Duties and Taxation (1855), and was a contributor to magazines and a frequent correspondent of The Times (H. Ch.).

TENNESSEE, a South Central State of the United States of North America, lying between latitude 35° and latitude 39° 40' N. and between longitude 81° 37' and longitude 90° 28' W. It is bounded on the N. by Kentucky and Virginia along a line which, because of erroneous surveys, varies considerably, east of the Tennessee river, from the intended boundary—the line of latitude 36° 30' N.—the variations all being measured to the north of that parallel; on the E. by North Carolina along the line of the crest of the culminating ridge of the Unaka Mountains till within 26 m. of the Georgia frontier, where it turns due south, giving to Tennessee a triangular piece of territory which extends about 15 m. eastward; on the S. by Georgia, Alabama and Mississippi along the 35th parallel of N. lat.; on the W. by the Mississippi river which separates it from Arkansas and Missouri. The extreme length of the state from E. to W. is 432 m., and the extreme breadth is 109 m. its area being 42,022 sq. m., of which 335 sq. m. is water surface. Amenities —Tennessee is traversed in the east by the Unaka Ridges of the Old Appalachian Mountains and in the Great Appalachian Valley; in the middle by the Cumberland Plateau, the Highland Rim Plateau, and the Nashville Basin of the Appalachian Plateau; and in the west by the Gulf Coastal Plains and a narrow strip of the Mississippi Flood Plain. The maximum elevation of 6636 ft. at Mount Guyot on the North Carolina border, in Sevier county, the surface descends to 117 ft. or less on the Mississippi Flood Plain in the S.W. corner of the state. The general slope, however, is west by north. About 1700 sq. m. are at least 2000 ft. above the sea, but 28,200 sq. m. are less than 1000 ft. above the sea, and the mean elevation of the state is 678 ft. in median terms. In median terms the state has a belt 8 to 10 m. wide along its E. border, are a series of somewhat irregular ridges developed on complexly folded and faulted crystalline rocks. Sixteen peaks exceed 6000 ft. in height. They are Mount Curtis (6012 ft.), Mount Davis (5953 ft.), Mount Morgan (6210 ft.), and Mount Susan (6012 ft.), Mount Curtis (6568 ft.), Mount Safford (6535 ft.), Mount Love (6443 ft.), Mount Henry (6373 ft.), Roan Mountain (6153 ft.), Mount Morgan (6362 ft.), Mount Davis (6130 ft.), Mount Curtis (6012 ft.), Mount Morgan (6088 ft.), Tricorner Mountain (5910 ft.), and Mount Davis (6130 ft.). Thermometer Knob (6157 ft.), Ocoee Mountain (6135 ft.), and Master Knob (6017 ft.). This state is the Appalachian Valley which traverses Tennessee is commonly known as the Valley of East Tennessee. It consists of parallel ridges and valleys developed from erosion on folded sandstones, shales, and limestones, the valley quality predominating because the weak limestones were of great thickness. The valley areas vary in height from 600 ft. in the south-west to 1000 ft. in the north-east. In the north-east the ridges are more numerous and higher than in the south-west, where White Oak Ridge and Taylor's Mountain are among the highest points of the state. The highest mountains in the state are better known, because of their association with battles of the Civil War. Along the north-west border of the valley a steep escarpment, known as the Breakaway, descends into North Carolina. This plateau has a mean elevation of about 2000 ft., is only slightly rolling, and slopes gently toward the north-west. The W. edge of the plateau is much broken by deep indentations of stream valleys, and the elevation of the plateau is about 750 ft. above sea level. The plateau, so named from the scarp formed by its western rim about the Nashville and (farther north) Louisville basin. It is generally level except where it is cut by river valleys. The Nashville Basin, which should be called the basin, lies for the most part 400 to 600 ft. below the Rim; a few hills or ridges, however, rise to the level of the Rim. The Basin is elliptical in form, extending nearly across the state from N.E. to S.W., with an extreme width of about 60 m.; narrower and shallower toward the south-west where the Tennessee river from the north or south-west with a free sweep across the state in a direction nearly parallel with the trend of the mountains. Above these are upper currents from the north or north-west, the Plateau has an alpine or continental type of climate characterized by long severe winters and occasionally to easterly winds. The average velocity of the winds is comparatively low and violent storms are rare. Soil.—The Lowland Basin, the least elevated parts of the Valley of East Tennessee, is the most fertile of the province and the portion of the Highland Rim have a fertile limestone soil. The deep deposit of silt on the Mississippi Flood Plain is even more fertile. There are narrow strips of rich alluvium along many other rivers. The soils on the abrupt way of overlooking the Mississippi Flood Plain. The E. slope, about one-fourth the length of the W. slope, is steep and rocky, and the W. slope is broken by the valleys of numerous streams. There is a slight dip to 2000 ft. at the head of the valley and a very slight curve or gentle valley which is only about 750 ft. above sea level. Each of the state, and is the only large lake in the state. The whole of the Appalachian Province, except the northern portion of the Cumberland Plateau, the Highland Rim, and the Lowland Basin are drained southward and westward by the Mississippi river and its tributaries. The western slope of the East Gulf; it is drained directly into the Mississippi by several small streams. Fauna.—A few black bears inhabit the Unaka Mountain region. Deer are quite numerous in the forests of the east half of the state. The wolf, fox, lynx ("wildcat"), otter, mink and beaver have become rare. Squirrels, rabbits, wood-chucks, skunks, muskrat and opossums are common. Among game-birds there are a few wild turkeys, wild geese, wood-grouse, the bobwhite, and greater numbers of grous and various ducks; among shore birds the tern, loon, and eagle are numerous, and in the fall migration there are white-fronted and red-breasted geese, the commoner fish are perch, pickerel, crappies, pike, drum, buffalo, carp, suckers and eels. Rattlesnakes and moccasins, or cottonmouths, both venomous, are occasionally seen. Flora.—Originally the state was wooded, and still has about one-half of it is still woodland containing a large variety of trees. On the mountains the trees are chiefly pines, firs, spruce and hemlock are common. In the valley, the state, especially on the Mississippi Flood Plain, the cypress is dominant. In the Lowland Basin small groves of what was once an extensive forest of red cedar remain. Poplar and larch are much more abundant in the western than in the eastern portion of the state, and is much more abundant in the eastern than in the western half. But in most parts of the state there are mixed forests of white oak, red oak, ash, red gum, black gum, maple, hickory, chestnut, sycamore, sweet gum, poplar, tamarack, cypress, birch, willow, birch, sassafras, and persimmon. Birch, mulberry, linden, willow, basswood, dogwood, the sorrel tree, pawpaw and wild plum are common. Blue grass is indigenous in the Lowland Basin. Of medicinal herbs the most important is the blackberry (Rubus latifolius). Among indigenous shrubs and vines are the baneberry, blackberry, gooseberry, whortleberry, huckleberry, grape and cranberry. Bird.—Tennessee is noted for its delightful climate. The mean summer temperature ranges according to elevation from 62° F. on the Unaka Mountains to 72° on the Cumberland Plateau, to 70° on the Highland Rim, to 75° in the Lowland Basin, and to 77° in the Lowland Basin. But the mean winter temperature for each of these divisions is about 20°. The annual temperature ranges from 57° in East Tennessee to 59° in Middle Tennessee and 65° in West Tennessee. The altitude being the same, the mean annual temperature on the south border of the state is about 2° higher than that on the north border. Usually the highest temperatures of the year are in July and the lowest in January. In some regions there is no record of a temperature as high as 100°; in others there is none as low as 10°; and the average absolute range is about 90°. However, during a period of fifty-four years (1854-1908) the records show a range of extremes from 30° at Erasmus, Cumberland county, in February 1899, to 107° in several places in July 1901. Rarely there are killing frosts, especially in the southern counties, but even these minor occurrences pass without comment until the middle of October. An average annual precipitation of about 50 in. is quite equally distributed over the state and a little more than 50 in. is well distributed in the following months. The average annual snowfall is about 8 in., and the snowfalls are usually light and melt within a few days. The average number of clear, fair, or only partly cloudy days in a year is about 250. The Midland Basin of Tennessee has a dry land climate from the south or south-west with a free sweep across the state in a direction nearly parallel with the trend of the mountains. Above these are upper currents from the north or north-west. The climate of Tennessee is not regarded as especially healthy for the invalids and invalids of the constitution. The climate is comparatively low and violent storms are rare.
mountains, on the ridges of the Valley of East Tennessee, and on the E. slope of the East Gulf Plains vary greatly according to the rock strata. In the Cumberland Plateau, which constitutes the inner portion of the Highland Rim, and in the W. slope of the East Gulf Plains there is for the most part a light sandy soil, much of it too poor for cultivation.

The area of farms in the state in 1900 was 20,342,058 acres, of which about one-half was classed as "improved." The average size was 90-6 acres, and the average number of acres of improved land per farm was 45-6. Of the total farm acreage 6,435,000 was covered with coal or other mineral deposits, chiefly iron and marble; 620 m. of navigable streams; 14,000 ft. of navigation, classified as the principal navigable streams; 341 of the state, the product in 1908 being 341 short tons of metallic zinc valued at $32,054. Among the other minerals found and mined to a small extent are copper, manganese, barites, fluor spar, slate, granite and petroleum. The total value of all minerals was $19,277,031 in 1908.

Manufactures.—To an unusual degree the natural resources of the state have attracted the rapid development of industries. The establishment of industrial establishments is largely in the hands of individuals, firms, and comparatively small corporations, rather than of large combinations, the average capital per establishment in 1905 being about $3,500. This rapid industrial growth has been due in a small degree to the great natural resources of the state and its excellent transportation facilities. Judged by the value of products, regardless of cost of production, the industrial output of Tennessee in 1905 was $102,438,451, and of products to $137,950,476. Some of the principal products are shown in the table on the next page.

The carefully cultivated land area of the state in 1900 was $2,120,000; the value of the products was $102,438,451, and of products to $137,950,476. The railroad mileage of the state was 6,539,783, they employed 1,486 persons, and the value of their products was $3,428,039. The fountains and machine shops of the state had a capital of $5,695,203. The manufacturer of leather was the chief sub-division of the industry, employing 153,375 spindles, 3008 looms and 1787 knitting machines.

The printing and publishing industry of the state had an invested capital of $8,583,133, and a product valued at $6,895,203. The manufacturer of cotton and other textiles had a capital of $5,639,445. The manufacturer of leather was another important industry. Large tanneries were attracted to the state, soon after the Civil War, by the abundance of tan bark in the forests, and the cheapness of labour. In 1905 $4,013,289 was invested in the manufacture of leather products, and the value of their products was $5,939,783. They employed 1,486 persons, and the value of their products was $3,428,039. The fountains and machine shops of the state had a capital of $5,695,203. The manufacturer of leather was the chief sub-division of the industry, employing 153,375 spindles, 3008 looms and 1787 knitting machines.

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The population of Tennessee increased from 1,255 m. in 1860 to 3,184 m. in 1900, and 3,480 on the 1st of January 1909. The principal railways operating in the state in 1910 were the Louisville & Nashville, the Chattanooga, & St Louis, the Cincinnati Southern and the Southern. The navigable waterways include the Mississippi river (which forms the western boundary of the state); the Tennessee river, navigable throughout its length, from Knoxville; and the Cumberland river, navigable throughout its length. The amount of capital invested in manufacturing was $3,220,890, and the value of the product was $2,400,256. Among the other important manufacturing industries of the state and the value of their products in 1905 are: men's clothing, $2,961,811; patent medicines, $2,268,000; oil, $792,000; coke, $424,000; artificial ice, $727,263; agricultural implements, $768,895; and coke, $800,801.

Karajan.—The total population in 1880 was 1,542,359; in 1890, 1,767,518; in 1900, 2,020,616; and in 1910, 2,184,789.1 Of the total population in 1900, 1,522,600 were native whites, 17,746 were foreign-born, 286,243 were negroes, 108 were Indians, 75 were Chinese and 4 were Japanese. Of the inhabitants born in the United States 35,361 were born in Georgia, 56,052 in Kentucky, 26,405 in North Carolina, 27,799 in Alabama, 55,179 in South Carolina, 25,826 in Virginia, 15,369 in Maryland, 31,372 in Pennsylvania and 11,164 were of German, 926 of Irish and 332 of English parentage on both the father's and the mother's side. Of the total population of the state in 1906, 697,570 were members of religious denominations. There

1 The populations in other census years were as follows: (1870), 35,691; (1880), 105,602; (1890), 261,727; (1892), 422,823; (1893), 891,904; (1894), 829,210; (1895), 1,002,717; (1896), 1,109,801; (1897), 1,238,520.
were 277,170 Baptists, 241,306 Methodists, 79,337 Presbyterian, 56,315 Disciples of Christ, 17,525 Roman Catholics, 7,874 Protestant Episcopalians, 3,225 Lutherans, 2,875 United Brethren and 2,426 Congregationalists. From 1890 to 1900 the urban population (i.e. the population of places having 4,000 inhabitants or more) increased from 219,792 to 283,886, or 30.1 per cent., the semi-urban population (i.e. the population of incorporated places, or the approximate equivalent, having less than 4,000 inhabitants) increased from 87,351 to 114,937, or 31.4 per cent., and the rural population (i.e. population outside of incorporated places) increased from 1,460,375 to 1,619,803, 63 per cent. of the total.

The principal cities of the state, with population for 1910, are Memphis, 131,105; Nashville, 110,364; Chattanooga, 44,604 and Knoxville, 36,346.

Government.—Tennessee has had three constitutions, but the present one, adopted in 1870, is a reproduction of the second (1834) with only a few changes. Amendments may be proposed not oftener than once in six years by a majority of the members elected to each house of the legislature, but before they can be adopted they must be agreed to first by two-thirds of the members elected to each house of the next succeeding legislature, and later by a majority of all the citizens of the state voting for representatives at the next regular election. The legislature may, also, submit to the people the question of calling a convention to amend or revise the constitution, and such a convention must be called whenever, upon the submission of this proposition, a majority of the votes cast in favour of it. Every attempt to amend or revise the present constitution has, however, been unsuccessful. The right of suffrage is given to every male citizen of the United States who has attained the age of twenty-one years and has been a resident of the state for one year, provided he has paid his poll tax and has not been convicted of bribery, larceny or other infamous crime. The election of the governor, members of the General Assembly and congressmen is held biennially, even numbered years, on the first Tuesday after the first Monday in November, but the election of judicial and county officers is held on the first Thursday in August.

The governor is the only state executive officer who is elected by the people. He is elected for a term of two years and is not eligible for more than three consecutive terms. He must be at least thirty years of age and have been a citizen of the state for the last seven years. If the president or other chief of the executive branch, or any member of the state military forces, he may call the militia into service only when there is a rebellion or invasion, and the General Assembly declares that the public safety requires it. The officers of the penitentiary and of the reformatories for boys are appointed by the governor with the advice and consent of the Senate, or an application for the pardon of an inmate of their institution, but he is not bound by their advice and there is no real restriction on his power to pardon. If the governor is impeached for bribery, larceny or other infamous crime. The governor may veto bills passed by the General Assembly, but to override his veto the vote of only a bare majority of the members elected to each house is required. His salary is $4000 a year. There is no lieutenant-governor; in case of a vacancy in the office of governor the speaker of the Senate becomes acting governor. The secretary of state, the comptroller, and the treasurer are elected by the people for a term of six years, and the secretary of state is president of the Senate. Each officer serves for a term of two years; the attorney-general is appointed by the judges of the supreme court for a term of eight years.

Both senators and representatives are elected for a term of two years, by counties or by districts having approximately the same population. The number of representatives is limited by the constitution to 99, and the number of senators to one-third the number of counties. The Legislature supplies $300 each for a term of two years; the attorney-general is appointed by the judges of the supreme court for a term of eight years.

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The supreme court consists of five judges elected by joint ballot by the legislature for a term of six years, and may be removed from office by the votes of two-thirds of the members of each of the three grand divisions (eastern, middle and western) and two votes of the electorate of the state or make the state "owner in whole or in part of any bank or a stockholder with others in any association, company, corporation or municipality."

The administration of justice is vested in a supreme court, a court of appeals, chancery courts, circuit court, and justices of the peace. The supreme court consists of five judges elected by joint ballot by the legislature for a term of six years, and may be removed from office by the votes of two-thirds of the members of each of the three grand divisions (eastern, middle and western) and two votes of the electorate of the state or make the state "owner in whole or in part of any bank or a stockholder with others in any association, company, corporation or municipality."

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of a county which contains the county seat there are two constables, and in other civil districts of the county one constable elected for a term of two years. The general law for the incorporation of cities and towns vests the government in a corporation consisting of a mayor and two aldermen, and provides that the property of the city shall be exempt from the state and county tax except in the case of a failure of a court to appoint a commission for the sale of the property of the city. A mayor and a board of aldermen are elected for a term of two years by the qualified voters. The election of the aldermen, and to override his veto a two-thirds majority is required.

Miscellaneous Laws.—For the protection of the property rights of married persons, the law provides that the property of the estate shall be exempt from her husband's debts; that the proceeds of her real or personal property shall not be paid to any other person except after the death of the surviving spouse; and that she may be appointed a trustee of her own estate or a part of her estate, and treasurer as ex officio, members, and seven other members, a portion retiring every two years, and their successors being appointed by the county court. The act for establishing the Tennessee Reformatory for Boys provides that the institution shall be governed by a board of trustees consisting of the governor and five other members, one retiring each year; that boys under eighteen years special leave to be convicted of a penitentiary offence shall be sent to it; that the trustees may transfer incorrigible boys to the penitentiary, put others out in the service of citizens on probation, or recommend them to the governor for pardon. A general control of all public charities and correctional institutions is exercised by an unincorporated Board of State Charities consisting of the governor and six members appointed by him with the advice and consent of the Senate. The principal duties of this board are to examine the condition and the management of such institutions and report to the governor and county and city authorities and submit to it for criticism all philanthropic enterprises. Education.—For the administration of the common school system each county having five or more civil districts is divided into five school districts, each having five or more civil districts. In each school district constitutes the board of education, in counties having less than five school districts one or more districts can be united by the county court for this purpose. The school district elects one member of the county board of education, and in counties having less than five school districts one or more districts may be united for this purpose. The salary of the superintendent is $750 per year, and to five, besides the county superintendent who is ex officio its secretary, are elected by the county at large, and to this county board of education together with the district advisory boards is entrusted the administration of the common school funds. A special education law enacted in 1909, 25 per cent. of the gross state revenue is paid into the general education fund, 61 per cent. of this fund is apportioned among the several counties according to their school population, 10 per cent. is apportioned among all school districts in counties with less than five schools, and 24 per cent. is apportioned among eligible counties in proportion to their school population but in inverse ratio to the taxable property; to have the use of any portion of this special fund a county must levy for the maintenance of common schools a tax not less than forty cents on each $100 of taxable property, a tax of $2 on each taxable poll, and such privilege taxes as the state permits it to levy for school purposes not to exceed 25 cents on a $100 of taxable property. The establishment of high schools to be maintained in part by additional county taxes and miscellaneous funds, and 8 per cent. of the state school fund is set apart for the encouragement of counties in this matter. In 1910 the legislature created eight Negro normal schools and 10190 in each of 50 counties. The high schools are largely under the control of the state board of education, consisting of the governor and five other members appointed by the governor, and six other members appointed by the governor and five other members appointed by the governor and six members appointed by the governor. When the general education law was enacted in 1909 Tennessee had no state normal schools, but by the law 13 per cent. of the state educational fund is set apart for the establishment and maintenance of schools solely for the education and professional training of teachers for the elementary schools; one for white teachers in each of three grand divisions of the state, and one agricultural and industrial normal school for the industrial education of negroes and for preparing negro teachers for the common schools, and the management of these schools is vested in the state board of education. The state university for normal instruction which embraces a college of liberal arts, a graduate department, a college of engineering, a college of agriculture, a school of pharmacy, an industrial department, and a law department at Knoxville, and the Agricultural and Mechanical College at Nashville and the State Normal School at Maryville is governed by a board of trustees consisting of the governor, the state superintendent of public instruction, the commissioner of agriculture, the president of the university and twelve other trustees. Each county has a board of education, consisting of the mayor of the county and nine other members, elected for a term of four years. The high school is governed by a board of nine members, elected at large. The Peabody College for Teachers, at Nashville, founded (1857) and maintained chiefly with proceeds of the George Peabody Fund for the improvement of education in the South. Other institutions of learning include the State Normal School, which is governed by the Board of Education (non-sect., 1828); the Agricultural and Mechanical College of the University of Tennessee (non-sect., 1875); Washington and Lee University (non-sect., 1871); the Peabody College at Nashville; Maryville College (non-sect., 1819); Maryville; Cumberland University (Presbyterian, 1842); at Lebanon; Burritt College (non-sect., 1849), at Spencer;
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Hiwassee College (non-sect., 1849), at Sweetwater; Bethel College (Presbyterian), Knoxville; and Tennessee College (Baptist, 1851), at Jefferson City; Walden University (Methodist, 1866), at Nashville; Fisk University (Congregational, 1866), at Nashville; University of Chattanooga (Methodist, 1867), at Chattanooga; University of the South (Episcopal Episcopal, 1866), at Sewanee; King College (Presbyterian, 1869), at Bristol; Christian Brothers College (Roman Catholic, 1871), at Memphis; Knoxville College (United Presbyterian, 1873), at Knoxville; (Chattanooga, 1882), at Milligan; South-western Presbyterian College (1889), at Clarksville; and Lincoln Memorial University (non-sect., 1895), at Cumberland Gap.

The state revenue is derived from a general property tax, a poll tax, an income tax, a tax on transfers of realty, an ad valorem tax on the average capital invested by merchants in their business, a privilege tax on merchants and many other occupations and professions, a tax on licenses to practice various professions, and a collateral inheritance tax, and fines and forfeitures. State, county and municipal taxes are assessed by a county assessor, who is elected for a term of four years, and one or more deputies whom the assessor is authorized to appoint. The law requires that all property shall be assessed at its full cash value, but personal property to the value of $1000 is exempt from taxation. Real estate is assessed biennially; personal property, privileges and polls annually. Assessments are examined and revised both by a county board of equalization and a state board of equalization. The county board consists of five members elected annually by the county court, and there is one member on the board for each corporation, and as are also all persons who have served on it within five years. The state board consists of the secretary of state, treasurer and comptroller. The clerk of the county court, the chief clerk of the offices of the state, the assessors of property and corporations subject to a privilege tax; the county treasurer the taxes of other persons. Three revenue commissioners, one of whom is an expert accountant, are elected biennially by the county court, and two books are kept for the assessment and collection of the taxes, and three state revenue agents are appointed biennially by the comptroller to examine the records of all officials charged with the collection or disbursement of state or county revenue. The state revenue for the two years ending the 19th of December 1806 amounted to $3,804,740, and the cost of conducting the state government for these two years was $3,588,977. The bonded debt of the state grew from $1,943,666 on the 1st of October 1839 to $35,069,666 on the 1st of October 1869, but by the 19th of December 1860 it had been reduced to $14,236,766.

History.—The present site of Memphis may be the point where the Spanish explorer, Hernando de Soto, reached the Mississippi river, but this cannot be determined with certainty. Father Marquette in his voyage down the Mississippi camped upon the western border, and La Salle built Fort Prud’homme upon the Chickasaw Bluffs, probably on the site of Memphis, in 1682, but it was abandoned, then rebuilt, and again abandoned. The territory was included in the English grant to Sir Walter Raleigh in 1584 and in the later Stuart grants, including that of Carolina, in 1663. No permanent settlement, however, was made until 1769, though wandering explorers and fur traders were long before in the region. The first permanent settlers were Virginians led by Dr Thomas Walker (1715-1794), in 1750 reached and named the Cumberland river and mountains in honour of the royal duke. In 1756 or 1757, Fort Loudon, named in honour of John Campbell, earl of Loudon, was built upon the Little Tennessee river, about 30 m. N. of the present site of Knoxville, as an outpost against the French, who were now active in the whole Mississippi Valley, and was garrisoned by royal troops. The fort was captured, however, by the Cherokee Indians in 1760, and both the garrison and the neighbouring settlements were destroyed.

Eastern Tennessee was recognized as a common hunting ground by the Cherokees, Creeks, Miamis and other Indian tribes, and the Iroquois of New York also claimed a considerable portion by right of conquest. In 1768 the Iroquois ceded whatever claim they had to the English, and in 1769 several cabins were built along the Watauga and Holston rivers upon what was thought to be Virginian soil. A settlement near the present Rogersville was made in 1771 and in the next year another sprang up on the Nolichucky. After the failure of the Regulator insurrection in North Carolina in 1771, hundreds of the Regulators made their way into the wilderness. When the season for planting was past, the settlers would go to the homes of their relatives and friends, that colony made no effort to assert jurisdiction or to protect the settlers from Indian depredations. Therefore in 1772 the residents of the first two settlements met in general convention to establish a form of government since known as the Watauga Association. A general committee of thirteen was elected to exercise legislative powers. This committee elected from its members a committee of five in whom executive and judicial powers were lodged. The smaller committee elected a chairman, who was also chairman of the committee of thirteen. A sheriff, an attorney and a clerk were elected, and regulations for recording deeds and wills were made. Courts were held, but any conflict of jurisdiction with Virginia or North Carolina was avoided. In 1775 the settlement on the Nolichucky was forced to join the association, and in the same year the land was bought from the Indians in the hope of averting war. With the approach of the War of Independence, the dream of becoming a separate colony with a royal governor was abandoned, and an petition of the inhabitants the territory was annexed to North Carolina in 1776 as the Washington District, which in 1777 became Washington county, with the Mississippi river as the western boundary. The population increased rapidly and soon several new counties were created.

During the War of Independence the hardy mountaineers under John Sevier and Evan Shelby did valiant service against both the royal troops and the Loyalists in South Carolina, chiefly as partisan rangers under Charles McDowell (1743-1813). Major Patrick Ferguson with several hundred Loyalists and a small body of regulars made a demonstration against the western settlements, but at King’s Mountain in South Carolina he was completely defeated by the Americans, among whom Colonel Sevier and the troops led by him were conspicuous (see KING'S MOUNTAIN).

After the War of Independence the legislature of North Carolina in 1784, offered to cede her western territory to the general government, provided the cession should be accepted within two years. The Watauga settlers, indignant at this transfer without their consent, and fearing to be left without any form of government whatever, called a convention which met at Elizabethton in the year 1784, and by which delegates to another convention to form a new state were appointed. Meanwhile North Carolina repealed the act of cession and created the western counties into a new judicial district. A second convention, in November, broke up in confusion without accomplishing anything; but a third adopted a constitution, which was submitted to the people, and ordered the election of a legislature. This body met early in 1785, elected Sevier governor of the new state of Franklin (at first Frankland), filled a number of offices, and passed several other acts looking to separate existence. Four new counties were created, and taxes were levied. In the autumn George Washington called another convention, to which the proposed constitution had been referred, adopted instead the constitution of North Carolina with a few trifling changes, and William Cocke was chosen to present to Congress a memorial requesting recognition as a state. Congress, however, ignored the request, and the diplomacy of the North Carolina authorities caused a reaction. For a time two sets of officials claimed recognition, but when the North Carolina legislature a second time passed an act of oblivion and remitted the taxes unpaid since 1784, the tide was turned. No successor to Sevier was elected, and he was arrested on a charge of treason, but was allowed to escape, and soon afterwards was again appointed brigadier-general of militia.

Meanwhile, settlers had pushed on further into the wilderness. On the 17th of March 1775 Colonel Richard Henderson and his associates extinguished the Indian title to an immense tract of land in the valleys of the Cumberland, the Kentucky and the Ohio rivers (see KENTUCKY). In 1778, James Robertson (1742-1814), a native of Virginia, who had been prominent in the Watauga settlement, set out with a small party to prepare the way for permanent occupation. He arrived at French
agreements were soon repealed, the general policy was continued, and in 1861 more than $17,000,000 of the state debt was due to these subscriptions, from which there was little return.

Though President Andrew Jackson was for many years practically a dictator in Tennessee politics, his arbitrary methods and his intolerance of any sort of independence on the part of his followers led to a revolt in 1836, when the electoral vote of the state was given to Hugh Lawson White, then United States senator from Tennessee, who had been one of Jackson's most devoted adherents. White's followers called themselves Anti-Van Buren Democrats, but the proscription which they suffered drove most of them into the Whig party, which carried the state in presidential elections until 1856, when the vote was cast for James Buchanan, the Democratic candidate. The Whig party was so strong that James K. Polk (Democrat), a resident of the state, lost its electoral vote in 1844. With the disintegration of the Whig party, the state again became nominally Democratic, though Union sentiment was strong, particularly in East Tennessee. There were few large plantations and fewer slaves in that mountainous region, while the middle and western sections were more in harmony with the sentiment in Mississippi and Alabama. In 1850 representatives of nine Southern states met in a convention at Nashville (q.v.) to consider the questions at issue between the North and the South. The vote of the state was given for Bell and Everett in 1856, and the people as a whole were opposed to secession.

The proposition to call a convention to vote on the question of secession was introduced in the first session of the 9th of February 1861, but after President Lincoln's call for troops the legislature submitted the question of secession directly to the people, and meanwhile, on the 7th of May 1861, entered into a "Military League" with the Confederacy. An overwhelming vote was cast on the 8th of June in favour of secession, and on the 24th Governor I. G. Harris (1818-1897) issued a proclamation declaring Tennessee out of the Union. Andrew Johnson, then a United States senator from Tennessee, refused to resign his seat, and was supported by a large element in East Tennessee. A Union convention, including representatives from all the western and a few of the middle counties, met on the 17th of June 1861 and petitioned Congress to be admitted as a separate state. The request was ignored, but the section was strongly Unionist in sentiment during the war, and has since been strongly Republican.

The state was, next to Virginia, the chief battleground during the Civil War, and one historian has counted 454 battles and skirmishes which took place within its borders. In February 1862, General U.S. Grant and Commodore A. H. Foote captured Fort Henry on the Tennessee river, and Fort Donelson on the Cumberland. The capture of these forts on the 6th and 7th of February was largely owing to the influence of President Lincoln. General D. C. Buell occupied Nashville. Grant next ascended the Tennessee river to Pittsburg Landing with the intention of capturing the Memphis & Charleston railway, and on the 6th-7th of April defeated the Confederates in the battle of Shiloh. The capture of Island No. 10 in the Mississippi on the 7th of April opened the river as far south as Memphis, which was captured in June. On the 31st of December and the 2nd of January General William S. Rosecrans (Federal) fought with General Braxton Bragg (Confederate) the bloody but indecisive battle of Stone River (Murfreesboro). In June 1863 Rosecrans forced Bragg to evacuate Chattanooga, Bragg, however, turned upon his pursuer, and on the 19th and 20th of September one of the bloodiest battles of the war was fought at Chickamauga. General Grant now assumed command, and on the 24th and 25th of November defeated Bragg at Chattanooga, thus opening the way into East Tennessee. There General A. E. Burnside at first met with success, but was shut up in Knoxville by General James Longstreet, who was not able, however, to capture the city, and on the approach of General W. T. Sherman retired into Virginia. Almost the whole state was now held by Federal troops, and no considerable military movements occurred until after the fall of Atlanta in September 1864. Then General J. B. Hood moved into Tennessee, expecting Sherman
to follow him. Sherman, however, sent reinforcements to Thomas and continued his march to the sea. Hood fought with General John M. Schofield at Franklin, and on the 15th-16th of December was utterly defeated by Thomas at Nashville, the Federals thus securing virtually undisputed control of the state.

After the occupation of the state by the Federal armies in 1862 Andrew Johnson was appointed military governor by the president (confirmed March 3, 1862), and held the office until inaugurated vice-president on the 4th of March 1865. Republican electors attempted to cast the vote of the state in 1864, but were not recognized by Congress. Tennessee was the first of the Confederate states to be readmitted to the Union (July 24, 1866), after ratifying the Constitution of the United States with amendments, declaring the ordinances of secession void, voting to abolish slavery, and declaring the war debt void. The state escaped "carpet bag" government, but the native whites in control under the leadership of William G. Brownlow (1805-1877) confined the franchise to those who had always been uncompromisingly Union in sentiment and conferred suffrage upon the negroes (February 25, 1867). The Ku Klux Klan, originating in 1865 as a youthful prank at Pulaski, Tennessee, spread over the state and the entire South, and in 1869 nine counties in the middle and western sections were placed under martial law. At the elections in 1869 the Republican party split into two factions. The conservative candidate was elected by the aid of the Democrats, who also secured a majority of the legislature, which has never been lost since that time. The constitution was revised in 1870. For a considerable time after the war the state seemed to make little material progress, but since 1880 it has made rapid strides. The principal occurrences have been the final compounding of the old state debt at fifty cents on the dollar in 1882, the rapid growth of cities, and the increased importance of mining and manufacturing.

GOVERNORS OF TENNESSEE

<table>
<thead>
<tr>
<th>State of Franklin</th>
<th>1783-1788</th>
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<tbody>
<tr>
<td>John Sevier</td>
<td>1798-1799</td>
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<tr>
<td>Territory South of the Ohio</td>
<td>1801-1803</td>
</tr>
<tr>
<td>John Sevier, Democratic-Republican</td>
<td>1803-1809</td>
</tr>
<tr>
<td>Archibald Roane</td>
<td>1809-1815</td>
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<tr>
<td>John Sevier</td>
<td>1815-1821</td>
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<tr>
<td>William Carroll</td>
<td>1821-1827</td>
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<tr>
<td>Sam Houston</td>
<td>1827-1829</td>
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<tr>
<td>William Hall (acting)</td>
<td>1829</td>
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<tr>
<td>William Carroll, Democrat</td>
<td>1829-1833</td>
</tr>
<tr>
<td>Newton Cannon, Chief Justice</td>
<td>1835-1839</td>
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<tr>
<td>James K. Polk, Democrat</td>
<td>1839-1841</td>
</tr>
<tr>
<td>James C. Jones, Whig</td>
<td>1841-1845</td>
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<tr>
<td>Aaron V. Brown, Democrat</td>
<td>1845-1847</td>
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<tr>
<td>Neil S. Brown, Whig</td>
<td>1847-1849</td>
</tr>
<tr>
<td>William Trousdale, Democrat</td>
<td>1849-1851</td>
</tr>
<tr>
<td>William B. Campbell, Whig</td>
<td>1851-1853</td>
</tr>
<tr>
<td>Andrew Johnson, Democrat</td>
<td>1853-1857</td>
</tr>
<tr>
<td>Isham G. Harris, Democrat</td>
<td>1857-1862</td>
</tr>
<tr>
<td>Andrew Johnson, Military</td>
<td>1862-1865</td>
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<tr>
<td>Interregnum, 4th March-4th April 1865,</td>
<td>1865-1869</td>
</tr>
<tr>
<td>William G. Brownlow, Republican</td>
<td>1865-1869</td>
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<tr>
<td>De Witt C. Senter, Conservative Republican</td>
<td>1869-1871</td>
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<tr>
<td>John C. Brownlow, Democrat</td>
<td>1871-1873</td>
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<tr>
<td>James D. Porter</td>
<td>1875-1879</td>
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<tr>
<td>Albert S. Marks</td>
<td>1879-1881</td>
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<tr>
<td>Alvin Hawkins, Republican</td>
<td>1881-1883</td>
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<tr>
<td>William B. Bate, Democrat</td>
<td>1883-1887</td>
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</tbody>
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1 The state furnished 115,000 soldiers to the Confederate and 31,000 to the Union Army.
2 The Constitutions of 1776, 1834 and 1879 all provided that the governor shall not serve more than six years in succession.
3 Resigned.
4 Formed to leave capital by invasion of Federal troops.
5 Andrew Johnson, the governor, was inaugurated as Vice-President, March 4, 1865, thereby vacating the office.

ROBERT L. TAYLOR, 1887-1891
John P. Buchanan, 1891-1893
Peter Turney, 1893-1897
Robert L. Taylor, 1897-1899
Benton McMillin, 1899-1903
James B. Fraizer, 1903-1907
John I. Cox, 1907-1911
Malcolm R. Patterson, 1911-1917
B. W. Hooper, Republican


There is no satisfactory complete history of the state. The best is James Phelan's History of Tennessee (Boston, 1888). For the early period see John Haywood, Civil and Political History (Knoxville, 1843, reprinted Nashville, 1891); J. G. M. Ramsey, Annals (Charleston, 1853); A. W. Putnam, History of Middle Tennessee, or Life and Times of General James Robertson (Nashville, 1889); Theodore Roosevelt, Winning of the West (New York, 1889-1896); John Carr, Early Times of Middle Tennessee (Nashville, 1857). For the middle period see O. P. Temple, East Tennessee in the Civil War (Cincinnati, 1896); James W. Fertig, Secession and Reconstruction of Tennessee (Chicago, 1868); and the Report of Joint-Committee on Reconstruction (U.S. Pub. Docs., Wash., 1866).

TENNESSEE RIVER, the largest tributary of the Ohio river, U.S.A. It is formed by the confluence of the Holston and the French Broad rivers 45 miles above Knoxville, Tennessee, and flows S.S.W. to Chattanooga, through which turns W. through the Cumberland Plateau and into the N.E. corner of Alabama, continues W. across the northern part of Alabama, turns N. on the boundary between Alabama and Mississippi, and continuing N. across Tennessee and Kentucky unites with the Ohio at Paducah. Its principal tributaries rise in the Appalachian Mountains: the Holston and the Clinch on the mountain slopes that flank the Appalachian Valley in western Virginia; and the French Broad, the Little Tennessee, and the Hiwassee in the mountains of western North Carolina. The Tennessee itself is 654 m. long, and, with the Holston and the North Fork of the Holston forms a channel about 900 m. long. Its drainage basin covers about 44,000 sq. m., and its low water discharge at Paducah is 10,000 cu. ft. per second. Its average fall is 0-79 ft. per mile; 0-956 ft. from Knoxville to Chattanooga; 1-19 ft. from Chattanooga to Florence, Alabama; and 0-39 ft. from Florence to its mouth. The banks are everywhere easily accessible except at Knoxville and Chattanooga, where, for short distances, high elevations rise precipitously from the water; and as the banks are mostly of clay or rock the channel is permanent and the river is unusually free from silt.

The Tennessee is navigable by steamboats throughout its entire course of 652 m. for several months of the year; its tributaries have a nearly equal navigable mileage, and the main river and its tributaries together have a navigable mileage for rafts and flat-boats of 2400 m. At low water there are three obstructions to steamboat navigation in the main stream: the Colbert and Bee Tree shoals, just below Florence; the Muscle shoals just above Florence; and Hales Bar, 33 m. below Chattanooga. The state of Alabama aided by the Federal government, constructed a lock canal affording a depth of 5 ft., around the Muscle shoals in 1831-1836, but because of the obstructions above and below the canal was little used and was soon abandoned. The Federal government, beginning in 1868, completed the reconstruction of the Muscle Shoals Canal in two divisions (one 3-5 m. long with two locks, the other 14-5 m. long with nine locks, and both providing a depth of 5 ft.) in 1890, began in 1893 the construction of a canal, about 8 m. long, with one lock around Colbert and Bee Tree shoal, and in 1904 authorized the construction with private capital of a lock and dam at Hales Bar to provide a channel 6 ft. deep at low water between it and Chattanooga; the water power to be used by the contractors furnishing the capital. In the fall of 1896 the United States Senate recommended that future improvements of the river be made with a view of obtaining ultimately a channel having a minimum depth of 8 ft. at low water, and for the appropriate amount for a project for extending to 5 ft. at low water the channel (145 m. long) between Hales Bar and the Muscle Shoals Canal. In 1908 the commerce carried on the Tennessee between

6 Resigned to enter the U.S. Senate.
Chattanooga and Paducah amounted to 755,010 tons, valued at $18,752,180; it consisted chiefly of general merchandise, farm products, forest products and iron ore in the upper section, of general merchandise, coal, timber products in the middle section, and of general merchandise, farm products and timber products in the lower section.

During the Civil War Fort Henry was erected by the Confederates on the Tennessee river, in Tennessee just below the Kentucky state line, and on the 6th of February 1862 was captured by Com. A. H. Foote; Fort Donelson on the Cumberland, several miles east, was seized by Com. Gideon Pillow and held by General Donelson, Grant, and the two rivers were thus opened for the advance of the Federals far into Confederate territory.

TENNIEL, SIR JOHN (1820-75), English humorous and satirical artist—specially identified with Punch—was born in London in 1820. He educated himself for his career, and although he became a probationer, and then a student, of the Royal Academy, he soon left the schools, where at that time there was little teaching. In 1836 he sent his first picture to the exhibition of the Society of British Artists, and in 1845 contributed a 16-ft. cartoon, "An Allegory of Justice," to the competition, held in that year, of designs for the mural decoration of the new Palace of Westminster. For this he received a £200 premium and a commission to paint a fresco in the Upper Waiting Hall (or "Hall of Poets") in the House of Lords. In spite of his tendency towards "high art," he was already known and appreciated as a humorist, and his early companionship with Charles Keene fostered and developed his talent for scholarly caricature. At Christmas time 1850 he was invited by John Leech to contribute to the magazine, on which he was to work under the pen-name "Tenniel," in *The Comic Almanac* of 1851. For this he drew a picture of "Dropping the Pilot," which appeared in *Punch* on 20th March 1850, xcviii. 150-51. Public exhibitions of Sir John Tenniel's work were given for the first time and an edition of *Alice in Wonderland* was published. He was also the author of one of the mosaics, "Leonardo da Vinci," in the South Court in the Victoria and Albert Museum; while his highly stippled water-colour drawings appeared from time to time in the exhibitions of the Royal Institute of Painters in Water Colours, of which society he was elected a member in 1874. As an illustrator on the wood-block he stands very high; his "Lalla Rookh" is perhaps the finest of all his work in point of conception, rendering, lineower and technical excellence.

**WORKS ILLUSTRATED.—** (1) *Juvenile Verse and Picture Book,* (1846); (2) *Undine* (1848); (3) *Aesop's Fables, 100 drawings* (1848); (4) "The Great Man's Receipt Book* (1848); (5) *Quaint Illustrations of Knave* (1848); (6) *The Silver Cord* (1861); (7) Moore's *Lalla Rookh,* 69 drawings (1861); (8) Lewis Carroll's *Alice's Adventures in Wonderland* (1866); (9) *The Mirror of Life,* 1867; (10) *Carroll's Through the Looking Glass* (1891); (11) *Punch* (1840-68); (12) *Poe's Poems* (1847); (13) *Home Affections* (1858); (14) *Cholmondeley Pennell's Punch on Pegasus* (1863); (15) *The Arabian Nights* (1853); (16) *English Sacred Poetry* (1856); (17) *Legends and Lyrics* (1865); (18) *Tupper's Provincial Philosophy* (1859); (19) *Barry Cornwall's Poems,* and other books. He also contributed to *Once a Week,* the Art Union publications, &c.

**TENNIS** (sometimes called royal tennis, and, in America, court tennis), one of the oldest of ball-games, and one of the most difficult to learn. It is now played in a walled and roofed court 110 ft. by 38 ft. 8 in., the floor, however, measured 76 ft. by 32 ft. 8 in., the difference being the width of a roofed corridor, the "penthouse," which runs along the two end walls and one of the side walls. Across the middle of the court a net is stretched, and the first object of the game is to strike the ball over this with a bat or racquet. The net is 3 ft. high at the ends, 3 ft. 6 in. at the middle, and divides the floor into two equal parts, the "service" side and the "hazard" side. The floor and walls are made of cement and should be smooth but not polished.

The court is lighted from the roof and sides. The height of the court to the tie-beam is 30 ft., the height of the play-line, above the floor, is 21 ft. 8 in., and the tie-beam is at the bottom of the roof. The roof of the penthouse, which is made of wood, slopes downwards towards the court, the lower edge being 7 ft. 14 in. from the floor, the upper 10 ft. 7 in., the width 7 ft. The illustrations show that one of the walls has its own peculiarities. The "caddies" is an opening in the end wall on the service side, under the penthouse, where provision is made for spectators, who are protected by a net. It is 2 ft. 3 in. in width; at a lower edge is 6 ft. 10 in. from the floor, the lower edge 3 ft. 3 in. The opening of the caddies is 4 ft. 6 in. from the main wall, 5 ft. 6 in. from the other side wall. Looking from the caddies (i.e. from the service side), the right-hand or main side wall has a peculiar peculiarity, which the wall is built inward, reducing the breadth of that part of the court to 30 ft. 2 in. In the right-hand corner of the hazard side end wall (as viewed from the caddies) is the "grille," an opening lined with wood, 3 ft. 1 in. square; and on this wall is painted a continuation of the "pass-line." The left-hand wall, along which runs the pent-house, is not continuous, being broken by a long opening between the floor and the pent-house similar to the door described, but on the right hand side of the opening the danger is the "battery." There is no wall in front of the "marker's box," through which the court is entered and from which all through of the net-post. This long opening in the left-hand wall is divided into two, and "doors," the latter situated where the entrances to the court used to be in early times. The measurements in order from the caddies are as follows, the numbers being the feet and inches: length of the court on the middle of the roof 90 ft. 6 in.; second gallery 9 ft. 6 in.; door 3 ft. 6 in.; first gallery, 5 ft. 8 in.; marker's box or line-opening, 7 ft. 10 in.; hazard side—first gallery, 5 ft. 8 in.; door, 3 ft. 6 in.; second gallery, 9 ft. 6 in.
From the Hazard Side. Tennis-court at Crabbett Park, Sussex, in place, and are covered with white Melton cloth. The American balls, made of layers of cotton and cloth alternately, are somewhat lighter and slower than the English. A set of balls consists of six or seven dozen; the same set should not be used twice in a day. The racquet is usually about 27 in. long and weighs about 16 oz. The head is about 9 in. long and 6 in. broad, but there are no restrictions as to size or weight. The head is somewhat pear-shaped; its centre line does not correspond with the centre-line of the handle, as it is curved upwards to facilitate the stroke when the ball is taken close to the floor. The earliest racquets were strung diagonally, i.e. in diamonds; later the present vertical-horizontal stringing was adopted, then followed knotting at the points of intersection, but now the knotting has disappeared. The name racquet (or racket) appears in French as raquette and in Italian as racchetta. It is variously derived from Latin reticulata (netted), Dutch rackets (to stretch), later Latin raku (palm of the hand or wrist) or the Arabic rahkat (palm of the hand); in favour of the two last derivations is the fact that tennis is a development of a game originally played with the hand, protected by a leather glove, and later on strings were stretched violin-fashion across the palm, to give more power to the stroke. Then followed a wooden bat (battoir), and then a short-handled racquet, either strung or covered with parchment, and finally the modern implement.

Technical Terms.—Some of these have already been explained, but the following may be added. "Bisque": the privilege, given as a form of odds, of scoring a stroke during any part of the game, except after the delivery of "service" or after a fault. "Hey-up"; to hit the ball on to the side wall first. "Cut"; to strike the ball with the head of the racquet held at an angle to the ball's course instead of meeting it with the full face, thus causing backward rotation of the ball (similar to the "screw" in billiards), which alters its natural rebound from the wall. "Twist"; analogous to "cut," but the strings are drawn across the ball at the moment of impact, so as to make it rotate sideways. A ball so struck with a fore-hand stroke twists towards the other player off the floor, and away from him if it is allowed to strike the end wall; the reverse being the effect of twist from a back-hand stroke. "Rest"; a series of strokes between the two players. "Service"; the first stroke of a "rest." The server may serve from any part of the court on the service side. The ball must strike the roof of the side penthouse, and fall within the service-court. "Fault"; a ball so served that it either does not touch the side penthouse or falls outside the service-court. "Pass"; a service in which the ball drops beyond the pass-line; the service in this case does not count, but a "pass" does not annul a previous fault, as was once the case. "Force"; to strike the ball hard; a hard-hit stroke. "Volley"; to strike a ball in its flight (à la volée) before it has touched the floor. "Half-volley"; to strike a ball immediately after it touches, and before it rises from the floor. "Nick"; the angle where the floor and walls meet. "Marker"; the attendant who marks and calls the chases and other points scored in the game. Scoring and Handicapping.—A match consists of three or five "sets"; a "set" of eleven games. The winner of six games wins the set. If a player wins six games consecutively he wins a "love set," even though his opponent may have won several games. The loser of a love set, by an old custom, gives the marker a shilling. Should the score be called "Five games all," the players may arrange to play a "vantage game," the set in that case not being won till one or other has won two games in succession. A game consists ordinarily of four winning strokes, called by the marker as "Fifteen," "Thirty," "Forty," "Game"; if the score is "forty-all," the marker calls "Deuce," and two strokes have to be won in succession by one of the players. When one has won a stroke his score is called "Vantage"; if he wins the next, he wins the game; if he loses it, the score reverts to deuce. The score of the player who won the last stroke or made the last chase is called first. In handicapping the usual odds are (1) bisques, which may also be given in addition to other odds, or to balance odds received; (2) half-fifteen, or one point to be taken at the beginning of the second and every alternate game; (3) fifteen, or one point in every game; (4) half-thirty, or one point in every odd game and two points in every even game; (5) thirty, or two points in every game; (6) half-forty, or two points in every odd game and three in every even game; (7) forty, or three points in every game. Other handicaps are:—Round services, the giver of odds having to serve so that the ball hits both the side and end penthouse; "half the court," the giver of the odds confining his strokes, except service, to one side of the court as divided by the half-court line, a stroke played into the other half counting to his adversary; "touch no walls," the giver of odds confining his play except service to the floor; "bar the openings," the giver of odds losing a point if his ball goes into a gallery or into the dedans or grille; "bar winning openings," which are closed to the giver of odds, who loses a point if the ball enters them; "side walls," the giver of odds losing a point if he plays the ball on to any side wall, the end penthouses being open to him, and the dedans and grille. In these "cramped" odds the rules do not apply if the ball goes out of limits after the second bound.

The Game and Hints on Play.—The players decide who shall serve by spinning a racquet on its head. One spins and the other calls "rough" or "smooth," the "rough" side of the head of the racquet showing the knots of some of the lower
strings. The winner takes the service side, service being an advantage. He serves from any part of the court, and in any way he thinks best, and the ball must go over the net, strike the side penthouse, and fall into the service-court (see "Fault" and "Pass"). His opponent ("striker-out") tries to return the ball over the net before it has touched the ground a second time; he may volley or half-volley it. For a stroke to be "good" it must be made before the second bound of the ball, and the ball must go over the net (even if it touches it), and must not strike the wall above the play-line, nor touch the roof or rafters. The first point to be attained is to be sure of getting the ball over the net, the next to do so in such a way as to defeat the opposing player's attempt to make a "good" stroke in return.

It often happens that a player, either intentionally or from inability, does not take or touch a ball returned to him over the net. In this event, chiefly on the service side, a "chase" (in Italian accia, in French chasse) is made, the goodness or the badness of which depends upon the spot on the floor which the ball touches next after its first bound. The nearer this spot is to the end wall the better the chase. The chase lines are numbered, being one yard apart, the shorter lines representing the half-distance. The chases are noted and called by the man in charge of a ball. If a ball falls on the chase line, he would call "chase four"; if between 4 and 3, he would call "Better than four"; if it fell nearer to 4 than the short line, and "Worse than three" if it fell on the short line or between the short line and 3; for if the ball fell on a line the striker is credited with the better stroke. Strokes into the galleries and doors, with the exception of the winning gallery (last gallery, hazard side) count as chases. The making, or, in technical language, the "laying down" of a chase does not immediately affect the score: it has to be won first, i.e., the other player tries to make a return within this line. To make a return within the chase line, the striker wins. For this purpose after two chases have been laid down (or if either player's score is at 40) the players change sides, e.g., if X has been serving and Y has laid down two chases, Y becomes the server and tries to defeat them, X to win them by making the ball fall nearer to the back wall after its first bound than Y did. Either player wins the chase if he "ends" (i.e., hits the ball into) one of the winning openings, or if his opponent fails to make a good return. The winner of the chase scores a point.

The chases are played off in the order in which they are made. Since X is in trying to win a chase the same chase as Y originally played, the original chase line becomes the chase for the scores. In France the chase is played again. The "rest" goes on till one of the players fails to make a good return, or deliberately leaves the ball alone in order that his opponent may lay down a chase (a procedure to be followed at the discretion of a player in whose judgment the chase will be a bad one), or lose a chase already laid down and in the course of being played off. Either player can score, there being no "hand-in" or "hand-out" as at racquets. A point is scored by that player whose opponent fails to make a good return stroke in a rest, or who strikes the ball into a winning opening, or wins a chase, or to whom two faults are served in succession. A player loses a stroke who strikes the ball twice, or allows it to touch himself or his clothes.

"He who would excel as a tennis-player must learn to serve," is the dictum of an amateur champion, but the necessary variations, the difference between the "railroad" and the "giraffe," &c., can only be explained by an experienced player and in the court. Variety is all-important, as is the knowledge of what sort of service is most valuable in defending a particular chase. All service should be heavily "cut." For the winning of hazard-side chases, indeed for winning chases in general, the service is useful. The end of it is to make the service drop at the nick of the grille-wall and hit the floor. In attempting this service it should be remembered that it is better for the ball to hit the floor first of all, as this allows the cut to act. It is wise to cultivate one sort of service to perfection, if possible, with a reserve of others to suit the occasion.

Again, the tennis "stroke," differing essentially as it does from the racquet stroke, can only be learnt in the court from a good teacher; but it is an axiom that tennis is not a game in which hard hitting necessarily tells, though force may be usefully employed in trying to "find" the winning openings. This, however, is an important point of etiquette—it is not "correct" to force for the dedans when the striker is close to the net, unless the force is "bossed" or there is no danger of hitting his opponent. In some clubs such a stroke is forbidden by a by-law. Some modern players of tennis are a fashion of hard strokes, and their predecessors, who considered strokes "on the floor," i.e. carefully judged chases, to be the true feature of the game; but in any case the beginner should remember that it is better to save his breath and to trust to winning an easy chase by-and-by than to run after a hard-hit stroke, which if left alone would leave "chase the door" or "second gallery," to be played for afterwords. Similarly in defending a chase, he should remember during the rest what that chase is, and not endeavour to return a stroke which would have lost it. Chases act as breathing-spaces, especially to the player who can trust to his skill "on the floor," and these, together with good service, give the chance when one can play tennis, and play it well, at a time of life when cricket, racquets and other active games have to be abandoned.

History.—Tennis may well be called a royal game, having been popular with various kings of England and France, though it is fanciful to connect it with Homer's Nausicaa, princess of Phaeacia (Odyssey, vi. 115), who is represented by him as throwing, and not as hitting the ball to her maids of honour. In the ball-games of the Greeks and Romans we may see the rudiments of the French jeu de paume, which is undoubtedly the ancestor of modern tennis. Of the origin of the name is quite obscure. Some give a numerical derivation from the fact that la longue paume was played by ten players, five on each side; others regard it as a corruption of tamis (sieve), for in a form of la paume the server bounced the ball on a sieve and then struck it: there is no possible reason for connecting "tennis" with the term Tenis, or Senois; probably is a derivation from Teuau (Take it Play it), especially when Charles V. was we remember the large number of French terms that adhere to the game, e.g., grille, tambour (drum, from the sound on the board that formed the face of that buttress) and dedans. Further, a poem dealing with the game, written in Latin elegies by R. Frissart, makes the striker cry "Excipe!" (Take it!) after each stroke: this seems to correspond with the custom which enjoins on the racket-markers not to speak unless an legitimate stroke has been made.

In the "Alexiad" of Anna Comnenus (about A.D. 1120) is a reference to a game played on horseback in which a staff, curved at the end and strung with strings of plaited gut, was used. This game was played in a court called "a court for golf (sic)" (according to the Lexicon of Alexandria Greek), and some similar game, corrupted through tchango into chicane, was played in France. In A.D. 1300 the game was also known as La boude. Throughout the century indeed it was played in France and by the highest in the land: thus Louis X. died from a chill contracted, after Charles V. had devoted himself to the game, though he vainly tried to stop it as a pastime for the lower classes; Charles VI. watched the game from the room where he was confined during his attack of insanity, and Du Guesclin amused himself with it during the siege of Dinan. In England the game, or some form of it, was known, Chaucer possibly alluding to it in the words "But canstow play racket to and fro"; and hand-ball, which may have been either tennis or cricket, was proscribed with other games by Edward III. in 1365. In France the game was prohibited to priests in A.D. 1245, and also in 1245, 1252 and 1673. In 1427 we hear of a woman named Margot, who was a skilled player, both her forehand and backhand strokes being commended; hence we may infer that the racquet had now been introduced. Tennis was at this time frequently played in some crude form in the courts of castles, where Charles VIII. used to watch the game. Henri II. is described as the best
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player in France, and worthy of the silver ball given to the finest players. Later, Henri IV, and Louis XIV. (who kept a regular staff to look after his court) were patrons and players of tennis; indeed, in Henri IV.'s reign so popular was the sport that it was said that there were "more tennis-players in Paris than drunks and in England"; in the 16th century Paris alone could boast of 250 courts, yet it is stated that in 1589 there were only six courts in the whole of France. The word "tennis"—the game having hitherto been described as lunes galice—is first found in Gower's "Balade unto the worthy and noble kynge Henry the fourth" (1400), but Shakespeare's allusion to tennis as known to Henry V. must not be omitted. In reply to messengers from the dauphin, who had sent him a present of tennis-balls by their hands, Henry says:

"When we have match'd their rackets to these balls. We will, in France, by God's grace, play a set. Shall strike his father's crown into the hazard. Tell him he hath made a match with such a wrangler That all the courts of France will be disturb'd With chases."

—(Henry V., Act i., sc. 2.)

Even if it be an anachronism that the poet should put these technical terms into the king's mouth, yet the fact is established that the terms were familiar in Elizabeth's time. Henry VII. indeed both played the game and revoked the edicts that forbade it; there was a court at Windsor Castle in his time, an open court with four bare walls, no penthouse, &c., being visible, and connected with the palace by a covered way. This court still existed in 1607. It was in that reign, possibly in that court, that the king of Castile played a match with the marquis of Gower. He played a racquet, conceiving "fifteen" to the marquis, who played with his hand. The king won the set. Henry VIII. probably built the court at Hampton Court Palace. In 1615 there were further courts in London of various sizes, and a picture of James II. as a boy represents him standing in a tennis-court holding a short-handled racquet, strung diagonally. Pepys frequently alludes to tennis at a time when there were two courts at Oxford and five at Cambridge. Though the game flourished in the 17th century, it lost some of its popularity, mainly through the demolition of courts as building operations increased; moreover, courts complete in every detail alone were built, the play being consequently confined to the members of the clubs that could afford the expense. The last of the old courts to disappear stood in Windmill Street, at the top of the Haymarket, London. King Edward VII., when prince of Wales, frequently played tennis at "Prince's" Court.

The evolution of the court as now built is not easily traced, but courts undoubtedly existed side by side which differed from each other both in detail and in dimensions. It is generally assumed that such details as the penthouse, grille, galleries, &c., were deliberately planned to elaborate the game, but it is not unreasonable to suggest that the game, played, as it must often have been, in extemporized courts, took some of its modifications from them: it is at least significant that in an old illustration of la paume a miniature penthouse appears (from which the ball is rolling), apparently a shelter for a bell. The net does not appear till the 17th century, a rope, fringed or tasselled, being stretched across the court: further, the racquet was not in universal use in 1527, since Erasmus in his Colloquies says, "Reticulum (net, or racquet) piscatoribus relictumque elegantis est palma ut." An Italian, Antonio Scano de Salo, is the first literary suggester of tennis. In his Trattato della Palla (treatise on the ball) he describes a game in which the ball was played with a racquet, and a small court for the game. The large court was 121 ft. long; it was entered by two doors, one between the first and second galleries on either side of the net; there were four galleries on each side; the dedans extended across the whole width of the court: the tambour was there and two grilles. He also mentioned chases, but these were decided by the place where the ball finally stopped, the spot being marked by a small movable standard. In another kind of court he says that there was no tambour, but two grilles.

The penthouse was sometimes confined to two walls, sometimes to one, the end wall service side. In the hand-court one side was open all its length, with the exception of the battery and some pillars that perhaps gave variety to the stroke. The Latin poem to which allusion has been made shows the similarity of the 17th-century game to the modern: the racquet is spun; the marker (signator) is there to mark the places (metes) with the movable standard; there is the grille (frenstra); the scoring by "15, 30, 40, game," the volley the time. In the 15th and 16th centuries tennis-balls were so largely imported from France that the Ironmongers' Company, who were the English manufacturers, twice petitioned—the last time in 1591—for "protection" in the matter of balls. The term "bisk" (bixgai, originally bisqaye) does not appear in English tennis till 1607 (Shadwell's True Widow), nor is the winning gallery mentioned before 1707. In the 17th century tennis became a spectacle in France, and the professional player came into existence, the most famous of that time being Le Pape, Clergé and Servo, and about the same time was formed the gild of Paulmiers-rocqueteurs (manufacturers of tennis material) with its arms, "Sable, a tennis-racquet proper; in a cross four tennis-balls of the same." De Garsault, writing in 1797, says, "La Paume is the only game that can take rank in the list of Arts and Crafts," and his book, L'art du Paumier-Racquetier, was adopted by the Académie Royale. In France very large sums of money were wagered on the game, especially at the end of the 16th century, the stakes being deposited under the cord or net, while in England, about 1759, there was so much betting and swindling, especially by professional players, that the game as played in the public courts fell into disrepute. In the middle of the 19th century, tennis-courts were rare indeed in England, the best known being those of the Marylebone Cricket Club (built in 1838), of the Messrs Prince in Hans Place, S.W., besides one at Brighton, one at Hampton Court, two at Cambridge, and one at Oxford; but the game progressed so fast that in 1910 there were between thirty and forty courts in England, each one in Ireland and Scotland, five in America, six in France, one in Melbourne (Australia) and one in Tasmania. The game has disappeared in Italy, Germany, Austria and Spain, except in Spain, which was popular in the days of Philip III. (1588-1621) who was himself fond of playing.

The great French players mentioned above were followed by others—Cabasse (who invented the "boasted force" known as the coup de Cabasse), Barcellon, Farolais and Barnéon, and in the 18th century the Charniers, Bergeron and Masson, the last-named a really great player who could give fifteen to any of his contemporaries. One of his feats was to stand in a barrel before receiving the service, spring out of it and into it before and after each stroke. Other good players of later date were C. A. Delahaye, and greatest of all, J. E. Barre, who in 1855 re-opened the Versailles court, famous for the meeting of the Tiers État on the 20th of June 1789, which body there assembled and took the celebrated "Oath of the tennis-court." Masson is supposed to have visited England in 1792 and to have played against Messrs Hawkins and Price, and a professional called Pillet (or Pilet); but of Barre's visit there can be no doubt, as he played on the new court of the Marylebone Club in 1839, meeting "Peter" Tompkins, the English champion, and beating him so severely that when they met again next year Tompkins received the odds of thirty and a bisque. As an instance of the marquis, he mentions in the dawn, Julian Marshall in his Annals of Tennis states that in Bell's Life, the leading sporting paper, Barre is reported as playing Cox and Tompkins "giving 71/2 for a bisque," the tennis term "half fifteen" being arithmetically rendered. C. G. Taylor, the great cricketer, was one of the best amateurs, about this time. Barre eventually resigned the championship in favour of George Lambert, who was beaten in 1855 by T. Pettitt, of Boston U.S.A. Athletic Association, an Englishman by birth, who
learned all his tennis in America. Charles Saunders beat Lambert in 1886, thereby becoming champion of England. Pettit and Saunders met for the championship of the world at Dublin, Pettit winning by seven sets to five. The match took place in May 1890, and during the autumn, Pettit declining to defend the title, Saunders assumed it, but five years later he was challenged by Peter Latham and beaten, Latham thus becoming the champion of the world both at racquets and tennis. An American, George Standing, challenged him in 1897 for the racquets championship, but was beaten, and next year Pettit challenged Latham at tennis. In 1904 C. Fairs ("Punch") challenged Latham for the championship, but was beaten; but in 1905 Fairs (then his title) again issued a challenge to any other player in the world to contest his right to the position of champion. The challenge was taken up in 1910 by G. F. Covey, the match for the championship, played at Brighton in the summer of 1910, being won by Fairs after a close contest, in which the younger player secured six sets to his opponent's seven, and fifty-three games to fifty-nine won by the champion. Among amateurs a formal championship was not established till 1885, the recognized champion being the winner of the gold prize annually given by the Marylebone Cricket Club to its members, the competition not being made open till 1896. For fifteen years, from 1867 to 1881, J. M. Heathcote held the title, among those whom he defeated during that period being such fine tennis-players as Julian Marshall, G. B. Crawley, the Hon. C. G. Lyttelton (afterwards Lord Cobham), R. D. Walker, C. E. Boyle, and the Hon. Alfred Lyttelton. In 1882 A. Lyttelton defeated Heathcote, only to be beaten next year by him, and to beat him in turn in 1884 and 1885; but in 1886 Heathcote (then fifty-three years of age) was again champion. From 1887 to 1895 inclusive the Hon. A. Lyttelton was champion, defeating during that time (besides Heathcote) A. J. Webb, Sir Edward Grey and H. E. Crawley. Grey's perseverance—he won the silver prize on six occasions—was rewarded with the gold prize in 1896, but he was dispossessed in 1897 by E. H. Miles, who won for the next ten years, with the exception of 1900 when he was beaten by J. B. Gribble. On six occasions during this series Sir Edward Grey was second to the winner.

In 1889 the amateur championship, open to all amateurs, was instituted at Queen's Club, West Kensington. The following list shows the winners:

1889, Sir E. Grey.
1890, E. B. Curtis.
1891, Sir E. Grey.
1892, H. E. Crawley.
1893, Sir E. Grey.
1894, E. H. Miles.
1895, A. E. Pettitt.
1896, Sir E. Grey.
1897, J. B. Gribble.
1898, Sir E. Grey.
1899, E. H. Miles.
1900, E. H. Miles.
1901, E. H. Miles.
1902, E. H. Miles.
1903, E. H. Miles.
1904, V. Penny.
1905, E. H. Miles.
1906, E. H. Miles.
1907, Jay Gould.
1908, J. B. Gribble.
1909, E. H. Miles.
1910, E. H. Miles.

It may be mentioned that Heathcote and Lyttelton, who monopolized the Marylebone Club's gold prize for twenty-nine years, were strict followers of the class-action, the winning and defending of chases and the clever placing of the ball being the leading feature of their game. A different and less attractive form, consisting of harder hitting, asserted itself in Miles's first success, which was followed by many others; but Jay Gould, an American amateur, who beat Miles for the championship in 1907 and again in 1908, owed his success to the perfection of his style in the older and more scientific tennis. He did not defend his title in 1909, when Miles again became champion in his absence, a title which Miles again retained in 1910.

The universities of Oxford and Cambridge have played two matches, not under the four-handed, rules, in 1874 and 1884, with the exception of 1886 when neither match was played. The games are played at the court of the Marylebone Club.

Tennis in America.—Few tennis-courts existed in America before 1880, about which time the buildings of the Boston Athletic Association and the New York Racquet and Tennis Club were built. There are now also courts at Chicago, Tuxedo, Lakewood and several other places, but the game is naturally played by comparatively few persons. Tom Pettitt, mentioned above as for several years champion of the world, was for many years in charge of the Boston courts. Other first-class men are Alfred Tompkins of New York, Boskies of Chicago and Forester. Richard Sears first won the American championship in 1892, and it has been won since by F. Warren, B. S. de Garmandia, L. M. Stockton (four times), Eustace Miles (champion of Great Britain), Joshua Crane, and Jay Gould (amateur champion 1907 and 1908). The older courts at Boston and New York are rather low and small, but the newer ones are perfect.

of sonnets which have been highly praised. In June 1829 Alfred Tennyson won the Chancellor’s prize medal for his poem called “Timbuctoo.” With great imperfections, this study in Miltonic blank verse displays the genius of a poet, in spite of a curious obscurity both of thought and style. Here are already both richness and power, although their expression is not yet clarified by taste. But by this time Tennyson was writing lyrics of still higher promise, and, as Arthur Hallam early perceived, with an extraordinary earnestness in the worship of beauty. The results of this enthusiasm and this labour of the artist appeared in the volume of Poems, chiefly Lyrical, published in 1830. This book would have been astonishing as the production of a youth of twenty-one, even if, since the death of Byron six years before, there had not been a singular death of good poetry in England. Here at least, in the slender volume of 1830, was a new writer revealed, and in “Mariana,” “The Poet,” “Love and Death,” and “Oriana,” a singer of wonderful though still uncastanched melody. Through these, and through less perfect examples, was exhibited an amazing reverence of fancy, at present insufficiently under control, and a voluptuous pomp of imagery, tending to an over-sweetness. The veteran S. T. Coleridge, praising the genius in the book, blamed the metrical imperfection of it. For this criticism he has himself constantly been reproved, and Tennyson (whose impatience of anything like censure was phenomenal) continued to resist it to the end of his life. Yet Coleridge was perfectly just in his remark; and the metrical anarchy of the “Madelines” and “Adelines” of the 1830 volume showed that Tennyson, with all his delicacy of modulation, had not yet mastered the arts of verse. 

In the summer of 1830 Tennyson and Hallam volunteered in the army of the Spanish insurgent Torrijos, and marched about a little in the Pyrenees, without meeting with an enemy. He came back to find his father ailing, and in February 1831 he left Cambridge for Somersby, where a few days later Dr George Tennyson died. The new incumbent was willing that the Tennysons should continue to live in the rectory, which they did not leave until six years later. Arthur Hallam was now betrothed to Emily Tennyson (afterwards Mrs Jesse, 1811–1886), and stayed frequently at Somersby. This was a very happy time, and one of great physical development on Alfred’s part. He took his share in all kinds of athletic exercises, and it was now that Brookfield said, “It is not fair that you should be Hercules as well as Apollo.” This high physical zest in life seems to have declined after 1831, when his eyes began to trouble him, and he became liable to depression. The poetical work of these three years, mainly spent at Somersby, was given to the world in the volume of Poems which (dated 1833) appeared at the end of 1832. This was certainly one of the most astonishing revolutions of finished genius ever produced by a young man of less than four-and-twenty. Here were to be read “The Lady of Shalott,” “The Dream of Fair Women,” “Oenone,” “The Lotus-Eaters,” “The Palace of Art,” and “The Miller’s Daughter,” with a score of other lyrics, delicious and divine. The advance in craftsmanship and command over the material of verse shown since the volume of 1830 is absolutely astounding. If Tennyson had died of the savage article which presently appeared in the Quarterly Review, literature would have sustained terrible losses, but his name would have lived for ever among those of the great English poets. Indeed, it may be doubted whether, in several directions, he ever surpassed the glories of this volume, to be found in this most exquisite and most precious book. It was well that its publication was not completed before the blow fell upon Tennyson which took for a while all the light out of him. In August 1833 Arthur Hallam started with his father, the great historian, for Tirol. They went no farther than Vienna, where Mr Hallam, returning to the hotel on the 15th of September 1833, found his son lying dead on a sofa: a blood-vessel had broken in his brain. His body was brought back to England, and buried at Cledendon on the 3rd of January 1834. These events affected Tennyson extremely. He grew less than ever willing to come forward and face the world; his health became “variable and his spirits indifferent.” The earliest effect of Hallam’s death upon his friend’s art was the composition, in the summer of 1834, of The Two Voices; and to the same period belong the beginnings of the Idylls of the King and of In Memoriam, over both of which he meditated long. In 1835 he visited the Lakes, and saw much of Hartley Coleridge, but would not “obtrude on the great man at Rydal,” although “Wordsworth was hospitably disposed.” Critics alike of fame and of influence, Tennyson spent these years mainly at Somersby, in a uniform devotion of his whole soul to the art of poetry. In 1837, to their great distress, the Tennysons were turned out of the Lincolnshire rectory where they had lived so long. They moved to High Beech, in Epping Forest, which was their home until 1840. The poet was already engaged, or “quasi-betrothed,” to Emily Sellwood, but ten years more had to pass before they could afford to marry. At Torquay, in 1838, he wrote Audley Court on one of his rare excursions, for he had no money for touring, nor did he wish for change: he wrote at this time, “I require quiet, and myself to myself, more than any man when I write.” In 1840 the Tennysons moved to Tunbridge Wells, and a year later to Boxley, near Maidstone, to be close to Edmund Lushington, who had now married Cecilia Tennyson. Alfred was from this time more and more frequently a visitor in London. 

In 1842 the two-volume edition of his Poems broke the ten years’ silence which he had enforced himself to keep. Here, with many pieces already known to all lovers of modern verse, were found rich and copious additions to his work. These he had originally intended to publish alone, and an earlier privately printed Morte d’Arthur, Dora, and other Idyls, of 1842, is the despair of book-collectors. Most of those studies of home-life in England, which formed so highly popular a section of Tennyson’s work—such as “The Gardener’s Daughter,” “Walking to the Mail,” and “The Lord of Burleigh”—were now first issued, and, in what we have grown to consider a much higher order, “Locksley Hall,” “Ulysses,” and “Sir Galahad.” To the older and more luxurious lyrics, as reprinted in 1842, Tennyson did not spare the curbing and pruning hand, and in some cases went too far in restraining the wanton spirit of beauty in its youthful impulse. It is from 1842 that the universal fame of Tennyson must be dated; from the time of the publication of the two volumes he ceased to be a curiosity, or the darling of an advanced clique, and took his place as the leading poet of his age in England. Among the friends whom he now made, or for the first time cultivated, were Carlyle, Rogers, Dickens, and Elizabeth Barrett. Material difficulties now, however, for the first time intruded on his path. He became the victim of a certain “earnest-frothy” speculator, who induced him to sell his little Lincolnshire estate at Grasby, and to invest the proceeds, with all his other money, and part of that of his brothers and sisters, in a “Patent Decorative Carving Company”; in a few months the whole scheme collapsed, and Tennyson was left penniless. He was attacked by so overwhelming a hypochondria that his life was despairsed of, and he was placed for some time under the charge of a hydro-pathic physician at Cheltenham, where absolute rest and isolation gradually brought him round to health again. The state of utter indigence to which Tennyson was reduced greatly exercised his friends, and in September 1845, at the suggestion of Henry Hallam, Sir Robert Peel was induced to bestow on the poet a pension of £200 a year. Never was public money expended in a more patriotic fashion. Tennyson’s health suffered considerably from this, for in 1846 he was hard at work on The Princess; in the autumn of this year he took a tour in Switzerland, and saw great mountains and such “stateliest bits of landscape” for the first time. In 1847 nervous prostration again obliged him to undergo treatment at Prestbury: “They tell me not to read, not to think; but they might as well tell me not to live.” Dr Gully’s water-cure was tried, with success. The Princess was now published, in a form afterwards considerably modified and added to. Carlyle and Fitzgerald “gave up all hopes of him after The Princess,” or
Tennyson pretended that they did. It was true that the bent of his genius was slightly altered, in a direction which seemed less purely and purely that of the highest art; but his concessions to public taste vastly added to the width of the circle he now addressed. The home of the Tennysons was now at Cheltenham; on his occasional visits to London he was in the habit of seeing Thackeray, Coventry Patmore, Browning and Macready, as well as older friends, but he avoided "society." In 1848, while making a tour in Cornwall, Tennyson met Robert Stephen Hawker of Morwenstow, with whom he thenceforth was associated; he resumed his intention of writing an epic on that theme. In his absent-minded way Tennyson was very apt to mislay objects; in earlier life he had lost the MS. of Poems, chiefly Lyric, and had been obliged to restore the whole from scraps and memory. Now a worse thing befell him, for in February 1850, having collected into one "long ledger-like book" all the elegies on Arthur Hallam which he had been composing at intervals since 1833, he lost this only MS. in the cupboard of some lodgings in Mornington Place, Hampstead Road. By extraordinary good fortune it had been overlooked by the landlady, and Coventry Patmore was able to recover it. In this way In Memoriam was dragged back from the very verge of destruction, and could be published, in its original anonymous form, in May 1850.

The public was at first greatly mystified by the nature and object of this poem, which was not merely a chronicle of Tennyson's emotions under bereavement, nor even a statement of his philosophical and religious beliefs; but, as he long afterwards explained, a sort of Divina Commedia, ending with happiness in the marriage of his youngest sister, Cecilia Lushington. In fact, the great blemish of In Memoriam, its redundance and the dislocation of its parts, were largely due to the desultory manner of its composition. The poet wrote the sections as they occurred to him, and did not think of weaving them together into a single poem until it was too late to give them real coherency. The metre, which by a curious naïveté Tennyson long believed that he had invented, served by its happy peculiarity to bind the sections together, and even to give an illusion of connected movement to the thought.

The scale of Tennyson's poems now made it safe for him to settle; and on the 13th of June 1850 he was married at Shiplake to Emily Sarah Sellwood (1813-1890). Of this union no more need be said than was recorded long afterwards by the poet himself, "The peace of God came into my life before the altar when I wedded her." Every species of good fortune was now to descend on the path of the man who had struggled against ill luck so long. Wordsworth died, and on the 19th of November 1850 Queen Victoria appointed Tennyson poet laureate. The salary connected with the post was very small, but it had a secondary value in greatly stimulating the sale of his books, which was his main source of income. The young couple took a house at Warninglid, in Sussex, which did not suit them, and then one in Montpelier Row, Twickenham, which did better. In April 1851 their first child was born dead. At this time Tennyson was brooding much upon the ancient world, and reading little but Milton, Homer and Virgil. This condition was elegantly defined by Carlyle as "sitting on a dunghill among innumerable dead dogs." In the summer of 1851 was made the tour in Italy, of which The Daisy is the immortal record. Of 1852 the principal events were the birth of his eldest son Hallam, the second Lord Tennyson, in August, and in November the publication of the Ode on the Death of the Duke of Wellington. In the winter of 1853 Tennyson entered Duke's possession of a little house and farm called Farrington, near Freshwater, in the Isle of Wight, which he leased at first, and afterwards bought: this beautiful place, ringed round with ilexes and cedars, entered into his life and coloured it with its delicate enchantment. In 1854 he published The Charge of the Light Brigade, and was busy composing Maud and its accompanying lyrics; and this volume was published in July 1855 just after he was made D.C.L. at Oxford: he was received on this occasion, which may be considered his first public appearance, with a "tremendous ovation." The reception of Maud from the critics, however, was the worst trial to his equanimity which Tennyson had ever had to endure, nor had the future anything like it in store for him. He had risen in Maud far above his ordinary serenity of style, to ecstasies of passion and audacities of expression which were scarcely intelligible to his readers, and certainly not welcome. It is odd that this irregular poem, with its copious and varied music, its splendid sweep of emotion, its unfailing richness of texture—this poem in which he wrote of "the dark dead mad," and in which he reached nowhere else, should have been received with bitter hostility, have been styled "the dead level of prose run mad," and have been reproved more absurdly still for its "ramrant and rabid bloodthirstiness of soul." There came a reaction of taste and sense, but the delicate spirit of Tennyson had been wounded. For some years the world heard nothing from him; he was at Farringford, busying himself with the Arthurian traditions. He had now become an object of boundless personal curiosity, being already difficult to find, and "the purest" of the "golden laurels." It was in 1857 that Bayard Taylor saw him, and carried away the impression of a man "tall and broad-shouldered as a son of Anak, with hair, beard and eyes of southern darkness." This period of somewhat mysterious withdrawal from the world embraced a tour in Wales in 1857, a visit to Norway in 1858, and a journey through Portugal in 1859. In 1857 two Arthurian poems had been tentatively and privately printed, as Enid and Nimue, or the True and the False, to see how the idyllic form would be liked by the inner circle of Tennyson's friends. In the summer of 1859 the first series of Idylls of the King was at length given to the world, and achieved a popular success far beyond anything experienced before by any English poet, save perhaps Byron and Scott. Within a month of publication, 10,000 copies had been sold. The idyls were four in number, "Enid," "Vivien" (no longer called "Nimue"), "Elaine" and "Guinevere." These were fragments of the epic of the fall of King Arthur and the Table Round which Tennyson was so long preparing, and which he can hardly be said to have ever completed, although nearly thirty years later he closed it. The public and the critics alike were entranced with the "sweetness" and the "purity" of the themes. A few, like Thackeray, were doubtful about "that increased quaintness of style" which two already suspected that the "sweetness" was obtained at some sacrifice of force, and that the "purity" involved a cession to Victorian conventionality. It was not perceived at the time that the four idyls were parts of a great historical or mystical poem, and they were welcomed as four polished studies of typical women: it must be confessed that in this light their even perfection of workmanship appeared to greater advantage than it eventually did in the general texture of the so-called "epic." In 1859 "Boadicea" was written, and "Rime of the " in The Times. Urged by the duke of Argyll, Tennyson now turned his attention to the theme of the Holy Grail, though he progressed with it but fitfully and slowly. In 1861 he travelled in Auvergne and the Pyrenees, with Clough, who was to die a few months later; to this year belong "Helen's Tower" and the "Dedication" of the Idylls to the prince consort, "These to his Memory." The latter led to Tennyson's presentation in April 1862 to the queen, who "stood pale and statue-like before him, in a kind of stately innocence," which greatly moved his admiring homage. From this time forth the poet enjoyed the constant favour of the sovereign, though he could never be moulded into a constitutional courtier. He now put the Arthurian legends aside for a time, and devoted himself to the composition, in 1862, of "Enoch Arden," which, however, did not appear until 1864, and then in a volume which also contained "Sea Dreams," "Aylmer's Field" and, above all, "The Northern Farmer," the first and finest of Tennyson's remarkable studies in dialect. In April of this year Garibaldi visited Farringford; in February 1865 Tennyson's mother died at Hampstead in her eighty-fifth
year; in the ensuing summer he travelled in Germany. The time slipped by with incidents but few and slight, Tennyson's popularity in Great Britain growing all the time to an extent unparalleled in the whole annals of English poetry. This universality of fame led to considerable practical discomfort; he was besieged by sightseers, and his nervous trepidation led him perhaps to exaggerate the intensity of the inflection. In 1867 he determined to make for himself a haven of refuge against the invading Philistine, and bought some land on Blackdown, above Haslemere, then a secluded corner of England; here Mr. (afterwards Sir) James Knowles began to build him a house, ultimately named Aldworth. This is the time of two of his rare, privately printed pamphlets, The Window; or, The Loves of the Wrens (1869), and The Vicar (1868). The noble poem Lucretius, one of the greatest of Tennyson's versified monographs, was published in May 1868, and in this year The Holy Grail was at last finished; it was published in 1869, together with three other idyls belonging to the Arthurian epic, and various miscellaneous lyrics, besides Lucretius. The reception of this volume was cordial, but not so universally respectful as that which Tennyson had grown to expect from his adoring public. The fact was that the heightened reputation of Browning, and still more the sudden vogue of Swinburne, Morris and Rossetti (1866-1870), considerably disturbed the minds of Tennyson's most ardent readers, and exposed himself to a severer criticism than he had lately been accustomed to endure. He went on quite calmly, however, sure of his mission and of his music. His next volume (1872), Gareth and Lynette and The Last Tournament, continued, and, as he then supposed, concluded The Idyls of the King, to the great satisfaction of the poet, who had found much difficulty in rounding off the last sections of the poem. Nor, as he was to find, was the poem yet completed, but for the time being he dismissed it from his mind. In 1873 he was offered a baronetcy by Gladstone, and again by Disraeli in 1874; in each case the honour was gracefully declined. Tennyson was through it all the time, of course, working on the Idylls; when the collection of new verses entitled Demeter and other Poems (1879), which appeared almost simultaneously with the death of Browning, an event which left Tennyson a solitary figure indeed in poetic literature. In 1891 it was observed that he had wonderfully recovered the high spirits of youth, and even a remarkable portion of physical strength. His latest drama, The Foresters, now received his attention, and in March 1892 it was produced at New York, with Miss Ada Rehan as Maid Marian. During this year Tennyson was steadily engaged on poetical composition, finishing "Akbar's Dream," "Kapiolani," and other contents of the posthumous volume called The Death of Osmon, 1892. In the summer he took a voyage to the Channel Islands and Devonshire; and even this was not his latest excursion from home, for in July 1892 he went up for a visit to London. Soon after entering his eighty-fourth year, however, symptoms of weakness set in, and early in September his condition began to give alarm. He retained his intellectual lucidity and an absolute command of his faculties to the last, reading Shakespeare with obvious appreciation until within a few hours of his death. With the splendour of the full moon falling upon him, his hard clasping his Shakespeare, and reading, as were told almost unearthly in the majestic beauty of his old age, Tennyson passed away at Aldworth on the night of the 6th of October 1892. Cymbeline, the play he had been reading on the last afternoon, was laid in his coffin, and on the 11th the 6th was publicly buried with great solemnity in Westminster Abbey. Lady Tennyson survived until August 1896.

The physical appearance of Tennyson was very remarkable. Of his figure at the age of thirty-three Carlyle has left a superb portrait: "One of the finest-looking men in the world. A great shock of rough, dusky, dark hair; bright, laughing, hazel eyes; massive aquiline face, most massive yet most delicate; of sallow brown complexion, almost Indian-looking, clothes cynically, looks very well; and when my eyes glided over him, I was struck by his musical, metallic, fit for loud laughter and piercing wail, and all that may lie between; speech and speculation free and
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plenteous; I do not meet in these late decades such company over a pipe." He was unusually tall, and possessed in advanced years a strange and rather terrifying air of sombre majesty. But he was, in fact, of a great simplicity in temperament, affectionate, shy, still exquisitely sensitive in extreme old age to the influences of beauty, melancholy and sweetness. Although exceedingly near-sighted, Tennyson was a very keen observer of nature, and at the age of eighty his dark and glowing eyes, which were still strong, continued to permit him to enjoy the delicate features of country life around him, both at Ald- worth and in the Isle of Wight. His Life, written with admirable piety and taste by his son, Hallam, second Lord Tennyson, was published in two volumes in 1897.

At the time of his death, and for some time after it, the enthusiastic recognition of the genius of Tennyson was too extravagant to be permanent. A reaction against this extravagance was perhaps inevitable, and criticism has of late been little occupied with the poet. The reason of this is easy to find. For an unusually long period this particular poetry had occupied public and professional opinion, and all the commonplace things about it had been said and re-said to satiety. It lacks for the moment the interest of freshness; it is like a wonderful picture seen so constantly that it fails any longer to concentrate attention. No living poet has ever held England—no poet but Victor Hugo has probably ever held any country—quite so long under his unbroken sway as Tennyson did. As he recedes from us, however, we begin to see that he has a much closer relation to those of his masters than we used to be inclined to admit. The distance between the generation of Wordsworth and Coleridge and that of Byron and Shelley is not less—it is even probably greater—than that which divides Keats from Tennyson, and he is more the last of that great school than the first of any new one. The qualities in which he seems to surpass his immediate predecessors are exactly those which should be the gift of one who sums up the labours of a mighty line of artists. He is remarkable among them for the breadth, the richness, the substantial accomplishment of his touch; he has something of all these his elders, and goes farther along the road of technical perfection than any of them. We still look to the earlier masters for supreme excellence in particular directions: to Wordsworth for sublime philosophy, to Coleridge for ethereal magic, to Byron for passion, to Shelley for lyric intensity, to Keats for richness. Tennyson does not excel each of these in his own special field, but he is often nearer to the particular man in his particular mastery than any one else can be said to be, and he has in addition his own field of supremacy. What this is cannot easily be defined; it consists, perhaps, in the beauty of the atmosphere which Tennyson contrives to cast around his work, moulding it in the blue mystery of twilight, in the golden light of the setting sun. In this is worthy of the past charm: this atmosphere, suffused with his poetry with inestimable skill and with a tact very rarely at fault, produces an almost unerring vision or mirage of loveliness, so that, even where (as must sometimes be the case with every poet) the thought and the imagery have little value in themselves, the fictive aura of beauty broods over the otherwise undistinguished verse. Hence, among all the English poets, it is Tennyson who presents the least percentage of entirely unattractive poetry. In his luminous subtlety and his broad undulating sweetness, his relationship with Virgil has long been manifested; he was himself aware of it. But he was also conscious that his exquisite devotion to mere lucidity and beauty might be a snare to him, and a happy instinct was always driving him to a study of mankind as well as of inanimate nature. Few English writers have known so adroitly as Tennyson how to bend the study of Shakespeare to the enrichment of their personal style. It should be added that he was a very deep and original student of literature of every description, and that the comparatively few specimens which have been preserved of his conversation contain some of the finest fragments of modern appreciation of the great poets which we possess. This is worthy of consideration in any attempt made to sketch the mind of a man who was above all other masters of recent literature an artist, and who must be studied in the vast and orbic fullness of his accomplishment in order to be appreciated at all.

(E. G.)

Alfred, Lord Tennyson: a Memoir (1897), by Hallam, second Baron Tennyson, is the authoritative source for the poet's biography, Mr. R. H. Shepherd in his Tennysoniana (1886), supplied a list of criticisms on his work, and a bibliography issued separately in 1896. Among the numerous books on the subject of his life and works that might be mentioned, A Commentary on Tennyson's In Memoriam (1901), by Prof. A. C. Bradley; Canon Rawnsley's Memories of the Tennysons (1900); Alfred Tennyson (1901), by Mr. W. A. Lang; an essay by Mr. W. S. Lilly's Studies in Religion and Literature (1904); and The Life of Lord Tennyson (1904), by Mr. A. C. Benson, who gives a more critical estimate of the poet than was possible in the Memoir by his son.

TENOR (through Fr. and It. from Lat. tenor, holding on, course, sense of a law, tone), a general course or direction, the drift or general meaning of a statement or discourse, hence, in law, the true purport and effect of a deed or instrument. The most general use of the word is, in music, for the highest kind of the natural adult male voice. This use descends from the Medieval Latin tenor, which was applied first to the chief melody, the cantus firmus, and then to the male voice to which the singing of this was assigned.

TENREC (Centetes cecaudatus), one of the largest representatives of the mammalian order Insectivora, the length being from 12 in. to 16 in.; called also the tailless ground-hog of Madagascar, to which island it is restricted. The coat consists chiefly of bristles and hairs, with an admixture of flexible spines, which in the young form longitudinal lines down the back; but in the adult they are limited to the back of the neck. The general hue is brown tinged with yellow. From twelve to sixteen young are produced at a birth, and twenty-one have been recorded. In habits the tenrec is fossorial and nocturnal; its home is in the brush in the mountain regions, and in the cool season, from May or June till December, it hibernates in deep burrows. The long flexible snout is used to root up worms and grubs, and ground-insects form part of its nourishment. These animals are very fat when hibernation begins, and are then much valued for food by the natives (see also INSECTIVORA).

TENT. A tent is a portable habitation or place of shelter, consisting in its simplest form of a covering of some textile substance stretched over a framework of cords and poles, or of wooden rods, and fastened tightly to the ground by pegs. Throughout the greater part of the interior of Asia the pastoral tribes have of necessity ever been dwellers in tents—the scantiness of water, the consequent frequent failure of herbage, and the violent extremes of seasons compelling a wandering life. Tents have also been used in all ages by armies in campaign. In ancient Assyrian sculptures discovered by Layard at Nineveh the forms of tent and tent-furnishings are similar to those which still prevail in the East, and it appears that then as now it was a custom to pitch tents within the walls of a city. The ordinary family tent of the Arab nomads of modern times is a comparatively spacious ridged structure, averaging from 20 to 25 ft. in length, but sometimes reaching as much as 40 ft. Its covering consists of a thick felt of black goat hair (cp. Cant. i. 5—4th black as the tents of Kedar''), or sometimes of alternate stripes of black and white disposed horizontally. The ridge or roof is supported by nine poles disposed in sets of three, the central set being loftier than those at each end, whereby a slope outward is formed which helps to carry off rain. The average height inside at the centre is 7 ft. and at the sides 5 ft., and the cloths at the side are so attached that they can easily be removed, the sheltered end being always kept open. Internally the tent is separated by a partition into two sections, that reserved for the women containing the cooking utensils and food. The fourt or tent of the Kirghiz of Central Asia is a very capacious and substantial structure, consisting of a wooden frame for sides, radiating ribs for roof, and a wooden door. The sides are made up of sections of laths, which expand and contract in lozenges, on the principle of lazy tongs, and to their upper extremities ribs are lashed at regular intervals. Over this
In 1789. For several years he practised as a special pleader under the bar, and was finally called at the Inner Temple in 1796. He joined the Oxford circuit and soon made rapid headway. In 1801 he was appointed recorder of Oxford. In 1802 he appeared in Law relative to Merchant Ships and Seamen, a concise and excellent treatise, which has maintained its position as an authoritative work. Its publication brought to him so much commercial and other work that in 1808 he was in a position to refuse a seat on the bench; this, however, he accepted in 1816, being made a judge of the court of common pleas. On the resignation of Lord Ellenborough in 1818 he was appointed to the bench, and, in the discharge of his duties, he developed his capacity as chief justice he presided over several important state trials, notably that of Arthur Thistlewood and the Cato Street conspirators (1826). He was raised to the peerage in 1827 as Baron Tenterden of Hendon. Never a great lawyer and with no pretence to eloquence, Tenterden made his way by sound common sense and steady hard work. He was an uncompromising Tory, and had no sympathy with the reform of the criminal law carried out by Romilly; while he strongly opposed the Catholic Relief Bill and the Reform Bill. He died on the 4th of November 1832, and was buried, by his own desire, in the Foundling Hospital, London, of which he was a governor.

Tenterden was succeeded in his title by his son, John Henry Abbott (1796-1870), then by his grandson, Charles Stuart Aubrey Abbott (1834-1882), permanent under-secretary for foreign affairs, who was made a K.C.B. in 1878. In 1882 the latter's son, Charles Stuart Henry Abbott (b. 1869) became the 4th Baron.

TENTERDEN, a market town and municipal borough in the Ashford parliamentary division of Kent, England, 62 m. S.E. by E. of London by the South-Eastern and Chatham railway, Pop. (1901) 3243. It lies on an elevation above the Newnall Channel, a tributary of the Rother, whose flat valley, called the Rother Levels, was an estuary within historic times; and even as late as the 18th century the sea was within 2 m. of Tenterden, which is a member of the affiliated Cinque Port of Rye.

The church of St Mildred is Early English and later, and its tall, massive Perpendicular tower is well known for the legend connecting it with Goodwin Sands. The story is that the Abbots of St Augustine, Canterbury, diverted the funds by which the sea-wall protecting Earl Godwin's island was kept permanent, and the purpose of building Tenterden as a stronghold, the consequence being that in 1099 an inundation took place and "Tenterden steeple was the cause of the Goodwin Sands." Attached to the church is a penitentary used in the reign of Queen Mary for the confinement of persons awaiting trial on a charge of heresy. The church of High Halden, in the neighbourhood, is remarkable for its octagonal wooden tower constructed of huge timbers, with a belfry of wooden tiles (shingles), of the time of Henry VI. Tenterden has a considerable trade in agricultural produce and stock. It is governed by a mayor, four aldermen and twelve councillors. Area, 5046 acres.
ship-money, as compared with £1o contributed by Faversham, and £6o by Hythe. Under Edward III, several refugee Flemings settled in the town and established the woollen manufacture. An old waste book, still preserved, contains entries of amounts of cloth sent from Tenterden to London. By 1835 this trade had completely died out, and Tenterden was suffering from the depression of agricultural interests.

**TENURE** (Fr. tenure, from Lat. tener, to hold), in law, the holding or possession of land. The holding of land in England was originally either *alodial or feudal*. Alodial land was land held not of a superior lord, but of the king and people. Such ownership was absolute. It possibly took its origin from the veneration of the clan; that the chief was the leader but not the owner, and was no doubt strengthened by the temporary and partial occupation by the Romans. Their withdrawal, followed by the Saxon invasion, tended, without doubt, to re-establish the principle of common village ownership which formed the basis of both Celtic and German tenure. In the later Saxon period, however, private ownership became gradually more extended. Then the feudal idea began to make progress in England, much as it did about the same time on the continent of Europe, and it received a great impetus from the Norman conquest. When English law began to settle down into a system, the principle of feudalism was taken as the basis, and it gradually became the undisputed maxim of English law that the sovereign was the supreme lord of all the land and that every one held under him as tenant, that there was no such thing as an absolute private right of property in land, but that the state alone as personified by the sovereign was vested with that right, and conceded to the individual possessor only a strictly defined subordinate right, subject to conditions from time to time enacted by the community (see also Feudalism). Feudal tenure was divided into free and non-free. Free tenures were *francium*, *knights* service, *serjeanty* and free socage. These tenures are dealt with under their separate headings. Base or non-free tenure was tenure in villenage (g.n.) and copyhold (g.s.), and see also Manor.

**TEPICY**, a territory of Mexico facing on the Pacific Ocean and bounded N., E. and S. by Sinaloa, Durango and Jalisco. Area 11,275 sq. m. Pop. (1900) 150,098. The active volcano of Ceboruco rises in the western part of the territory. The slopes and valleys are densely wooded, the lower regions being very fertile and adapted to tropical agriculture. The town of Tepic is situated, and the climate hot, damp and malarial. The Rio Grande de Lerma, or Santiago, is the principal river, whose sources are to be found on the high plateau in the state of Mexico. The next largest river is the Mezquital, which has its sources in the state of Durango, not far from the city of that name. The products of the territorial coast lands are sugar, cotton, tobacco, maize, palm oil, coffee, fine woods and medicinal plants. Mining attracts much attention in the sierras, and its mineral deposits are rich. There are cotton and cigarette factories at the town of Tepic, besides sugar works and distilleries on the plantation tenures. The capital of the territory is Tepic (pop. 15,488), attractively situated on a small plateau 2050 ft. above sea level, 26 m. E. by S. of its port, San Blas, with which it is connected by rail.

The territory of Tepic was detached from the State of Jalisco in 1889 on account of the belligerent attitude of its population, chiefly composed of Indians. A territorial form of government places it more directly under the control of the national executive.

**TEPIDARIUM**, the term given to the warm (*tepidaus*) bath-room of the Roman baths. There is an interesting example at Pompeii; this was covered with a semicircular barrel vault, decorated with reliefs in stucco, and round the room a series of square recesses or niches divided from one another by Telamones. The tepidarium in the Roman thermes was the great central hall round which all the other halls were grouped, and which gave the key to the plans of the thermes: it was probably the hall where the bathers first assembled prior to taking the cold bath or passing through the various hot baths, and was decorated with the richest marbles and mosaics: it received its light through clerestory windows, on the sides, the front and the rear, and would seem to have been the hall in which the finest treasures of art were placed; thus in the thermes of Caracalla, the Farnese Hercules, and the Tero Farnese, the two gladiators, the sarcophagi of green basalt now in the Vatican, and numerous other treasures, were found during the excavations by Paul III. In 1546, and transported to the Vatican and the museum at Naples.

**TEPLITZ** (Czech, *Teplice*), or *Teplitz-Schönau*, as it is officially called since the incorporation of the village of Schönau in 1805, a town of Bohemia, Austria, 80 m. N.N.W. of Prague by rail, 10 m. from the L. Teplice. Situated on the plain of the Biela, which separates the Erzgebirge from the Bohemian Mittelgebirge, and is a favourite watering-place, containing a large Kurhaus and numerous handsome bath-houses. The environs are laid out in pretty and shady gardens and promenades, the finest being in the park which surrounds the château of Prince Clary-Aldringen, built in 1751. The other chief buildings are the Roman Catholic Schlosskirche, built in 1568 and altered to its present form in 1790, the Protestant church, the Jewish synagogue with a conspicuous *synagogue* tower. The town contains the remains of several ancient towers, probably the remains of the Benedictine convent, but ascribed by local tradition to the knight Kolostuj, the legendary discoverer of the springs. The saline-alkaline springs of Teplitz, ten to twelve in number, ranging in temperature from 90° to 117° Fahr., are classed among what are called "indifferent" waters. Used almost exclusively for bathing, they are prescribed for gout, rheumatism, and some scrofulous affections, and their reputed efficacy in alleviating the effects of gun-shot wounds had gained for Teplitz the sobriquet of the "warriors' bath." Military baths are maintained in the town by the governments of Austria, Prussia and Saxony, and there are also bath-houses for the poor. Teplitz is much visited for the after-cure, after Carlsbad and similar spas. The number of patients is about 6000 and the passing visitors about 25,000. The presence of a bed of lignite in the neighbourhood has encouraged the industrial development of Teplitz, which carries on manufactures of machinery and metal goods, cotton and woollen goods, chemicals, hardware, sugar, dyeing and calico-printing.

The thermal springs are said to have been discovered as early as 1433, as the first mention of the baths occurs in the 16th century. The town is mentioned in the 12th century, when Judith, queen of Ladislaus I. of Bohemia, founded here a convent of Benedictine nuns, which was destroyed in the Hussite wars. In the 17th century it was a resort for the Elector of Saxony after Kinsky's murder (25th February 1634) the lordship was granted by Ferdinand II. to Johann Count Aldringen. His sister Anna, who inherited it, married Freiherr Friedrich von der ClARY, who assumed the additional name and arms of Aldringen. The family, which was raised to the rank of count in 1666 and of prince of the Empire in 1667, still retains the property. Teplitz figures in the history of Wallenstein, and is also interesting as the spot where the monarchs of Austria, Russia and Prussia first signed the triple alliance against Napoleon in 1813. It is a curious fact that on the day of the earthquake at Lisbon (1st November 1755) the main street of Teplitz collapsed under the remains of the *Tepic* hill.

**TERAMO**, an episcopal see of the Abruzzi, Italy, the capital of the province of Teramo, 16 m. by rail W.S.W. of Giulianova, a junction on the Ancona-Brindisi railway. Pop. (1901) 10,508 (town); 24,001 (commune). The town stands on the left bank of the Tordino, where it is joined by the Vezzola, at an altitude of 876 ft. above sea-level. The picturesque valley of the Tordino is here dominated by the peaks of the Gran Sasso d'Italia. The town is traversed by one straight wide street with large houses, but for the most part it consists of narrow lanes. The cathedral has a Romanesque Gothic portal of 1332 by a Roman marble worker named Deodatus, and the interior is decorated in the Baroque style, but still retains the pointed vaulting of 1134, introduced into Italy by French Benedictines; it contains a splendid silver antependium by the 15th-century goldsmith Nicolo di Guardiagrele (1433-48). The tower is fine. The church of S. Antonio is also in the Romanesque Gothic
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style. Under the church of S. Anna dei Pompei remains of Roman houses and of the original cathedral have been discovered (F. Savini in Notizie degli scavi, 1898, 137). In the Communal Gallery is an altarpiece from the cathedral by the Venetian Jacobello del Fiore (1400-1439). The antiquities include remains of a gateway, a theatre and baths, as well as numerous inscriptions. The town manufactures wool and silk, and of straw hats and pottery.

The ancient Interamna Practuttiorum (so called to distinguish it from Interamna Lirenas and Interamna Nahars) was the chief town of the tribe of the Praetutti. Its pre-Roman necropolis was discovered in 1905 (F. Savini in Notizie degli scavi, 1905, 267). Of its municipal constitution little is known, indeed in an inscription of the end of the Republic it is spoken of both as a colonia and a municipium. It was situated on a branch of the Via Cæcilia (q.v.). Remains of an amphitheatre still exist. In the valley of the Vomatoe near Montorio was a Roman village, probably dependent on Interamna, with a temple of Hercules (Corp. inscr. Lat., ix, p. 484).

See V. Bindu, Monumenti degli Abruzzi (Naples, 1889), i sqq.

TERAPHIM (A.V., sometimes transcribes, e.g. Judges xvii. 5; xviii. 14 seq.; Hosea iii. 4; sometimes translates "image," 1 Sam. xix. 13; "idols," Zech. x. 2; "idolatry," 1 Sam. xv. 23; R.V. renders consistently "teraphim"), a Hebrew word, found only in the plural, of uncertain etymology. The name appears to be applied to some form of idol (cf. Gen. xxxix. 19 and 30), but details as to its precise configuration, &c., are lacking. From c. x. 14 to the 1st century B.C. it was in common use. In the early monarchical period a regular place in every household was still reserved for the teraphim; while in the 8th century Hosea (iii. 4) speaks of "ephod and teraphim" as essential elements in the national worship. Later the teraphim with other adjuncts of heathenish worship were banned by the prophets. The meaning of the Elohist story in Gen. xxxv. 2-4 clearly is that the employment of teraphim and of other heathenish practices of Aramean paganism was given up by Israel in order that they might serve Jehovah alone at Bethel. In Judges and Hosea the teraphim were closely connected with the ephod; both are mentioned in connexion with divination (cf. 2 Kings xxii. 24; Ezek. xxxi. 26; Zech. x. 2). Whether the teraphim were "consulted" by lot or not is uncertain. In view of Ezek. xxxi. 21 and Hosea iii. 4 it is difficult to suppose that the teraphim were purely household idols. The Rabbinical conceptions on the subject can be found in Buxtorff, Lex. Talm. (ed. Fischcr), 1315 seq. One of the most curious is that the teraphim consisted of a mumified human head (see also Ephod).

(W. R. S.; G. H. Bo.)

TEREBITHIA [symbol T] (atomic weight 159-2 (O=16)), a magnetic chemical element belonging to the rare earth group. It was originally called erbia by its discoverer Mo gönder (see Rare Earth). Pure terebithia compounds were obtained by G. Urbain (Compt. rend., 1904 seq.) by fractional crystallization of the nickel double nitrates, the ethyl sulphates, and the bismuth double nitrates of the terebithium earth. Terebithia appears to be trivalent. The oxide is a black or brown powder according as it is prepared from the exalate or sulphate, and when pure it is non-fluorescent, but mixed with gadolinia or alumina it possesses this property. It yields colourless salts; the crystallized sulphate has the formula Tb(SO₄)₂·12H₂O.

The terebithia earth obtained by these processes was a reddish brown powder. The element was first prepared by P. Cadet (J. Chem. Soc., 1906, 1556). It was isolated first by F. Demidoff (Loch. Minore, 1761, 1556). Thomas T. Chapman and H. E. Elbel (J. Amer. Chem. Soc., 1910, 32, 1446) obtained the element in a state of high purity.

TEREBITHYN, botanical name PISTACIA TEREBINTHUS, a member of the natural order Anacardiaceae, usually a small tree common in the south of Europe and the whole Mediterranean area. It has a purplish grey bark and compound leaves with two to four pairs, and an odd terminal one, of smooth dark green oval blunt leaflets, which when young are thin, translucent and strongly tinged with reddish purple. The very small numerous unisexual flowers are borne on panicles which spring from just above the scars of last year's leaves. The fruit is a small roundish bright red drupe with a scanty pulp. The plant has been long known in English gardens. A liquid oleo-resinous exudation, known as Chian, Scio or Cyprus turpentine, is obtained by cutting the stem. The Chian turpentine of commerce is obtained exclusively from the island of Scio; the produce is very small, a large tree yielding only 10 or 11 ounces in one year. An allied species, P. LENTISCA, is the mastich tree.

TEREDO, a genus of Lamellibranchiate Mollusca, of the order Eulamellibranchia, sub-order Adesmacea, family Terebridiacea. The animals included in this genus are commonly

when he painted the small portraits on copper of "Jan Six" and "A Young Lady" (Six Collection, Amsterdam). In 1648 he was at Münster during the meeting of the congress which ratified the treaty of peace between the Spaniards and the Dutch, and executed his celebrated little picture, painted upon copper, of the assembled plenipotentiaries—a work which, along with the "Guitar Lesson" and a portrait of a "Man Standing," now represents the master in the national collection in London. The picture was bought by the marquess of Hertford at the Demidoff sale for £250, and presented to the National Gallery by Sir Richard Wallace, at the suggestion of his secretary, Sir John Murray Scott. At this time Ter Borch was invited to visit Madrid, where he received employment and the honour of knighthood from Philip IV., but, in consequence of an intrigue, it is said, he was obliged to return to Holland. He seems to have resided for a time in Haarlem; but he finally settled in Deventer, where he became a member of the town council, as which he appears in the portrait now in the gallery of the Hague. He died at Deventer in 1681.

Ter Borch is excellent as a portrait painter, but still greater as a painter of genre subjects. He depicts with admirable truth the life of the wealthy and cultured classes of his time, and his work is free from any touch of the grossness which finds so large a place in Dutch art. His figures are well drawn and expressive in attitude; his colouring is clear and rich, but his best skill lies in his unequalled rendering of texture in draperies, the meaning of which are seen to advantage in such pictures as the "Letter" in the Dutch royal collection, and the "Patental Advice" (known as the "Satin Gown")—engraved by Wille—which exists in various repetitions at Berlin and Amsterdam, and in the Bridgewater Gallery. Ter Borch's works are comparatively rare; only about eighty have been catalogued. Six of these are at the Hermitage, six at the Berlin Museum, five at the Louvre; four at the Dresden Museum, and two at the Wallace Collection.


TERCEIRA, an island in the Atlantic Ocean, belonging to Portugal, and forming part of the Azores archipelago. Pop. (1900) 48,770; area, 224 sq. m. Terceira, i.e. "the third," was so called as being the third island of the archipelago to be discovered by the Portuguese. From its central position it was long the seat of administration, but its capital, Angra (q.v.) or Angra do Heroismo (pop. 10,788), has lost much of its commercial importance. The other chief towns are Ribeirinha (3690), and Praia da Victoria (3265). Unlike the neighbouring islands Terceira is extensively used for cattle-farming, and the summits of its mountains are generally level. It abounds in grain and cattle; but the wines are inferior, and fruits are raised merely for internal consumption. (See also Azores.)
known as "ship-worms," and are notorious for the destruction which they cause in ships' timbers, the woodwork of harbours, and piles or other wood immersed for a long period in the sea. They inhabit long cylindrical holes, which they excavate in the wood, and usually occur in great numbers, crowded together so that often only a very thin film remains between the adjacent burrows. Each burrow is lined with a layer of calcareous substance secreted by the mollusc; this lining is not usually complete, but stops short a little distance from the inner end of the burrow, where the teredo continues to take place.

In some burrows, however, the lining is complete, either because the animal has reached its full size or because some cause prevents it continuing its tunnel; in such cases the calcareous tube has a hemispherical termination. The burrows are usually driven in the direction of the grain of the wood, but not invariably so. When a knot or nail or the tube of a neighbour is reached, the course of the burrow is altered so as to bend round the obstruction. One burrow is never found to break into another.

The adult Teredo, when removed from its burrow and calcareous tube, is from a few inches to 3 ft. in length, according to the species, to which it belongs, and is cylindrical and worm-like in appearance. The anterior end, which lies at the bottom of the burrow, is somewhat enlarged and bears a pair of shells or valves, which are not completely separated by the mantle in life. The valves are triangular in shape and very concave on the side which is in contact with the animal. In front their edges are wide apart, and behind they are edge to edge. There is also a cavity or trough formed by the fold of the mantle, in front of which is a small opening, which is secreted by this part. Anteriorly this portion contains part of the body proper; posteriorly it is formed by the internal cavity of a horizontal partition in two chambers are separated by a pair of two tubular, outgrowths of the mantle called siphons, here united together. In the lower chamber are the elements of the foot, while in the upper the Lameillibranch structure. In the upper chamber anteriorly is the rectum. A thick muscular ring terminates this region of the body, and bears two calcareous plates shaped like spades or battle-axes. The expanded parts of these plates are free and project backwards; the handle is fixed in a deep socket or pit lined by epidermis. These calcareous plates are called pallets (Fr. paumeaux). Behind them are formed the pallets the tubular body burrow, and the two species to which it belongs, and is cylindrical and worm-like in appearance.

The principal organs of the animal, which belong to the branch Rhizaria—are situated in the anterior part of the body, forming a visceral mass, which extends some distance behind the valves. The heart is above the intestine and not perforated by it. These tubes are perforated by a dorsal vessel, which is rudimentary, and situated just above the mouth, while the posterior is large and passes between the middle parts of the shell-valves. The visceral mass is a distance behind the posterior adductor, and behind the rectum, and the visceral ganglia, which in most Lamellibranchs are attached to the ventral surface of the posterior adductor, are in this case at the end of the visceral mass and at the anterior end of the gills. Besides the visceral ganglia a cerebral and a pedal pair are present. The stomach is provided with a large crystalline style. The function of the pallets is to form an operculum to the calcareous tube when the siphons are withdrawn in the shell. The special tubes, which are the calcareous pallets, are in number generally two. The calcareous tube is provided with transverse laminae projecting into the lumen; and in some the external aperture is divided by a horizontal partition into two, one for each siphon.

The Teredo is dioecious, and the males are only in the proportion of 1:500 of the females. As in the case of the oyster, the ova are retained in the shell, and the male and female organs lying in the same stage of development. The segmentation of the ovum is unequal, and leads to the formation of a gastrula by epiboly. By the growth of the preoral lobe provided with a ring of cilia, and by the formation of a rudiment of the shell, the larva is provided with the calcareous shell, and the pelagic larvae, the valves of the shell have grown so large as to cover the whole of the body when the velum is retracted; the foot is also long, cylindrical and flexible, and can be protruded far beyond the shell. The valves of the stage at this are fages relates that at Guipuzcoa (N. Spain) a ferry-boat was sunk accidentally in the spring, and was raised four months afterwards, the soft timbers were already rendered useless by Teredo. How long the animals live is not accurately known, but Quatre-fages found that they nearly all perished in the winter. This cannot be so, as their last remains are usually to be found in the harbours of countries which are not subjected to the ravages of the Teredo. In Holland their most ravages are made in July and August. Iron ships have nothing to fear from their attacks, and the copper sheathing now almost universally used protects wooden hulls. A remarkable instance of the ease with which a ship could be taken from the bottom, and the wrecking taken place, is that of a ship in Russia, which went down in 1715, and was afterwards raised in 1720. The Teredo grows and burrows at an extremely rapid rate: spawning takes place in the spring and summer, and before the end of the year the animals are adult and their burrows of large size. Fourteen

FIG. 1.—Sagittal median section of Teredo a., anus; a.a., anterior adductor muscle; a.s., anal siphon; b.a., branchial siphon; c., cerebral ganglion; g., gill; h., heart; m., mantle; p.a., posterior adductor; p.g., pedal ganglion; r.a., renal opening; r.p., reno-pericardial orifice; v.g., visceral ganglion. (Partly after Grobben and Beuck, from Lankester's Treatise on Zoology.)
Near one-third of the area is occupied by hilly tracts, the remainder being undulating and flat land belonging to the depression of the Terek; one-half of this last, on the left bank of the river, is occupied by sandy deserts, salt clay steps, and arid stretches unsuitable for cultivation. The Caucasus Mountains are described under that heading. Tertiary formations, overlain by Quaternary deposits, cover a wide area in the plains and steppes. Mineral springs occur near Pyatigorsk.

The climate is continental. The mean annual temperatures are 1°.9 at Pyatigorsk (1580 ft., above sea; January 35°, July 70°) and 47° at Vladikavkaz (2345 ft.; January 23°, July 69°), but frosts a few degrees below zero are not uncommon. The mountain slopes receive an abundance of rain (37 in.), but the steppes suffer much from drought (rain between 10 and 20 in.). Nearly the whole of the government belongs to the drainage area of the river Terek, but the north-west corner is drained by the upper tributaries of the Kuma. In the lower part of its course the Terek flows at a higher level than that of the neighbouring plains, and is kept in its bed by embankments. Nevertheless inundations are frequent and cause great destruction.

The estimated population in 1906 was 1,454,880. The province is divided into seven districts, the chief towns of which are Vladikavkaz, Grozny, Kizlyar, Nalchik, Pyatigorsk, Sunzhinsk, and Khasyavurt, the last two being somad centres of administration. The culture of tobacco is important, and the area under crops being 9 per cent. of the total. Ely, wheat, oats, barley and potatoes are the principal crops. The vine is very extensively cultivated and the district of Pyatigorsk, where 1,500,000 gallons of wine are made annually. Live-stock breeding is widely engaged in, and fishing is an important source of income, especially at the mouth of the Terek. Tea is generally kept at the wholesale table, and the Sterling worth of honey and wax. Melons, cucumbers and sunflowers are extensively grown. The railway, which formerly stopped at Vladikavkaz, has been continued from the Beshan station, near Vladikavkaz, to Petrovsk on the Caspian Sea, and thence to Baku.

TERENCE. Our knowledge of the life of the celebrated Latin playwright, Publius Terentius Afer, is derived chiefly from a fragment of the lost work of Suetonius, De viris illustribus, preserved in the commentary of Donatus, who adds a few words of his own. The prologues to the comedies were among the original sources of Suetonius; but he quotes or refers to the works of various grammarians and antiquaries—Porcius Licinus, Volcacius Sedigitus, Q. Coconius, Nepos, Santra, Fenestella. There is uncertainty as to both the date of the poet's birth and the manner of his death. His last play was exhibited in 160 B.C., and shortly after its production he went abroad, "when he had not yet completed his twenty-fifth year." Cornelius Nepos is quoted for the statement that he was about the same age as Scipio Africanus the younger (born in 185 or 184 B.C.) and Laelius; while Fenestella, an antiquary of the later Augustan period, represented him as older than either. If Terence was born in 185, he published his six plays between the ages of eighteen and twenty-five. Even in an imitative artist such precocity of talent is remarkable, and the date is therefore open to legitimate doubt.

In order to have been born in Carthage, and brought to Rome as a slave. At Rome he was educated like a free man in the house of Terentius Lucanus, a senator, by whom he was soon emancipated; whereupon he took his master's nomen Terentius, and thenceforward his name was Publius Terentius Afer, of which the last member seems to imply that he was not a Phoenician (Poenus) by blood. He was admitted into the intimacy of young men of the best families, such as Scipio, Laelius and Pufius Philus; and he enjoyed the favour of older men of literary distinction and official position. In the circle of Scipio he doubtless met the historian Florus, who was brought to Italy in 168 B.C., and it is said that he have owed the favour of the Roman senators, near as much to his personal gifts and graces as to his literary eminence; and in one of his prologues he declares it to be his ambition, while not offending the many, to please the "boni."

Terence's earliest play was the Andria, exhibited in 166 B.C. A pretty, but perhaps apocryphal, story is told of his having read the play, before its exhibition, to Catullus (who, after the death of Plautus, ranked as the foremost comic poet), and of

Jefreys, in his British Conchology, gives the following species as British: Teredo norvegica, Spengler; T. navalis, Linn.; T. pedicellata, Quatrefages; T. megalota, Hanley. T. norvegica occurs chiefly in the northern counties. It was described by Thompson at Portpatrick in Wigtownshire, and occurred in Jefreys' time in abundance at Milford Haven. This species has been described by Gmelin and a number of other authors. It differs from its congeners by having the base of the pallets simple, not forked, and the tube semi-encrusted at its narrower posterior end. The length does not usually exceed a foot. It is the T. navalis of Celli, which Linnaeus referred; Celli called it T. marina. It occurs on all the western and southern coasts of Europe, from Christiana to the Black Sea, and is the species which causes so much damage to the Dutch wharves. The pallets of this species are small and forked, and the stalk is cylindrical. The tube is simple and not chambered at its narrow end. T. pedicellata was originally discovered by Quatrefages in the Channel Islands, at Toulon, in Provence and in Algeria. In T. megalota the tube is simple and the pallets like those of T. Home, and approximately 2 ft. in length. It has been recorded from both Vancouver's and Woodward's. It is known as T. fimbriata. In the Mediterranean it has also been found in the Channel Islands, at Toulon, in Provence and in Algeria. The shell of T. megalota is closely related to that of T. Home, and approximately 2 ft. in length. It has been recorded from both Vancouver's and Woodward's. It is known as T. fimbriata.
the generous admiration it manifested by Caccilius. A similar instance of the recognition of rising genius by a poet whose own day was past is found in the account given of the visit of Accius to the veteran Pacuvius. The next play was the Hecypa, first produced in 165, but withdrawn in consequence of its not having been received, and produced in 160. The Heauton Timorumenos appeared in 163, the Enneacles in 161, the Phormio in 161, and the Adelphoe in 160 at the funeral games of L. Aemilius Paullus. Of these six plays the Phormio and probably the Hecypa were drawn from Apollodorus, the rest from Menander. After bringing out these plays Terence sailed from Greek parts, either to escape from the suspicion of publishing the works of others as his own, or from the desire to obtain a more intimate knowledge of that Greek life which had hitherto been known to him only in literature and which it was his object to imitate in his comedies. The latter is the more probable motive, and we recognize in this the first instance of that impulse to visit the scenes familiar to them through literature which afterwards acted on many of the great writers of Rome. From this voyage Terence never returned. According to one account he was lost at sea, according to another he died at Stymphalus in Arcadia, and according to a third at Leucas, from grief at the loss by shipwreck of his baggage, containing a number of new plays which he had translated from Menander. An old poet quoted by Suetonius states that he was ruined in fortune through his intimacy with his noble friends. Another account has it that he was the cause of leaving behind him gardens, to the extent of about twelve acres, close to the Appian Way. It is further stated that his daughter married a Roman knight.

No writer in any literature, who has contented himself with so limited a function, has gained so great a reputation as Terence. He lays no claim to the position of an original artist painting from life or commenting on the results of his own observation. His art has no relation to his own time or to the country in which he lived. The chief source of interest in the fragmentary remains of Naevius, Ennius, Pacuvius, Lucilius, and Lucilius is their relation to the national and moral spirit of the age in which they were written. Plautus, though, like Terence, he takes the first sketch of his plots, scenes and characters, from the Attic stage, is yet a true representative of his time, a genuine Italian, writing before the genius of Italy had learned the restraints of Greek art. The whole aim of Terence was to present a faithful copy of the life, manners, modes of thought and expression which had been drawn from reality a century before his time by the writers of the New Comedy of Athens. The nearest parallel to his literary position may be found in the aim which Virgil puts before himself in his Aeneid. Another fact that will prove to his advantage is the popularity of his comedies, which were often acted on his life. To bring back the shepherds of Theocritus on Italian scenes. Yet the result obtained by Virgil is different. The charm of his pastoral is the Italian sentiment which pervades them. His shepherds are not the shepherds of Theocritus, nor are they in any sense true to life. The extraordinary result obtained by Terence is that, while he has left no trace in any of his comedies of one sketching from the life by which he was surrounded, there is perhaps no more truthful, natural and delicate delineator of human nature, in its ordinary aspect, of all leading kinds, than Lucilius is their relative to the national and moral spirit. His permanent position in literature is due, no doubt, to the art and genius of Menander, whose creations he has perpetuated, as a fine engraver may perpetuate the spirit of a great painter whose works have perished. But no mere copyist or verbal translator could have attained that result. Though without claims to creative originality, Terence must have had not only critical genius, to enable him fully to appreciate and identify himself with his originals, but artistic genius of a high and pure type. The importance of his position in Roman literature consists in this, that he was the first writer who set before himself a high ideal of artistic perfection, and was the first to realize that perfection in style, form, and consistency of conception and execution. Living in the interval between Ennius and Lucilius, whose original force and genius survive only in rude and inartistic fragments, he produced six plays, which have not only reached our time in the form in which they were given to the world, but have been read in the most critical and exacting literary epochs, and still may be read without any feeling of the need of making allowance for the rudeness of a new and undeveloped art.

While his great gift to Roman literature is that he first made it artistic, that he imparted to "rude Latium" the sense of elegance, consistency and moderation, his gift to the world is that through him it possesses a living image of the Greek society in the 3rd century B.C., presented in the purest Latin idiom. Yet Terence had no affinity by birth either with the Greek race or with the people of Latium. He was more distinctly a foreigner than any of the great classical writers of Plautus. He lived at the mediant height of three distinct civilizations—the mature, or rather decayed, civilization of Greece, of which Athens was still the centre; that of Carthage, which was so soon to pass away and leave scarcely any vestige of itself; and the nascent civilization of Italy, in which all other modes were soon to be absorbed. Terence was by birth an African, and was thus perhaps a fitter medium of connexion between the genius of Greece and that of Italy than if he had been a pure Greek or a pure Italian; just as in modern times the Jewish type of genius is sometimes found more detached from national peculiarities, and thus more capable of reproducing a cosmopolitan type of character than the genius of men belonging to other races.

The prologues to Terence's plays are of high interest. Their tone is for the most part apologetic, and indicates a great sensitiveness to criticism. He constantly speaks of the malleability and distraction of an older poet, whose name is said to have been Luscinius Lavinius or Lanuvius. The chief charge which his detractor brings against him is that of contumacito, the combining in one play of scenes out of different Greek plays. Terence justifies this practice by that of the older poets, Naevius, Plautus, and later by that of Ciceron and Quintilian, and the description of the plays to Scipio had the honour to be accepted by Montaigne and rejected by Diderot.

We learn from these prologues that the best Roman literature was ceasing to be popular, and had come to rely on the patronage of the great. A consequence of this change of circumstances was that comedy was no longer national in character and sentiment, but had become imitative and artistic. The life which Terence represents is that of the well-to-do citizen class whose interests are commonplace, but whose modes of thought and action are refined and intelligent. His characters are finely delineated and discriminated rather than, like those of Plautus, boldly conceived. Delicate irony and pointed epigram take the place of broad humour. Love, in the form of pathetic sentiment rather than of irregular passion, is the chief motive of his pieces. His great characteristics are humanity and urbanity, and to this may be attributed the attraction which he had for the two chief representatives of these qualities in Roman literature—Cicero and Horace.

Terence's pre-eminence in art was recognized in the Augustan age; and Horace expresses this opinion, though not as his own, in these words (Epistles II. i. 59):—

"Vincere Caecilius gravitate, Terentius arte."

The art of his comedies consists in the clearness and simplicity with which the situation is presented and developed, and in the
TERENTIANUS—TERM

Consistency and moderation with which his various characters play their parts. But his greatest attraction to both ancient and modern writers has been the purity and charm of his style. He makes no claim to the creative exuberance of Plautus, but he is entirely free from his extravagance and mannerisms. The superiority of his style over that of Lucilius, who wrote his satires a generation later, is immeasurable. The best judges and the greatest masters of style in the best period of Roman literature were his chief admirers in ancient times. Cicero frequently reproduces his expressions, applies passages in his plays to his own circumstances, and refers to his personages as typical representations of character.1 Julius Caesar's lines on Terence, the "dimidiatus Menander," while they complain of comic power, characterize him as "our sermons amator." Horace, so depreciatory in general of the older literature, shows his appreciation of Terence by the frequent reproduction in his Satires and Odes of his language and his philosophy of life. Quintillian applies to his writings the word elegansissima. His works were studied and learned by heart by the great Latin writers of the Renaissance, such as Erasmus and Melanchthon; and Casaubon, in his anxiety that his son should write a pure Latin style, inculcates on him the constant study of Terence. Montaigne2 applies to him the phrase of Horace: "on aura toujours le bon goût de lui." He speaks of "his fine expression, elegance and quaintness," and adds, "he does so possess the soul with his graces that we forget those of his fable." Sainte-Beuve devotes to him two papers of delicate and admiring criticism. He quotes Fénélon and Addison, "deux esprits polis et doux, de la même famille littéraire," as expressing their admiration for the inimitable beauty and naturalness of one of his scenes. Fénélon is said to have preferred him even to Molière. Sainte-Beuve calls Terence the bond of union between Roman urbanity and the Atticism of the Greeks, and adds that it was in the 17th century, when French drama possessed most truly Attic, that he was most appreciated. M. Joubert3 applies to him the words, "Le mont Hymenté est sur ses lèvres; on croirait aisément qu'il naquit sur le mont Hymenté."

The chief manuscript of Terence is the famous Codex Bembius, of the 4th or 5th century, in the Vatican. Another Vatican MS. of the 10th century contains illustrations based on an old tradition. Each play has an argument in metre by Sulpicius Apollinaris (2nd century of our era). We have also a valuable commentary newly edited by P. Wessner.) on five of the plays, derived from Eunapius and Donatus (both of the 4th century), and another of less importance by one Eugraphius. The edition was published at Strassburg in 1470. The most famous edition is that of Bentley, published at Cambridge in 1726. At present the best texts are those by K. Dziaziok (Lelzig, 1884), and A. Fleckせいten (Teubner, 2nd ed., 1898). Each of these bases its edition on English notes.


Molière mode large use of the Thermis in Les Fournières de scapin, and the subject of l'Ecole des maris is taken from the Adéphoe. Terence was translated into English verse by George Colman (1765). (W. Y. S.; E. H.)

TERENTIANUS, surnamed MAURUS (a native of Mauretania), Latin grammatical writer on prosody, flourished probably at the end of the 2nd century A.D. His references to Septimius Serenus and Aulus Avitus, who belonged to the school of "new poets" (poetae neoterici or novellii) of the reign of Hadrian and later, seem to show that he was a near contemporary of those writers. He was the author of a treatise (incomplete) in four books (written chiefly in hexameters), on letters, syllables, feet and metres, of which considerable portions have been printed on similar subjects. The most important is that which deals with metres, based on the work of Caesius Bassus, the friend of Persius. By some authorities Terentianus has been identified with the presbyter of Syene mentioned in Martial (i. 86), who would make his date about a century earlier; others, again, who placed Petronius at the end of the 3rd century (a date no longer held), assigned Terentianus to the same period, from his frequent references to that author.

Best edition, by H. Kell, Grammatici Latini, v.; with commentary by L. Santen (1829); see also Teuffel-Schwabe, Hist. of Roman Literature (Eng. tr.), 375a.

TERGESTE (mod. Trieste, q.v.), an ancient city of Istria, 26 m. by road E.S.E. of Aquileia, at the northern extremity of the peninsula of Istria, in a bay at the head of the Adriatic Sea. Its importance was in ancient days, as now, mainly due to its harbour. The dates of its foundation are uncertain; it is first mentioned about 100 B.C. as a village. In 52 B.C. it was attacked by barbarian tribes from the interior. In 33 B.C. Augustus during his Dalmatian wars built a wall and towers there, as an inscription records; in a medieval copy of it the emperor Frederick III. mentions his own restoration of the city walls for the fourth time in 1470. At this time it probably became a colony, as it certainly was in Pliny's days. It appears to have had an extensive territory assigned to it. The lofty situated cathedral of S. Giusto occupies the site of a Roman temple. An inscription of the walls and column of the basilica is still preserved in the tower. Into the façade are built fragments of sepulchral reliefs. The church itself has a curious plan which is due to its having been formed out of two distinct churches standing side by side, which were united in the 14th century. Each of these is a basilica with ancient columns and mosaics in the apse. The southern church, S. Giusto, has a central dome. The so-called Arco di Riccardo is a half-buried Roman arch with Corinthian pilasters, possibly a triumphal arch, possibly connected with an aqueduct.

The museum contains inscriptions, mosaic pavements, &c., from the ancient town, of which no remains beyond those mentioned now exist above ground.


TERLIZZI, a town in Apulia, Italy, in the province of Bari, and 18 m. by steam tramway W. from that town, situated in the midst of a fertile plain, 621 ft. above sea-level. Pop. (1891) 23,394. It has a castle which at one time was very strong, and occasionally resorted to by the Emperor Frederick II. and afterwards by the Aragonese sovereigns. The walls and towers still remain, but the fosse has been turned into boulevards. Terlizzi has some trade in the wine and fruit of the district. Near it, in an ancient tomb, was found in 1745 a fine inkaost inlaid in silver.

TERM, an English word which has various meanings, all arising from its etymology (Lat. terminus), and the idea of limiting or defining.

A term of years, in English law, is the time during which an interest in an estate for life or for years is enjoyed, also the interest itself, because such an interest must determine at a definite time. If the interest be for life, it is an estate of freehold for years, on which the tenant has the same rights in the estate, and so personally, even though the length of the term—for leases of 1000 years—may far exceed in duration any possible life estate. A term of years is of two kinds—the first that created by an ordinary lease reserving a rent, as of a house or a building lease; the second that created by a settlement or a will, usually without rent reserved, for the purpose of securing payment of money, such as portions to younger children, by the owner of the land. Both kinds have been considerably affected by the Conveyancing Acts of 1881 and 1882, which enable a mortgagee or mortgagee in possession to make certain leases. Before 1845 provision was always made in conveyances for keeping the foot and town or the siting and amount of the town or the siting and amount of the town rablear, but these fosse has been turned into boulevards. Terlizzi has some trade in the wine and fruit of the district. Near it, in an ancient tomb, was found in 1745 a fine inkaost inlaid in silver.

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although the term had been satisfied—that is, the purpose for which the term has been created had been fulfilled. By the Assignment of Satisfied Terms Act 1843 the assignment of satisfied terms was rendered unnecessary. The Conveyancing Acts 1881 and 1882 give power to enlarge the unexpired residue of a long term in certain cases into the fee simple.

Terms, in the sense of a limited and certain period of time during which the law courts are open, used to affect only what were called in England the superior courts—that is, the king's bench, common pleas and exchequer. They were originally the leisure seasons of the year which were not occupied by great feasts or fasts of the Church or by agriculture. Their origin is no doubt to be traced back to the legislation of the early Christian emperors, the principle being adopted in England through the influence of ecclesiastical judges. Terms were regulated by many acts of parliament, the effect of which was to confine to a comparatively short period the time during which the courts could sit in banco—that is, for the decision of questions of law as distinguished from the execution of opinions of fact. There were four terms, Hilary, Easter, Trinity and Michaelmas, the average duration of each being about three weeks. All legislation on the subject previous to 1873 is now merely of historical interest, for by the Judicature Act of that year terms were abolished so far as related to the administration of justice and sittings substituted. The previous subdivisions of the legal year were, however, retained, the dates of commencement and termination being somewhat changed. The Michaelmas sittings of the high court and court of appeal are fixed by the 19th of October, the Hilary or Hilary sittings by the 14th of January to the Wednesday before Easter, the Easter sittings from the Tuesday after Easter week to the Friday before Whitsunday, and the Trinity sittings from the Tuesday after Whitsun week to the 12th of August, all dates inclusive. The old terms, with their duration as fixed by statute, are now kept alive only for the purpose of reference in all cases in which they are used as a measure of time. In the United States the terms or sittings of the courts are not limited to any fixed period of time, but vary according to the judges and the amount of judicial business which is likely to come before the courts. The dining-terms at the Inns of Court also correspond in point of time with the old terms and not with the sittings.

In universities and schools the word term is used for the period during which instruction is given to the students or pupils. University and school terms differ from law terms and from each other both in period and duration. At the university of Cambridge the academic year is divided into three terms, Michaelmas, Lent and Easter; while at the university of Oxford there are four terms in the year, Michaelmas, Hilary, Easter and Trinity. School years now generally consist of three terms, divided by Christmas, Easter and Summer holidays, the old half-years having gradually been abolished. In higher educational institutions in the United States the university or college year is generally divided into three terms called either the Fall, Winter and Spring terms, or much less frequently the first, second and third terms. In some institutions, however, the so-called semester system has been adopted, the year being divided into two terms, so far as instruction is concerned, though even in these cases vacations at Christmas time and in the early spring divide the year into three parts, which are sometimes, though not in the usual or proper sense, called terms.

In Scotland terms are the days at which rent or interest is payable. They are either legal or conventional: the legal are Whitsunday and Martinmas; the conventional are fixed by agreement between the parties. Terms as times of court sittings were defined by 6 Anne c. 53, which fixed four terms—Martinmas, Candlemas, Whitsuntide and Lammas—for the now obsolete court of exchequer, to which the winter and summer sittings of the court of session now correspond.

TERMINUS, also called "termini" or "terms," in architecture, figures of which the upper parts only, or perhaps the head and shoulders alone, are carved, the rest running into a parallelopiped, and sometimes into a diminishing pedestal, with feet indicated below, or even without them (see HERMAE).

TERMINATOR (from the Latin terminare, to limit), in astronomy, the bounding line between light and darkness on the apparent disk of the moon or of a planet.

TERMINI IMERESE (anc. Thermae Himeraeae), a seaport town of Sicily, in the province of Palermo, 23 m. E.S.E. of it by rail. Pop. (1901) 70,632. It is finely situated on a promontory above its harbour, and it is possible that it was occupied by an early Phoenician settlement; as a town, however, it was not founded until 407 B.C. by the Carthaginians, after their destruction of Himera, in the vicinity of hot springs mentioned by Pindar (Od. xii. 19) which are still resorted to and are well fitted up (temp. 110° F.). It remained a Carthaginian colony, though thoroughly Greek in character, until it was taken by Rome in the First Punic war. In the time of Cicero it was flourishing, though not of great importance. Augustus sent a Roman colony to it, and a Roman road ran from it to Catana. Its medieval castle was destroyed in 1860. The modern town presents no features of interest; there is a collection of antiquities and pictures, with a considerable number of Roman inscriptions. Scanty remains of buildings of Roman times (an amphitheatre and a so-called basilica) exist in the upper part of the town; and outside it on the S. are considerable remains of two aqueducts of the same period crossing a deep ravine. The surrounding district is fertile.

Four m. E. of Termini, about r m. W. of the railway station of Cerda, on an E. spur of the Monte S. Calogera, called Monte Castellaccio, is a Cyclopean wall, about 60 ft. long, 70 ft. thick, and 30 ft. high in the middle, blocking the only access to the summit of the spur, on the N.E. Fortifications in this style are very rare in Sicily.

See B. Romano, Antichità Terminane (Palermo, 1838); Mauceri, Archopoli Pelagie nei dintorni di Termini Imere (Palermo, 1896). (T. A.)

TERMINUS, in Roman mythology, the god of boundaries, the protector of the limits both of private property and of the public territory of Rome. He was represented by a stone or post, set up in the ground with the following religious ceremonies. A trench was dug, in which a fire was lighted; a victim was sacrificed, and its blood poured into the trench; the body, upon which incense and fruits, honey and wine were thrown, was then cast into the fire. When it was entirely consumed, the boundary stone, which had been previously anointed and crowned with garlands, was placed upon the hot ashes and fixed in the ground. Any one who removed a boundary stone was accused (sacer) and might be slain with impunity; a fine was afterwards substituted for the death penalty. On the 23rd of February (the end of the old Roman year) the festival called Terminalia, according to Wissowa a festival not of the god but of the boundary stones (termini), was held. The owners of adjacent lands assembled at the common boundary stone, and crowned their own side of the stone with garlands; an altar was set up and offerings of cakes, corn, honey and wine were made (later, a lamb or a sucking pig was sacrificed). The proceedings closed with songs to the god and a general merrymaking, in which all the members of the family and the servants took part. A similar festival was also held at the old boundary of the Roman territory between the fifth and sixth milestones on the road to Laurentum. The custom of fixing the boundaries of property and the institution of the yearly festival were both ascribed to Numa. Another Sabine prince, Titus Tatius, had dedicated a stone to Terminus on the Capitoline hill. When Tarquinius Superbus desired to build a temple to Jupiter, the auguries forbade its removal, and it was enclosed within the walls of the new sanctuary, an indication of the immovability of such stones and of the permanence of the Roman territory. Terminus was probably in its origin only an epitaph of Jupiter. The fact of the inclusion of his statue in the temple of Jupiter Capitolinus; the hole cut in the temple roof so that he might be worshipped in the open air as being, like Jupiter, a god of

1 Agathocles was a native of Thermae.
the sky; and the later assumption of a Jupiter Terminus or Terminalis (cf. the Greek Zeus' apo) support this view.

See Dion. Halic. ii. 74; Plutarch, Numa, 16, Quast. Rom., 15; Livy i. 55; Horace, Epodes, ii. 59; Ovid, Fasti, ii. 637, 677; Siculus Flaccus in Gromatici veteres, ed. Lachmanne (1848); G. Wissowa, Religion und Kultur der Körner (1902); W. W. Fowler, The Roman Festivals (1899); G. Jourde, Le Culte du dieu Terme (Paris, 1886).

**TERMITE**, the name applied to a group of insects with four wings which are developed outside the body (a large proportion of the individuals become adult, however, without wings appearing at all). The wings are of nearly one size, of long, narrow form, of paper-like consistence, and in repose are placed flat on the back of the insect so that only one wing shows. After a short time the wings are shed, and newly emerged adults remain as evidence of the individual being a winged form. The mouth has strong mandibles. Formerly termites were classed as a part of the order Neuroptera, but more recently they have been separated by certain zoologists from the true Neuroptera, and associated with some other forms as an order Corrodentia.

By Packard they have been associated with Mallophaga, and called Platypitera. They now constitute with the Embidina—a small and obscure family—the order Isoptera, of which about 300 species are known. Termites are more widely known as white ants, but as they are extremely different from true ants, and as they are rarely white, this designation is very deceptive, and should be abandoned. Termites are found only in warm climates, where they are sometimes very destructive. They are vegetarian, but occasionally eat, or destroy, dry animal matter. The basis of their alimentary regimen is woody matter. Some of them make use of fungi growing in their abodes as food; some cut and store grass; others prepare a peculiar kind of food, which is stored in a tough, dry form, so that it has to be moistened before it can be eaten. Termites are social insects; many of them construct large edifices called termittaria and often spoken of as nests. A termitarium frequently contains an enormous number of individuals forming the society or colony. Termites are totally different in structure and development from all other social insects, but their social existence exhibits numerous analogies with that of the ants and other social Hymenoptera. The most remarkable of these analogies is that the reproduction of the species in each community is confined to a single pair, or to a very limited number of individuals. The members of one society or colony, however numerous or diminutive they may be, are the descendants of a single pair. The colony is—so far as is known, and on this, as well as on many other points, authentic information is scanty—first started by a pair of winged individuals that cast their wings, secrete themselves in a suitable place, and produce young. The colony, however huge, being subsequently developed by the extreme fertility of the reproductive pair. Very little is known as to how long a colony endures, and, as there is great variety in the social conditions of different kinds of termites, it is probable that there is considerable difference as to the point in question. As a rule a family or colony has only a single termitarium, but there are cases in which a single family has several separate abodes, though usually only one of them is a real home containing reproductive individuals. The social life in termites, as well as in all other social insects, is clearly a development of the family life. It is accompanied by extraordinary modifications of the forms of the individuals constituting the society, and by a great division of labour. As regards the forms, or castes, termites differ totally from those of other social insects; in the latter case there are great differences between the males and females, and the whole of the castes are of the female sex, whereas in termites the males and females are extremely similar, and the castes are in no way related with the relatives with sex. As the termite life is a family life, and as there is normally only a single pair of reproductive individuals in each community, it is easily comprehensible that if anything goes wrong with this pair, the community is at once thrown into a state of complete disorganization. But this misfortune is mitigated by a method which termites have of keeping individuals in an undifferentiated state, and of turning some of them speedily into reproductive individuals, whereby the community is restored to something like a natural condition of activity and growth.

Apart from the forms that are merely juvenile, the following kinds of adults are normally present in a colony: (1) workers, (2) soldiers, (3) winged individuals ready to leave the nest, (4) king and queen.

(1) The worker termite resembles the young in general appearance, and, like the young, has no trace of wings (fig. 1). The two segments behind the head are more contracted, so that head, thorax, and abdomen are more differentiated than they are in the young. The colour too is different, the young being milky-white, whereas the adult worker is variously pigmented according to its species, but is never milky-white. The worker is generally blind, and in only a few species does it possess rudimentary eyes. The species of the group *Calotermitidae* have no workers. In the other species the workers look after the eggs and young, and perform most, if not all, of the industrial work of the community. They are also, in some cases, effective combatants, though quite destitute of any special structures to suit them for this purpose. The sexual organs do not undergo development, but it has been satisfactorily ascertained that both males and females are represented amongst the workers. In certain species the workers seem to be dimorphic, so far as size is concerned, but this point has apparently been only very inadequately considered. Workers form a very large but variable proportion of the members of a community.

(2) The soldier termite is the most extraordinary feature of termite biology. It is more varied than any of the other castes, so that most of the species of termites can be best distinguished by their soldiers. The chief feature of the soldier is an extraordinary development of the head, or of the head and mandibles. There are two very distinct kinds of soldiers: (a) the flat-headed or mandibulate soldier, and (b) the nasute or rostrate soldier (fig. 2). In the first kind the head is usually developed out of all proportion to the rest of the body; the mandibles are frequently enormous, and, being in many cases asymmetric, give the appearance of deformity. In the nasute form the head is thick or convex, and may be described as unicorn—that is to say, it is prolonged in the middle so as to form a single pointed horn; the mandibles are never largely developed. No species of termite has both mandibulate and nasute soldiers, although the reverse is sometimes still
stated in books. The soldiers of some species are, however, dimorphic to the extent that larger and smaller forms occur in the same nest without intermediates. In other cases soldiers of simply variable size exist. The soldier termite and winged termite, though a few soldiers minute wing-rudiments can be detected. As in the worker, the development of the sex organs is arrested, but both sexes are represented. The function of the soldiers is probably, as stated by Haviland, defence. The mandibulate soldiers use their heads as blocks to stop gaps in the nests, and employ terrifying but somewhat theatrical devices, making threatening motions and producing noises by movements of the head and thorax. The nasute soldiers emit a fluid from the tip of the rostrum, and dab it upon their enemies with some skill. Soldiers are present in all species of termites except the South American genus *Anoplotermes*. It is a remarkable fact that in the group *Calotermes* soldiers exist although there are no workers, but in this case the function of the soldier seems to be very much that of a worker. Grassi says that in *Calotermes flavicollis* all the individuals of a community work for the common welfare. Moreover, in the *Calotermes* no very great development of the heads or mandibles occurs.

(3) Adult or Winged Termites.—Such of the young as do not become workers or soldiers grow and develop after the fashion usual in exopterygote insects. Moults take place, the wing-pads gradually increase in size, eyes appear, and finally pigmentation takes place, and the winged insect is perfected at the last moult (fig. 3). In prosperous colonies these winged insects are produced in large numbers and emerge at intervals as swarms. They have extremely feeble powers of flight, and apparently scarcely any other capability. They are a favourite food of a large number of animals, including even man. They have well-developed eyes and ocelli, and differ from all the other forms by their greater pigmentation. The function of these adults is to diffuse the species, and to favour crossing outside the family circle. Attaining the size of the second end is, in some cases, favoured by the fact that the whole of the individual individuals constituting a swarm consist of one sex only. This extraordinary fact is attested by Grassi, but has not yet received the attention it merits. If a termite colony be compared with a tree or plant, the winged forms, it is clear, functionally correspond to the flowers and seeds of the tree; indeed, Fritz Müller and Grassi go further, and conclude that the modes of diffusion and reproduction of termites are analogous to the modes of plants of containing the species by means of cleistogamous as well as ordinary flowers. The force of this comparison will be better appreciated after the reader has made himself acquainted with the facts connected with the neotenic forms of termites.

(4) King and Queen.—As a rule each community includes only a single pair of individuals apt for reproduction; these are the royal pair, or king and queen (fig. 4). They are adult termites that have shed the wings they formerly possessed. The queen usually undergoes an extraordinary increase in the size of the abdomen, which may be discerned to many hundred times its original capacity (fig. 4, A). In many species the queen is a royal cell, out of which they cannot move, though the workers, owing to their smaller size, can get in and out to tend them. In other cases the queen only is so imprisoned, the king being able to leave the cell. In still other cases neither king nor queen is effectually imprisoned. Much discrepancy of opinion exists as to the invariable presence of a king in each nest; this, however, is explained by Grassi's observation that the king is active and timid, and when a nest is opened seeks safety by running away and concealing himself, so that he is sometimes only discovered when the very last fragment of the nest is brought under scrutiny. Another point on which extremely diverse opinions are expressed is the copula of the sexes. It is usually stated that the swarming of termites is analogous to that of bees and ants, in which groups of insects the conjunction of the sexes takes place at this period, and at this period only. In the termites the reverse is the case. The swarming is not at all a nuptial flight; indeed, at that time the sexes are not apt for reproduction. Copulation only takes place after pairs have lost their wings and have established themselves together. It is repeated at intervals, and is thus quite dissimilar from the corresponding phenomenon in Hymenoptera. The male may be provided with an intromissory organ, so that copula during flight is impossible. Grassi has actually witnessed the act in subsequent life. Haviland is of opinion that in some cases the male fertilizes the eggs without connection with the female.

(5) Neotenic and Substitution Forms.—When a colony of termites is deprived of king and queen it can replace them by forms specially prepared. These substitution forms are of two kinds—(a) normal adult individuals, (b) neotenic forms. The latter may be recognised by their unattractive and unnatural kings and queens possessing reproductive powers, though the wings have never been developed and some other parts of the body have not taken on the fully adult state. These individuals are removed from nests of *Termes maigaetus*, and after three or four months again examined the nests: in three out of the five cases substitution pairs exactly resembling the original ones, with well-formed wing-stumps, were present; in the other two cases they failed to find the royal cell, and believes that the loss had not been repaired. In other species the bereavement is made good by means of neotenic instead of normal individuals, for in certain species neotenic forms are abundantly found. In the case of substitution forms there is usually more than one pair present in a colony, and sometimes numerous pairs exist. Grassi says that in Sicily the colonies of *Termes lucugus* are kept up entirely by neotenic kings and queens; in other words, the swarms are nearly or quite useless. The neotenic forms are compared to cleistogamous flowers; and this curious case is paralleled with that of a species of plant whose reproduction should be accomplished entirely by its cleistogamous flowers. Grassi, although at the same time it produced perfect flowers in abundance, the condition recorded by Grassi as the case, it is probably extremely exceptional. Fritz Müller found once a colony in which a true king was acting as consort to a considerable number of neotenic queens, no true queen being present.

In order to understand the causes phenomena presented by the casts and variety of forms of a single species of termites, it is not necessary to become acquainted with their food habits, which are very peculiar and may be described as comminucious. Termites have the habit of eating their case skins and even their dead companions, and in fact their system of keeping the nest clean seems to be that of eating the refuse of their own bodies till it no longer contains any digestible matter. This cannibalism is the more remarkable, as they will not eat other termites. The most curious part of their dietary is their complex system of feeding from the matters contained in the alimentary systems of their fellows. When a termite wishes food it stroke the body of another individual with its antennae, and the specimen thus caressed exudes from the posterior or from the anterior part of the body a drop of matter, which is eaten by the hungry one. The matter exuded from the place into which the termites is not very different; for at the base of the mouth, so that there are at least two kinds of this excretory food. The proteasial food (that comes from the proctodeal part of the body) is in great favour with adult termites, but so far as is known is not used for feeding the newly born young, which are believed to be fed on matter elaborated in the bodies of the adult workers and communicated by their mouths. Subsequently the young take also proteasial food, and triturated vegetable matter.

**Origin of the Castes.**—When termites are hatched from the eggs none of the remarkable differences that are manifested in the individuals in subsequent life can be detected. The sexes are in termites extremely similar in external characters. When the young are hatched they all appear nearly exactly alike, though on careful examination the sexes can be distinguished.
But no other difference than that of sex can be detected. In the article Ant in the ninth edition of the *Encyclopaedia Britannica* it was stated that “the distinction between soldier and worker can be easily seen in the egg.” This is contradicted by all modern observations, and is certainly erroneous. It is true that considerable difference of opinion exists as to when the distinction between soldier and worker first becomes evident, but all are agreed that it is not till after the growth is to some extent accomplished. The discrepancy that exists in opinions on this point is due to the facts: (1) that different species have been under observation; and (2) that the modification of the larva to form a soldier may begin at more than one period of the development even in the same species. It being ascertained that all termites begin as undifferentiated larvae, the question arises as to what causes the differentiation into castes. This question is the more important as two of the castes (the worker and soldier) do not at all resemble their parents. Grassi, from an examination of the individuals of a large number of nests of *Termes lucifugus*, arrived at the conclusion that all start as undifferentiated larvae, and that the regular development of *Termes* up to the perfect insect may undergo a deviation at various periods of life leading to the formation of workers, of neotenic forms, or of soldiers, the last passing through the stage of the young worker. He attributes this deviation, which may take place at various periods, to the influence of food, and attaches special importance to the salivary food. The soldiers have no wings; nevertheless a larva, or young nymph that has the rudiments of wings, can be made into a soldier. Grassi has found juvenile specimens that have already assumed the soldier form, although they possess the rudiments of wings. It appears from his observations that the worker may be considered as a form with arrested development, and the soldier as a form with arrested and much diverted development, while the neotenic forms are individuals in which the reproductive organs are perfectly developed, while some of the bodily structures have suffered arrest of development and even some amount of atrophy.

The soldier form of termite presents most difficult questions to the biologist, its special structures bearing no approximation to any characters possessed by the parents. Various theories have been proposed to account for this fact, but they are mere guesses. We may, however, mention that it is possible that soldiers and workers occasionally produce young. This has never been actually observed, but specimens have been found with the sexual organs partially developed, and F. Silvestri has recorded the occurrence of workers with some of the characters of the females, in South America, in a nest of *Termes struchii*.

**Fig. 5.**—Termitarium of *Termes malayanus*: f, fungus-chamber; c, royal cell.

**Termitaria.**—There is nothing in which termites display more variety than in their dwellings. These are sometimes of great beauty, and are always remarkable for their cleanliness and perfect order. The primitive *Calotermes flavicollis*—in which there is no worker—frequently inhabits rotten places in trees; at most it increases these a little by excavation, and modifies the passages by slight and imperfect barricades. In the case of the species of the community never attains a greater number than one thousand individuals, and even this is comparatively rare. On the other hand, we have the huge solid structures, 10 or 20 ft. high, delineated by Smeathman with cattle standing on their summits. Saville Kent has observed termitaria in Australia 18 ft. high. In equatorial Africa termitaria are frequently 12 to 25 ft. high and sharp-pointed. As a rule large termitaria do not occur in considerable numbers in a restricted area, but there are exceptions even to this. At Somerset, Cape York, there is one of the most remarkable termite cities of the world. Viewed from the sea, it appears as if the plain for a mile or more in extent were covered with pointed pillars, varying, according to different accounts, from 6 to 13 ft. in height, broad at the base and tapering to the summit, forming regular symmetrical pyramids. In this part of Australia there is also found the "compass," "magnetic," or "meridian" termite, the mounds of which have somewhat the shape of a tombstone, and have always the same orientation, the wider face of the structure always extending north to south. It has been suggested that this is connected with the necessity of regulating the temperatures of the inner part of the mound, but there is no evidence whatever on the point. A termitarium on being opened displays a vast number of irregular chambers separated by thin partitions (fig. 5, f), the royal cell being placed in the middle (fig. 5, c). The material used is of an earthy nature, but the interiors of many earthy termitaria are largely composed of woody fibre, the refuse proceeding from the alimentary canals of the insects being used for this purpose. A considerable number of the larger termites use fungi for their foodstuff. There are special chambers where these are cultivated, the matter on which the fungus is grown being of a woody nature and sponge-like in its structure. The fungi make their appearance as small globules. Probably the spores or mycelium are placed in the mass when it is formed by the termites; but very little is yet known as to this fungus and its mode of treatment by them.


**TERMONDE** (Flemish *Dendermonde*), a town of Belgium in the province of East Flanders, situated 25 m. S.W. of Antwerp at the junction of the Dender and the Scheldt. Pop. (1904) 10,441. It is still one of the five fortified places in Belgium, although its defences are not modernized. It was before Termonde that Louis XIV. in 1667 was compelled to beat an ignominious retreat through its defenders opening the dikes and flooding the country. The church of Notre Dame contains two fine pictures by Van Dyck, and one masterpiece of Crayer’s.

The fonts are of the 13th century.

**TERN** (Norsk *taurin, tenne eller tende; Swedish *tarna*; Dutch *Stern1*), the name now applied generally to a group of sea-birds,

1 "Stern" was used in Norfolk in the 19th century as a name for the bird commonly known as the black-tern, thus, confirming Turner, who, in 1544, describes what seems to have been the same
the sub-family Sterninae of the gulls or Laridae, but, according to
P. J. Selby, properly belonging, at least in the Farne Islands,
to the species known by the book-name of Sandwich tern, all
the others being those called sea-swallows—a name still most
commonly given to the whole group throughout Britain from their
long wings, forked tail and marine habit. In F. Willughby’s
Ornithologia (1676), however, the word tern is used for more
than one species, and, though it does not appear in the older
English dictionaries, it may well have been from early times as
a general name as it is now.

The breeding-grounds to which are but occasional visitors to the
British Islands, six species of terns may be regarded as
indigenous, though of them one has ceased from ordinarily breeding
in the United Kingdom, while a second has become so rare and
regularly appears in so few places that mention of them must for
prudence sake be avoided. This last is the beautiful roseate tern,
Sterna dougalli; the other is the black tern, Hydrochelidon
nigra, belonging to a genus in which the toes are only half
webbed, of small size and dark leaden-grey plumage. It is
without doubt the Sterna of Turner, and in former days was
abundant in many parts of the far country, to say nothing of
other districts. Though nearly all its ancient abodes have been
drained, and for its purposes sterilized these many years past,
not a spring comes but it shows itself in small companies in the
eastern counties of England, evidently seeking a breeding-place.
All around the coast the diminution in the numbers of the
remaining species of terns is no less deplorable than
demonstrable.
The Sandwich tern, S. cantans—named from the place of its
discovery, though it has long since ceased to inhabit that
neighbourhood—is the largest of the British species, equaling in
size the smaller gulls and having a dark-coloured bill tipped with
yellow, and dark legs. Through persecution it has been
extirpated in all its southern haunts, and is become much
scarcer in those to which it still resorts. It was, however,
never so abundant as its smaller congeners, the so-called
common and the arctic tern—two species that are so nearly
alike as to be beyond discrimination on the wing by an ordinary
observer, and even in the hand require a somewhat closer exa-
mination. The former of these has the more southern range,
and often affects inland situations, while the latter, though by
no means limited to the Arctic circle, is widely distributed over
the British isles. The former resorts to the more southern
localities where, as on the Farne Islands, both meet and breed
without occupying stations apart. The minute distinction of
these two species cannot be briefly given. It must suffice here
to state that the most certain difference, as it is the most easily
recognizable, is to be found in the tarsus, which in the arctic
tern is a quarter of an inch shorter than in its kinsman. The
remaining native species is the lesser tern, S. minuta, one of the
smallest of the genus and readily to be distinguished by its
permanently white forehead. All the species already mentioned,
except the black tern, have much the same general coloration—
species as “rostati lingua sterna appellata.” In at least one
instance the word has been confounded with one of the old forms
of the modern Starling (g.v.). To Turner’s name, repeated by
Gosner and other authors, we owe the introduction by Linnaeus of
Sterna into scientific nomenclature. “Istern” is another Dutch
form of the word.

1 It was known there as carr-swallow, carr-crow (corrupted into
carr-hundo), and blue-far (g.v.).

2 Linnaeus’s diagnosis of his Sterna hirundo points to his having had an “arctic”
tern before him; but it is certain that he did not suspect that specific appellation (already used by other writers for
the “sandpiper” tern) to cover a second species. Some modern
authorities disregard his name as being insufficiently definite, and
much is to be said for this view of the case. Undoubtedly
“hundr” has now been used so indiscriminately for one species
or the other, that confusion arises, perhaps in fact, by adopting the epithets of Naumann (181, pp. 1847, 1848),
who, acting on and confirming the discovery of Nitzsch (who
first gave the specific differences), called the southern species
S. fluidissima and the northern S. macrura. Temminck’s name
S. arctica, applied to the latter a year afterwards, has, however, been
most generally used for it.

the adults in summer plumage wearing a black cap and having
the upper part of the body and wings of a more or less pale
grey, while they are mostly lighter beneath. They generally
breed in association, often in the closest proximity—their nests,
containing three eggs at most, being made on the shingle or
among herbage. The young are hatched clothed in variegated
down, and remain in the nest for some time. At this season the
parents are almost regardless of human presence and expose
themselves freely.

which half-a-dozen other species have been recorded as
occurring in British waters, and among them the Caspian tern,
S. caspia, which is one of the largest of the genus and of wide
distribution, though not breeding nearer to the shores of
England than on Sylt and its neighbouring islands, which still
afford lodgings for a few pairs. Another, the gull-billed tern,
S. anglica, has also been not infrequently shot in England. All
these species are now recognized,—though the contrary was once
maintained—as inhabitants of North America, and many go
much farther. S. forsteri is the North American, and S.
medanogaster the Indian tern.

Terns are found throughout the world, and among exotic forms may
be particularly mentioned the various species of noddy (g.v.). Often
confounded with these last are the two species called in books sooty
terns (S. fuliginosa and S. anasthetes), but by sailors “egg-birds”
and “black-legged” terns. They are found in innumerable multitude to
certain islands within the tropics, where they breed, and the wonderful assemblage known as “wide-
awake fairs” on the island of Ascension has been more or less fully
described in many very ancient times. W. Dampier in his
voyage to New Holland in 1699 particularly described and figured the sooty
tern (Voyages, iii. p. 142), discriminating it from the noddy, from
which it had not before been distinguished. (A. N.)

Ternate, a small island in the Malay Archipelago, off the north
coast of Halmahera, in 6° 48’ N., 127° 10’ E. It is nearly
circular in form, with an area of about 25 sq. m., and consists
almost entirely of a remarkable volcano (5400 ft.) formed of
three superimposed cones. Frequent destructive eruptions
have occurred. On the island is the small town of Ternate,
which, in spite of its good harbour, carried on no considerable
trade or shipping, and has only 3000 inhabitants. But it is
the headquarters of the Dutch residency of Ternate, which
exercises authority over the area of the ancient kingdoms of
Ternate and Tidore. The residency consists of the following
groups of islands: the Halmahera group, the Bachan and the
other islands on the Sula Island, with the islands near the north
of New Guinea (Gehe, Vaigen, Salawati, Misol, collectively
called the Papuan Islands), the western half of New Guinea as
far as 141° E., with the islands in Geelvink Gulf on the north
coast of New Guinea (Schouten Islands, Yapen, &c.),
along with others on the south coast. To this residency also belong
the state of Banggai in East Celebes, and the Banggai Islands.
The residency stretches from 2° 43’ N. to 5° 45’ S., and 121°
141° E., with an area of 155,800 sq. m. The Dutch government
exercises direct authority only over parts of Ternate, Halmahera,
Bachan and Obi Islands. Its rule over the other groups it
carries on through the sultans of Ternate and Tidore (g.v.).
Both the island and town of Ternate suffer from their isolation,
and have never regained the importance they had in former
centuries. Pop. of the whole residency (1905) 168,415. The
inhabitants are of Malay race and Mahommedans in religion.
The breaking up of the old government of the Moluccas tended
to make Ternate perhaps the most important Dutch-Indian
political centre of the archipelago east of Celebes. Nominally
the sultan is still ruler, but virtually his powers were greatly
curtailed by his conventions with the Dutch-Indian government,
and even as an ex-sultan he is the nominal head of his grandees,
many of his former rights to the Dutch resident, who now bears the
de facto governor of the easternmost colonial possessions of
Holland, especially since the transfer of Dutch New Guinea
in 1901. Among the rights surrendered by the sultan of
Ternate to the Dutch were those of granting monopolies and
mining concessions, now vested in the Dutch resident. The island
of Bachan is worked by a kind of chartered company. For
surrendered rights and privileges the sultan and his grandees
received monetary compensations in the shape of annual sub-
ventions, and these also have been paid for the losses formerly
incurred by the wilful destruction of the nutmeg plantations,
carried out in order to enhance the value of this commodity
and monopolize its cultivation. The restrictions on nutmeg-
growing have long since been removed, and many plantations,
with free labour, have been started in Ternate since 1885.
It is a curious fact that Christianity has declined in Ternate in
modern times, though it was an early stronghold, and the
modern Roman Catholics are strictly connected with the
churches in the town.
TERNI (anc. Interamna Nakara), a town, episcopal see, and
the seat of a sub-prefecture of the province of Perugia, Italy,
situated among the Apennines, but only 426 ft. above sea-
level, in the valley of the Nera (anc. Nar), from which the town
took its distinguishing epithet, 5 m. below its junction with
the Velino, and 70 m. N. by E. of Rome by rail. Pop. (1906)
20,230 (town), 33,256 (commune). It has important iron and
steel works and iron foundries, at which armour-plates, guns
and projectiles are made for the Italian navy, also steel castings,
machinery and rails, a royal arms factory, and steel works.
Terni lies on the main railway line from Rome to Foligno and
Ancora, and is the junction for Rieti and Sulmona. Its most
interesting buildings are the cathedral (17th century, with
remains of the earlier 13th century façade), the church of
S. Francesco (partly dating from the 13th century, with some
frescoes of the 14th), and other old churches. Its antiquities
include traces of the city walls of rectangular blocks of tra-
vertine, remains of an amphitheatre of the time of Tiberius;
a temple, theatre and baths (?), and numerous inscriptions.
Remains have also been found of a pre-Roman necropolis.
The excavations and the objects found are described by A.
Pasqui and L. Lanzi in Notizie degli scavi, 1907, 575 seq. Five
miles to the east are the falls of the Velino (Cascate delle Marmore).
Alike in volume and in beauty these take a very high place
among European waterfalls; the cataract has a total descent
of about 650 ft., in three leaps of 65, 330 and 190 ft. respectively.
They owe their origin to M. Curius Dentatus, who in 272 B.C.
first opened an artificial channel by which the greater part of
the Lacus Velinus in the valley below Reate was drained. They
supply the motive power for the factories of the town.
Terni is the ancient Interamna (inter amnes, "between the rivers," i.e.
the meeting point of its branches, signally belonging to Umbria,
and founded, according to a local tradition preserved in an inscrip-
tion, in the year 672 B.C. It is first mentioned in history as being,
and has remained, a town of great antiquity, not only to the
people among his soldiers by Sulla. Its inhabitants had frequent litiga-
tions and disputes with their neighbours at Reate in connection
with the regulation of the Velinus, the waters of which are so
strongly impregnated with iron oxides that it is impossible
by the way in which they tend to block up their own channel.
The first interference with its natural course was that of M.
Curius Dentatus already referred to. In 54 B.C. the people of Reate appealed to Cicero
to plead their cause in an arbitration which had been appointed
by the Roman senate to settle disputes about the river, and in
connexion with this he made a personal inspection of Lake Velinus
and its outlets. In the time of Tiberius there was a project for
regulating the river and its outlets from the lake, against which
the citizens of Interamna and Reate energetically and successfully
protested (Tac. Ann. i. 79). Similar questions arose as the river
formed fresh deposits during the middle ages and during the
16th and 17th centuries. A branch of the Via Flaminia passed from
Narnia to Forum Flamini, and is given instead of the direct line
in the Antonine and Jerusalem itineraries. A road led from here
to the Via Salaria at Reate. Interamna is also mentioned in Cicero's
time as being the place where Clodius wished to prove
that he was on the night when he was caught in Caesar's house
at the celebration of the games of the Lupercalia. Tertullian
and his brother Florianus were probably natives of Inter-
amna, which also has been claimed as the birthplace of Tertullian,
the historian, but with less reason. During most of the middle
ages this town seems to have been deserted. It was a scene of
the defeat of the Neapolitans by the French on the 27th of
November 1798.
TERPANDER, of Antissa in Lesbos, Greek poet and musician.
About the time of the Second Messenian war, he settled in
Sparta, whither, according to some accounts, he had been
summoned by command of the Delphian oracle, to compose
the differences which had arisen between different classes in
the state. Here he gained the prize in the musical contests at
the festival Carnea (672-2 B.C.; Athenaeus, 635 e.). He is
regarded as the real founder of Greek classical music, and of
lyric poetry; but as to his innovations in music our information
is imperfect. According to Strabo (xiii. p. 618) he increased
the number of strings in the lyre from four to seven; others
take the fragment of Terpander on which Strabo bases his
statement (Bergk, 3) to mean that he developed the citharoid
lyre (sung to the accompaniment of the cithara or lyre) by
making the divisions of the ode seven instead of four.
The seven-stringed lyre was probably already in existence.
Ter-
pander is also said to have introduced several new rhythms in
addition to the dactylic, and to have been famous as a composer
of drinking-songs.
Fragments (the genuineness of which is doubtful) in T. Bergk,
Poetis Lyrici Graeci, iii.; see also O. Löwe, De Terpandri Lesbii
natale (1856), who places him about 676 B.C.
TERPENES, in organic chemistry, the generic name of a
group of hydrocarbons of the general formula (C₅H₈)n and
the more important oxygen derivatives, mainly alcohols, aldehydes
and ketones, derived from them. They may be classified into
several distinct groups: hemiterpenes, C₅H₄n; terpenes proper,
C₅H₈n; sesquiterpenes, C₁₅H₂₀n; and polyterpenes, C₅H₈n.
In addition to these, a series of open-chain olefine terpenes is
known.
The chief sources of the terpenes and their derivatives are the
essential oils obtained by the distillation or extraction by
pressure of various plants, chiefly of the Coniferae and different
species of Citrus. Certain of these oils consist very largely of
hydrocarbons; for example, those of terepine, citron, thyme,
orange, pine-needle, eucalyptus (from Solidago canadensis) and
cypress, while others contain as their chief constituents
various alcoholic and ketonic substances. With the exception
of camphene, all the terpenes are liquids, boiling approximately
between 160° and 190° C., so that it is almost impossible
for the people to separate them from the various essential oils by
fractional distillation. In order to prepare the individual members pure,
advantage is taken of the different physical properties of
their derivatives. The terpenes all possess a characteristic odour
and are fairly stable to alkalies, but are easily decomposed by
acids or by heating to a sufficiently high temperature. Many
polymerize readily, or are transformed into isomers by boiling
with dilute alcoholic sulphuric acid. Some oxidize rapidly on
exposure to air, passing into resinous substances. The forma-
tion of addition compounds with the halogens, halogen hydrides,
and with nitrosyl chloride, is characteristic of many, whilst
others unite readily with nitrogen peroxide. According to
A. v. Baeeyer (Ber., 1895, 28, p. 648; 1896, 29, p. 10) the
nitrosochlorides are not simple addition products, but bi-
molecular compounds or bisnitrosochlorides.
HEMITERPENES
The best known is Isoprene, C₅H₈, which is obtained on distilling
cauchochue or guuta-percha. It was synthesized by W. Euler
(1897, 59, p. 199) by distilling the addition compound of methyl
iodide and 1,3-dimethylpropyliden chloride with caustic potash.
It is an unstable liquid which boils at 33.5° C. and on heating
rapidly polymerizes to dipentene, the same change being effected
by heating with a dilute acetic acid-camphor solution. It combines
with bromine to form an unstable liquid dibromide; it also unites with
one molecule of hydrobromic acid to form the tertiary bromide
as dimethyllyliden; this points to its being β-methylidivinyl,
CH₂=C(CH₃)=CH₂ (V. A. Mokiewsky, Jour. Soc. Phys. Chem.
Russ., 1900, 32, p. 207).
TERPENES PROPER
The terpenes proper may be subdivided into the simple mono-
cyclic terpenes and the more complex (usually bicyclic) terpenes.
The simpler monocyclic terpenes are called camphenes, the
tetrahydrocamphenes becoming terpenes and the hexahydroxycamphene, the
carbon atoms being numbered according to the inset formula:
In the more complex terpenes the name camphene is retained, and camphene is
used for the dibasic dibutylcamphene. G. Wagner (Ber., 1894, 27, p. 1635 Anm.)
designates the hexahydroxycamphenes, the tetrahydroxycamphenes,
and the hexahydroxycamphenes. The position
of the double linking in the molecule is shown by the use of the symbol A followed by the number of the carbon atom immediately preceding it.

**Monocyclic Terpene**

Limonene, Δ1:8(9) terpene, C_{10}H_{16}. It is known in three forms, namely, L-, D-, and d-Limonene. D-Limonene is the chief constituent of oil of oranges, and is also found in oil of lemon and oil of bergamot. l-Limonene is found in oil of fir-cones and in Russian peppermint oil. Both are pleasantly smelling liquids, which boil at 176-178 °C. They differ from each other only in rotatory power. Dry hydrochloric acid gas converts them into optically active limonene hydrochloride, while hydrobromic acid converts them into the corresponding hydrobromides. When heated to a sufficiently high temperature they are converted into dipentene. Four optically active nitrosochlorides are known, two corresponding to each of the active limonenes, and the products with alcohol have the corresponding nitrosochlorides with p-vaniloxime. Dipentene (l-limonene) is found widely distributed in many essential oils, e.g. of camphor, Russian turpentine, cubeb, bergamot, cardamom, &c., and is also a product of the dry distillation of many vegetable essences. It may be produced by heating many terpenes (pinene, camphene, sylvestrene, limonene) for several hours at 250-270 °C; or by the polymerization of isoprene at 100-104 °C. To prevent polymerization it is best to use hydrochloride with anhydrous sodium acetate and glacial acetic acid (O. Wallach, Ann. Chem. Pharm., 1887, 239, p. 3). It is a pleasant-smelling liquid, which boils at 175-176 °C, and polymerizes on heating to high temperatures. When warmed with alcoholic sulphuric acid it yields terpinene, whilst concentrated sulphuric acid or phosphorus pentasulphide converts it into para-cymene.

Dipentene dichloride, C_{10}H_{14}Cl_2, best prepared by distilling the hydrochloride on the surface of a glacial acetic acid solution of dipentene, crystallizes in rhombic plates which melt at 50 °C. and boil at 118-120 °C. (10 mm.). It is decomposed by alkali. (Ber., 1893, 269, p. 2863) has obtained a cis-dihydrochloride of melting-point 25 °C. (cineol) by the action of hydrochloric acid on cineole.

**Terpinene, Δ1:4(8) terpene, has not as yet been observed as a pure oil, but is obtained by the action of hot dilute sulphuric acid on terpinel, terpin hydrate and cineol. It is an inactive liquid boiling at 183-185 °C, and is readily converted into terpinolene by sodium.

**Terpinolene, Δ1:4(8) terpene (?), is found in cardamom oil and is one of the volatile oils of wild olive. It is obtained by the action of hydrochloric acid on terpinol, terpin hydrate and cineol.

Phellandrene is a mixture of Δ1:5 terpene and Δ2:1(7) terpene (pseudo-phenellandrene) (F. W. Semmler, Ber., 1903, 36, p. 1749). It is found as d-phenellandrene in oil of water-tan, and oil of elemi, and as l-phenellandrene in Australian eucalyptus oil and oil of bay. It is an exceedingly unstable compound, and must be extracted from the oils by distillation in vacuo. The hydrocarbons obtained by distillation and eucalyptus oil correspond to Δ1:5-terpinene.

A similar hydrocarbon was obtained by C. Harries and M. Johnson (Ber., 1905, 38, p. 1832) by converting carvone hydrobromide into d-terpinolene, then reducing the hydrogen bromide of phellandrene tetrachloride into d-phenellandrene, which is finally reduced.

**Sylvestrene, Δ1:8(9) meta-terpene, is found in Swedish and Russian oil of turpentine and in various pine oils. It boils at 175-176 °C when distilled-volatile. It is one of the most stable of the terpenes and gives a characteristic deep blue colour on the addition of a drop of sulphuric acid to its solution in acetone anhydride. On treating the hydrobromide with bromine in the presence of iodine, a product is obtained which on reduction yields meta-cymene (A. v. Baeyer and V. Villiger, Ber., 1898, 31, p. 2007).

Caryophyllene is obtained by the distillation of caryllaline or vestyanine hydrocarbon (A. Ber., 1894, 27, p. 549). It was obtained as a liquid by E. Wallach and W. Perkin (J. Chem. Soc., 1894, 58, 232) by the application of the Grignard reaction to the ethyl ester of γ-tokohexahydrobenzoic acid, (C_{10}H_{14}O_2). The mixture of magnesium methyl iodide this ester yields the lactone of γ-hydroxyhexahydro-meta-toluic acid, which is transformed by hydrobromic acid into the corresponding β-hydroxy-hexahydro-meta-toluic acid. This lactone, on reduction with magnesium and hydrochloric acid, the ester of which by magnesium methyl iodide is converted into Δ1:meta menthenol-8 (2). The meta-menthenol on dehydration by potassium bisulphate yields caryophyllene (3) of boiling-point 179-180°C.

A synthetic, monocyclic terpene, viz. 1-methyl-4-isopropyl dicyclohexene was prepared by A. v. Baeyer (Ber., 1893, 26, p. 232). Succino-succinic ester is converted into the methyl isopropyl derivative, which on hydrolysis and elimination of carbon dioxide yields 1-methyl-4-isopropylidiketohexamethylen. This ketone is then reduced to the secondary alcohol, the hydroxyl groups replaced by bromine, and hydrobromic acid is then removed from the bromo-compound by boiling it with quinoline, leaving the terpine alcohol, a liquid which boils at 174 °C. and shows a complete terpene character.

**Alcohol and Ketone Derivatives**

Menthol (terpan-ol-3), C_{10}H_{16}O. The laevo variety is the chief portion of oil of peppermint, and is isomeric with the menthone obtained by E. Beckmann and M. Pleissner (Ann., 1891, 262, p. 21) from pulegone hydrobromide with sodium and alcohol. It is readily oxidized by hydrogen peroxide in dilute acid in the cold.

When readily oxidized by chromic acid to the corresponding ketone menthone. By the action of phosphorus pentoxide, or zinc chloride, it is converted into menthone, C_{10}H_{16}O, and when heated with hydrobromic acid, the corresponding hydrobromide is formed. It is reduced by hydrobromic acid and phosphorus to hexahydrocymene. The phosphorus haloids yield haloid esters of composition C_{10}H_{16}Cl, which, according to I. L. Kondakov (Journ. pharm. Chem., 1899 [2], 60, p. 257) are to be regarded as tertiary esters; a similar type of reaction is found in the case of carvomenthol. A d-menthol has been prepared from the t-mixture obtained by reducing menthene.

**Terpineol, C_{10}H_{16}O, is an inner oxide of terpin. It is found in the oils of wormwood and isomeric with the ketone. It is formed by the action of dry hydrochloric acid gas into wormseed oil, the precipitated hydrochloride being then distilled in a current of steam (O. Wallach and W. Brase, Ann., 1884, 225, p. 297). It is an inactive liquid, which boils at 176 °C. The oxygen atom in the molecule does not appear to possess either an alcoholic, ketonic, aldehydic or acid function.

**Terpineol, Δ1-terpenol-8), C_{10}H_{16}OH.** The term "terpineol" has been used to denote what is now known to be a mixture of various isomeric alcohols. Liquid terpeneol has been isolated from the oil of dalbergia odorifera and isomeric with the ketone.

Liquid terpineol is generally prepared by the action of dilute sulphuric acid on terpene hydrate. It consists of a mixture of various isomers, from which a solid terpineol melting at 35 °C. and an isomeric terpineol melting at 80 °C. may be obtained by replacing the halogen atoms in the active monohydrobromide of limonene by the hydroxyl group; it has also been obtained by the action of acetic acid on linalool. The racemic variety has been prepared by the action of formic acid on ylang, and was synthesized by the following method (W. H. Pirkin, Journ. Chem. Soc., 1904, 85, p. 654). γ-Cypentane tricarboxylic ester (1) (prepared by the
aceton of cyanoacetic ester on β-isodopropionic ester (2) is hydrolyzed to pentane-2-tert-butylicarboxylic acid (3), which when boiled with acetic anhydride and distilled gives 3-keto-1,3-dihydroxybenzoic acid (4). The ester of this acid, when treated with the Grignard reagent, yields β-oxoxyethylenehydrolic acid (5), which is converted into the corresponding 1-terpene by means of phosphoryl hydroxotetone into the latter compound on treatment with dilute alkali or pyridine yields Δ3-tetrahydro-para-toluic acid (6), the ester of which with magnesium and methyl iodide furnishes terpeneol (6):—

\[
\text{ROCOCH₂CH₂OCOCNCH₃} \xrightarrow{\text{HOC₆H₄CH₂CH₂OCOCNCH₃}} \xrightarrow{\text{CO₂H}} \]

This synthesis determines the constitution of terpin (7) and of dipentone (8), since the former is produced by the action of 5 per cent. sulfuric acid on terpineol, and the latter by heating terpineol with acetic acid sodium sulphate.

Terpineol adds on nitrosyl chloride to form a nitrosochloride, which on elimination of hydrochloric acid yields the oxime of an unsaturated oxo ketone; this on boiling with acids is converted into a strongly dextro-rotatory d-limonene (Beckmann, Comptes rendus, 1905, 140, p. 1303); when oxidized with Caro’s reagent it yields trioxoethylene hydroxycymene (A. V. Baeyer and V. Villiger, Ber., 1899, 32, p. 1321). The isomer isoborneol (Δ3(8)-terpenol-1) see A. V. Baeyer, Ber., 1894, 27, p. 443, 815.

Menthone (terpan-one-3), C₁₃H₁₄O₂, occurs with menthol in oil of peppermint. It was first obtained by M. Mariya (Journ. Chem. Soc., 1881, 39, p. 77) by oxidizing menthol with chromic acid mixture at 120°C, and was described as an inactive compound; but R. W. Atkinson (ibid., 1882, 41, p. 50) showed that when menthol was oxidized at 130°C a strongly dextro-rotatory monoborneol was produced. For the preparation of l-methone and d-methone (Beckmann’s d-methone) see E. Beckmann, Ann., 1889, 250, p. 325; 1891, 262, pp. 21 seq. The methone obtained by Beckmann by the reduction of pulegone hydrobromide was shown by C. Martine (Ann. chim. phys., 1904 (8), 3, p. 49) to be not completely identical with l-methone; it is consequently designated P-methone. An inactive methone has been synthesized as follows. β-Methyl pimelic ester is converted by sodium ethylate into methyl-1-cyclohexanol-3-carboxylic ester-4, into which the propyl group is introduced (also in position 4) by the action of isopropyl iodide and sodium ethylate. The ester is then hydrolysed, and carbon dioxide eliminated from the (carboxyl) group; the inactive methone is obtained (A. Einhorn and L. Klages, Ber., 1901, 34, p. 3753). It boils at 204–206°C, whereas Beckmann’s methone (C. A. Haller and C. Martine (Comptes rendus, 1905, 140, p. 130) synthesized natural methone from isopropyl iodide and the sodium derivative of methyl-1-cyclohexanol-3. It has also been prepared by condensing methylene, sodium ethylate, and the acetyl derivative of methyl-1-cyclohexanol-3 being converted into the propyl derivative, yielding acetylacetone, which is then hydrolysed to methone (G. Leser, Comptes rendus, 1902, 134, p. 1115). A. Koltz and L. Hesse (Ann., 1905, 342, p. 396) convert methyleneoxide (1) by means of ethyl oxalate and subsequent hydrolysis into methyleneoxide oxalic acid (2), the isopropyl ester of which on treatment with a methyl alcohol solution of caustic potash yields d-methone (3).

O. Wallach (Ann., 1900, 312, p. 171) showed that the oximes of cyclic ketones are converted by phosphorus pentoxide into oximes, which are readily decomposed by concentrated hydrochloric acid to yield aliphatic amino-acids; in this way methone may be converted into t-amido-decyl acid,

\[
\text{CH₂CO} \rightarrow \text{CH₂CH₂CH₂CH₂CH₂OCH₃} \xrightarrow{\text{CH₂CH₂OCH₃}} \]

Pulegone (Δ3(8)-terpenone-3), C₁₀H₁₈O₂, is an unsaturated ketone found in peppery oil, from which it may be obtained by distillation with a dextro-rotatory d-limonene obtained from thujyl alcohol. It is hydrolyzed to form pulegone, which yields ammonium silver nitrate on long boiling. It is reduced by hydrogen to 1-menthol. When heated with acetic anhydride it yields 1-menthone-4-acetate (3). When methylcylohexanelone and acetone are condensed together in the presence of sodium methylate, an isomer of pulegone boiling at 215–216°C is obtained. Pulegone combines with hydrobromic acid to furnish 4-bromopulegone, which on distillation in methyl alcohol solution with basic lead nitrate is converted into isopulegone (Δ8(9)-terpenone-3) (C. Baeyer and Ber., 1899, 32, p. 3361). It is a leavo-rotatory mixture (terpenone form) is also obtained by the oxidation of isopulegone with chromic acid. On reduction with sodium yields isopulegone and no menthol (cf. pulegone).

Carvone (Δ6: 8(9)-terpdenone-one-2), C₁₀H₁₄O, an unsaturated optically active ketone which is found very widely distributed in nature. The dextro form is the chief constituent of oil of caraway, and is also found in oil of dill; the levo form is found in oil of spearmint and fennel. The dextro form is obtained practically pure by the fractional distillation of caraway oil. The levo form from the oils containing it, by first forming its addition compound with sulpherated hydrogen, decomposing this by alcoholic potassium bicarbonate, and distilling the resulting mixture, it can be synthetically prepared from fimbine nitroisoc lorohene, alcoholic potash converting this compound into l-carvone, which on boiling with dilute sulphuric acid yields l-carvone; similarly terpineol nitroisoclorohene by the action of alcoholic potassium hydroxide on the boiling mixture, which on heating with carvone acid, on which heating with carvone is converted into carvacrol (1-methyl-2-propyl phenol), and is then oxidized to phenildrene, for C. Harries and M. Johnson (Ber., 1905, 38, p. 182) by reduction of carvone hydrobromide, obtained Δ6-carpon-2, which with phosphorus pentachloride gives chloro-2-phenildrene.

Bi-Cyclic Terpene Group

A nomenclature for the bicyclic hydrocarbons was devised by A. V. Baeyer (Ber., 1900, 33, p. 3771). According to this system each hydrocarbon contains two terepene atoms, which may be combined with each other three times, either directly or by means of other intervening carbon atoms, the combination forming a series of "bridges." These bridges are distinguished by numbers, denoting the number of carbon atoms contained in the bridge, the direct union of the two tertiary carbon atoms being designated as 0; if one carbon atom intervenes, then the number 1 is used, and so on. These three numbers serve as the characteristic for the compound. Hydrocarbons of this class with five terepene atoms are termed "bicyclenentes," with six atoms of carbon "bicyclohexenes," etc. Thus, for example, the compound (1) would be called "bicyclo-(4-0 -1.4)-heptene," and (2) would be called "bicyclo-(6-0-1.4)-heptene." These names are distinguished by (t) for the true thujene; the name "t-" signifies the true thujene isoborneol, whereas "l-" signifies the natural thujene isoborneol, which is isomeric with the true thujene. It is synthesized by heating the thujylglycerol isoborneol obtained from thujyl alcohol. It is exceedingly unstable. The isomeric B-thujene was also obtained by the same investigator by the dry distillation of trimethylthyjul ammonium hydroxide. It boils at 150–151°C, and possesses a different rotary power. Another 0-bridge bicyclic acid it yields terpinenol (2)-(terpen-ol-4) (O. Wallach, Ber., 1907, 40, p. 592). Pulegone, derived from "bicyclo(1-0 -1.3)-heptene," is found in many essential oils, and is the chief constituent of oil of turpentine; the l-variety is found in French oil of turpentine, the d-variety in Russian, American, and Swedish oil of turpentine. Pinene is also a component of "oil of thujylpiperita" and "oil of thujylolibanum, bay, fennel, sassafras, rosemary and of valerian." The active varieties are obtained by the fractional distillation of the various oils of turpentine. The inactive variety is obtained by heating pineine nitroisoclorohene with an alcoholic potassium hydroxide solution. O. Wallach, Ann., 1889, 252, p. 132; 1900, 258, p. 243), or better with methylamine (W. A. Tilden). The three varieties boil at 155–156°C. The resinous reaction by absorbing oxygen from the air, resinous products being formed, together with small quantities of formic and acetic acids.
Act oxidizing agents convert it into terpene and terfolic acids, whilst alkaline potassium permanganate in dilute solution oxidizes it to pinene glycol, \( \text{C}_{10}\text{H}_{16}\text{OH} \), pinonic acid, \( \text{C}_{10}\text{H}_{16}\text{O} \), pinic acid, \( \text{C}_{10}\text{H}_{16}\text{O} \), etc. The product of the reaction varies according to the temperature (G. Wagner, Ber., 1894, 27, p. 2270; F. Tiemann and F. W. Semmler, Ber., 1895, 28, pp. 1344–1778). Concentrated sulfuric acid converts it into camphene; and an alcoholic solution of this acid gives terepin in menstruum, and when heated to 250–270°C it yields dipentene; the most halogen acids at ordinary temperature convert it into the dihalogen halides of dipentene. 

Hydrochloric acid yields pinene hydrochloride (artificial camphor), \( \text{C}_{10}\text{H}_{16}\text{Cl} \), a white crystalline solid identical with bornyl chloride which melts at 131°C. Elimination of halogen hydride by means of a weak alkali (e.g., soap, silver acetate, &c.) combines it into camphene, which on heating and conversion of pinene into its hydrochloride is probably accompanied by an intramolecular rearrangement:

\[
\text{H}_2\text{C} = \text{C} - \text{CH}_2 \rightarrow \text{H}_2\text{C} = \text{C} - \text{CH}_2\text{C} = \text{C} - \text{CH}_3
\]

Pine. 
Bornyl chloride.

Nitric acid in aqueous alcoholic solution converts it into terpin hydrate. Pinene nitrosoroctrochlorel, \( \text{C}_{10}\text{H}_{16}\text{NOCl} \), was first obtained in 1874 by W. A. Tilden (Jahresth., 1874 p. 214) from nitrosyl chloride and a mixture of pinene and chloroform. O. Wallach (Ann., 1893, 251, p. 1290) prepared it by the reaction of the former with metallic potassium and ethyl nitrite on oil of turpentine in presence of fuming hydrochloric acid. W. A. Tilden (Jour. Chem. Soc., 1904, 85, p. 759) showed that strongly active pinene gives bad yields of the nitrosoroctrol at that time. Sodium, which acts as a reducing agent, and the action of potassium and ethyl nitrite on oil of turpentine is in presence of fuming hydrochloric acid. 

Camphene, \( \text{C}_{10}\text{H}_{18} \), also a bicyclo-[1.2.2]-heptene derivative, is a constituent of the oils of camphor, frankincense, camphor, ginger and of rosemary, and also of French and American oil of turpentine. It may be obtained by the action of sulfuric acid on pinene; by heating pinene hydrobromide or hydrochloride with sodium acetate or glacial acetic acid to 200°C; or by heating bornyl chloride with aniline (O. Wallach, Ber., 1892, 25, p. 916). According to Kononowalow it is best prepared by heating borneol with a diluted sulfuric acid (1:2) for about 6–8 hours, between 60–100°C, with water in the distillation apparatus. The products of this reaction vary rather slightly according to the sources from which it is obtained, the former being about 55°C and the latter about 135°C. It is known as d-, l- and l- forms or combinations with hydrochloric or hydrobromic acid, which with reduction with sodium and alcohol yields camphene. Many different oxidation products may be obtained from camphene, partly by the conditions of the experiment (J. Brecht, W. Jegelski, Ann., 1900, 310, p. 114; G. Wagner, Ber., 1890, 23, p. 2381; S. Miyado and F. Zienkowski, Ann., 1905, 340, p. 17; J. E. Marsh and J. A. Gardner, Jour. Chem. Soc., 1891, 59, pl. 648; 1896, 60, p. 74).

Pencalene, \( \text{C}_{10}\text{H}_{18} \), a bicyclo-[1.2.2]-heptene derivative, is not found in any naturally occurring products. The hydrocarbon may be obtained by the reduction of penciline and elimination of water from the reacting fenchyl alcohol, or by the elimination of hydrogen from the pencalene hydroxyl from the fenchyl halogen compounds (O. Wallach, Ann., 1892, 253, p. 145; 1898, 302, pp. 371 seq.).

The hydrocarbons and hydroxylates of camphene are the most probably best represented by the following formulae (pinene is given above):

Alcohol and Ketone Derivatives

Borneol (Borneo camphor). \( \text{C}_{10}\text{H}_{18}\text{OH} \) occurs in the pine cavities of Dryobalanops camphora, and in the oils of spice and rosemary: esters are found in many fir and pine oils. It may be prepared by heating camphor with alcoholic potash (M. Berthelot, Ann., 1859, 12, p. 363) or by reducing camphor in alcoholic solution with sodium (O. Wallach, Ann., 1885, 230, p. 225; J. Bertram and H. Walbaum, Jour. prak. Chem. 1894 (3), 49 p. 12). L. Tschugaev (Chem. Centralblatt, 1903, 4, p. 94) obtains pure d-borneol as follows: Sulfuric d-borneol, combusting in alcoholic solution (3) in the presence of a reducing of camphor is dissolved in xylene and converted into the sodium salt by metallic sodium. This salt is then turned into the xanthate, \( \text{C}_{10}\text{H}_{18}\text{OCNa} \), which with metallic sulphate yields the camphoronic acid, which, when heated, is decomposed and yields alcohol by steam distillation, which also decomposes any methylic xanthate of isoborneol that may have been formed. The residue is crystallized as hydrobromic acid, which may be obtained. It behaves as a secondary alcohol. Nitric acid oxidizes it to camphor, and when heated with potassium bisulfate, it gives camphene. With phosphorus pentachloride it forms a bornyl chloride, identical with camphoronic acid.

Isoborneol is a tertiary alcohol which may be obtained by dissolving camphene in glacial acetic acid, adding dilute sulfuric acid and heating to 50–60°C for a few minutes, the isoborneyl acetate so formed being sublimed and then distilled. 

Chronic acid oxidizes it to camphor.

Camphene (tanacetum), \( \text{C}_{10}\text{H}_{18} \), is found in many aromatic plants. Oil of this substance contains camphene, and of its chiefly \( \beta \)-thujone. Oil of artemisia and oil of sage contain a mixture of the two, whilst oil of absinthe contains principally the \( \beta \)-variety. The \( \alpha \)-form may be obtained by the action of zinc chloride or of zinc nitrate on the oil. The oil is obtained by distillation of half of the terpene. The nitrosochloride melts at 115°C (circa) and is a white pleasant-smelling powder. Alcoholic potash converts it into its nitrosopine, \( \text{C}_{10}\text{H}_{16}\text{NO} \).

Borneol. \( \text{C}_{10}\text{H}_{18} \), derived from bicyclo-[1.2.2]-heptane, is prepared by heating borneol iodide to 170°C for several hours with a concentrated solution of alcoholic potash (G. Wagner, Ber., 1900, 33, p. 2121), or by decomposition of the methyl esters of the \( \alpha \)- and \( \beta \)-forms. The former yielding \( \alpha \)-borneoic and the latter \( \beta \)-borneol (L. Tschugaev, Chem. Centralblatt, 1905, i, p. 94).

Camphene. \( \text{C}_{10}\text{H}_{18} \), also a bicyclo-[1.2.2]-heptene derivative, is a constituent of the oils of camphor, frankincense, camphor, ginger and of rosemary, and also of French and American oil of turpentine. It may be obtained by the action of sulfuric acid on pinene; by heating pinene hydrobromide or hydrochloride with sodium acetate or glacial acetic acid to 200°C; or by heating bornyl chloride with aniline (O. Wallach, Ber., 1892, 25, p. 916). According to Kononowalow it is best prepared by heating borneol with a diluted sulfuric acid (1:2) for about 6–8 hours, between 60–100°C, with water in the distillation apparatus. The melting- and boiling-points of camphene vary slightly according to the sources from which it is obtained, the former being about 55°C and the latter about 135°C. It is known as d-, l- and l- forms or combinations with hydrochloric or hydrobromic acid, which with reduction with sodium and alcohol yields camphene. Many different oxidation products may be obtained from camphene, partly by the conditions of the experiment (J. Brecht, W. Jegelski, Ann., 1900, 310, p. 114; G. Wagner, Ber., 1890, 23, p. 2381; S. Miyado and F. Zienkowski, Ann., 1905, 340, p. 17; J. E. Marsh and J. A. Gardner, Jour. Chem. Soc., 1891, 59, pl. 648; 1896, 60, p. 74).

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The hydrocarbons and hydroxylates of camphene are the most probably best represented by the following formulae (pinene is given above):
A vast amount of work has been done on the constitution of the camphor molecule. The earlier investigations on theready forma- tion of benzaldehyde derivatives by the breaking down of camphor led to the view that the molecule was a simple six-membered carbon ring. Subsequent research, however, showed that the formula proposed by J. Bredt (Ber., 1893, 26, p. 3047) in which camphor could be regarded as a bicycle-berried derivative is correct. This formula is based on the fact that camphoronic acids yield trimethylsuccinic, isolobutyr, and carboxylic acids, and carbon on dry distillation, and Bredt suggested that it was an aS-trimethylcarballylic acid, a conclusion confirmed by W. H. Perkins, jun., and J. F. Thorpe and H. W. K. Howarth (J. Soc. Chem. Ind., 1895, 15, 353) who isolated camphoric acid and camphonic acid, the latter being converted into a camphoronic acid by heating with hydrochloric acid in quinoline, which acid yields camphoronic acid (3) and some trimethyl glutaric acid:

\[
\text{CH}_3\text{COOH} \rightarrow \text{CH}_3\text{CO}+\text{CH}_3\text{CO}+\text{CH}_3\text{CO} \rightarrow \text{CH}_3\text{COOH} \quad (2)
\]

\[
\text{Fenofene, } \text{C}_9\text{H}_{10}\text{O}, \text{ is trimethyl-(2-7-7)-bicyclo(1-2-2)-heptane-3. It occurs in } d-\text{and } l-\text{forms, the former in oil of fenugreek and bulb of onion, the latter in oil of thuya. It may be converted into a mixture of the oils by treating the fraction boiling between 190-195 °C with nitric acid and distilling the product in a current of steam. The fenofenes are pleasant-smelling oils which boil at 192-193 °C, and on solidification melt at 5-6 °C. They do not contain with sodium bisulphite. They dissolve unchanged in cold concentrated hydrochloric and sulphuric acids, and are very stable; thus the monobromofenofene is only formed by heating the ketone with bromine to 100 °C under pressure (H. Czerny, Ber., 1900, 33, p. 2287). On oxidation with potassium permanganate it yields acetic and oxalic acids together with dimethylmalonic acid. By the action of hot concentrated sulphuric acid it yields acetyl-orthoxylene,}

\[
\text{CH}_3\text{CO}(\text{CO})\text{(CH}_2\text{)(CH}_3\text{)}(1-2)
\]

(1, J. E. Marsh, Jour. Chem. Soc., 1899, 75, p. 1058). When heated with phosphorus pentachloride at 150-155 °C with metacynamene. Since it does not yield any oxymethylene compounds, it cannot contain the grouping-CH=CH in the molecule.

**Hydrocarbons, C_{n}H_{2n}, of the Terpene Series**

Meuckland, C_{10}H_{(16)}(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16})(CH}_{16}) (1899, 75, p. 1058). When heated with phosphorus pentachloride at 150-155 °C with metacynamene. Since it does not yield any oxymethylene compounds, it cannot contain the grouping-CH=CH in the molecule.

**Olefine Terpenes**

Myrcene, C_{10}H_{18}, was first isolated by F. B. Power and C. Kleber from oil of bay (Schimmel & Co., Bulletin, April 1895, p. 11); it is the principal odour in oil of sassafras leaf. It is obtained from bay oil by shaking the oil with a 5 per cent. solution of caustic soda, followed by fractionation in vacuo. It boils at 67-68 °C (20 mm.), and polymerizes when heated for some time. When oxidized by potassium permanganate it yields benzoic and isobenzoic acid, a fact strongly suggestive of the presence of a hydroxytrimethylacetic acid in the molecule, with which it is probably identical. The facts are confirmed by the formation of isobutyric and isovaleric acids during the introduction of hydroxytrimethylacetic acid, which is a crystalline solid which melts at 153 °C and boils at 160 °C.
a more drastic oxidation with potassium permanganate yields acetone and \( \beta \)-methylidipic acid.

1. **Rheinol, \( \text{C}_6\text{H}_4\text{OH} \)** or (CH\(_2\))\(_2\)C=C(CH\(_3\))\(_2\) (CH\(_2\))\(_2\) (CH\(_3\))\(_2\) CH \( \text{CH}_2\text{OH} \), which occurs in the essence of geranium oil, is of rose color and of rose. It is a structural isomer of citronellol (P. Barbier and L. Bouveault, *Comptes rendus*, 1896, 122, pp. 599, 673; *Bill. Soc. Chim.*, 1900, 19, 3, p. 499), and its inactive form has been shown (B. Wecker, *Comptes rendus*, 1896, 122, p. 540) that it is obtained from the alkyl radical with alcoholic potash and then fractionating in vacuo. The geranial fraction is then mixed with freshly dried calcium chloride and the mixture is allowed to stand in vacuo at a low temperature, when the compound \( \text{C}_6\text{H}_4\text{OH} \)-\( \text{C}_6\text{H}_5\text{CH} \) separates out. This is washed with absolute ether and finally decomposed by water, when pure geranial is liberated (O. Jacobson, *Ann.*, 1871, 157, p. 232; J. Bertram and E. Gildemeister, *Jour. prakt. Chem.*, 1897 (3), 56, p. 507). It may also be prepared by reducing the corresponding aldehyde (citral) with sodium amalgam.

**Citronellol, \( \text{C}_6\text{H}_4\text{OH} \)** was obtained in 1902 from geraniol oil by A. Hesse and H. Speck (Zeitschel, *Ber.*, 1899, 32, p. 310). It is found in eucalyptus oil, in the absolute of coriander oil, and is obtained by boiling the oil with sodium hypochlorite and acetic acid (acetone, \( \text{CH}_3\text{CH} = \text{CH} \text{CH} = \text{CH} \text{CH}_2 \text{OH} \)). When heated with concentrated acetic acid to 150 °C it is converted into dimethylheptenol (P. Barbier, *Comptes rendus*, 1899, 128, p. 455). The compound is formed in a faintly yellowish solution of acetyl phenylhydride with steam.  **Citral, \( \text{C}_6\text{H}_4\text{OH} \)** is obtained from eucalyptus oil, and is also prepared by boiling the alkaline solution of 

**Geraniol, \( \text{C}_6\text{H}_4\text{OH} \)** or (CH\(_2\))\(_2\)C=C(CH\(_3\))\(_2\) (CH\(_2\))\(_2\) (CH\(_3\))\(_2\) CH \( \text{CH}_2\text{OH} \), is a 2,6-dimethylcyclohexene-2-6-o-8, is found in the oils of geranium, citronella, neroli, petit-grain, spike, ylang-ylang, and in Turkish and German rose-geranium oil, and is obtained by distillation with alcoholic potash and then fractionating in vacuo. The geraniol fraction is then mixed with freshly dried calcium chloride and the mixture is allowed to stand in vacuo at a low temperature, when the compound \( \text{C}_6\text{H}_4\text{OH} \)-\( \text{C}_6\text{H}_5\text{CH} \) separates out. This is washed with absolute ether and finally decomposed by water, when pure geraniol is liberated (O. Jacobson, *Ann.*, 1871, 157, p. 232; J. Bertram and E. Gildemeister, *Jour. prakt. Chem.*, 1897 (3), 56, p. 507). It may also be prepared by reducing the corresponding aldehyde (citral) with sodium amalgam.

**Citronellic, \( \text{C}_6\text{H}_4\text{O} \)** is the aldehyde of citronellol. It is a constituent of many essential oils, and was first discovered in citronella oil by M. Ziegler and by F. W. W. Chappell (1891). It is also found in eucalyptus oil and in lemon-grass oil. It is a dextro-rotatory liquid which boils at 203-204 °C. It is readily reduced by sodium amalgam to citronellol, and oxidized by ammoniacal silver nitrate to hydroxy-terpenic aldehyde (W. Gildemeister, *Chem.*, 1899, 32, p. 310). It forms a dimethyl acetal, \( \text{C}_6\text{H}_4\text{OCH}_2\text{CH}_3 \), which on oxidation with potassium permanganate yields a dioxo-hydroxy-citronellal dimethyl acetal, \( \text{CH}_2\text{C(\text{CH}_3\text{CH}_2\text{OH})(\text{CH}_3\text{CH}_2\text{OH})-\text{CH}_2\text{CH}_3} \), which must possess the above composition, since on further oxidation by chromic acid it yields a keto-aldehyde of the constitution \( \text{CH}_2\text{C(\text{CH}_3\text{CH}_2\text{OH})(\text{CH}_3\text{CH}_2\text{OH})-\text{CH}_2\text{CH}_3} \). It combines with sodium bisulphite, giving a normal bisulphite and also a mono-dihydroxy-terpenic acid.

**Geraniol (citral), \( \text{C}_6\text{H}_4\text{OH} \)** is the aldehyde corresponding to geranial. It is found in the oils of lemon, orange, lemon-grass, citronella, bay, verbena, and in various eucalyptus oils. It may be obtained from the oils by means of its bisulphite compound, provided the operation is carried out at a low temperature, otherwise the unsaturated compound will be formed. The reaction may either be produced by the oxidation of geraniol with chromic acid mixture, or by distilling a mixture of calcium formate and potassium permanganate with the oil and distilling the alcohol obtained, one boiling at 165-166 °C (13 mm) and the other at 173 °C. They are distinguished by their different optical activities, one being practically inactive, the other strongly laevo-rotary (see also M. Guerbet, *Comptes rendus*, 1900, 139, p. 417; *Bill. Soc. Chim.*, 1900 (3), 23, p. 540). Carvonephyl alcohol is obtained from oil of cloves; by elimination of water it yields clovene, \( \text{C}_6\text{H}_4\text{OH} \), a lime oil.

Many di- and tri-terpenes have been described, but as yet they are not thoroughly characterized.

TERRACE—TERRACOTTA

TERRACE (Fr. terrasse, from It. terrazia, terrazzia, Lat. terra, earth), a raised platform of earth; in geology the term is used of level horizontal ridges on the side of a slope, formed by volcanic action, or more usually by the action of water; they are thus frequent along the shores of lakes or by rivers; on the sea-shore they are generally known as "raised beaches." The term is used in architecture of an artificial platform in front of a building, which is utilized as a proenade; sometimes, when the building is erected on an elevation, there may be a series of terraces rising one above the other, with flights of steps leading from one to the other, as in the Villa D'Este at Tivoli; or there may be a single terrace raised high above the ground and supported on arches, as the terrace to the Adelphi buildings in the Strand, or the river front at Somerset House, or in France at the castles at Amboise and St. Germain-en-laye, or again a low terrace like that in front of the Houses of Parliament at Westminster overlooking the Thames, which is 670 ft. long and 35 ft. wide. The terraces of the gardens at Isola Bella on the Lago Maggiore are known as hanging gardens (Porzia pensilis), and were similar to those which were built by the Assyrian king at Babylon. Though properly applied to a row of buildings on a raised level, the word is often used of any row of houses.

TERRACINA (Lat. Tarracina, Volsc. Anxur), a town and episcopal see of the province of Rome, Italy, 76 m. S.E. of Rome by rail (56 by the Via Appia), 40 ft. above sea-level. Pop. (1901) 7,755; (1911) 10,790 (comune). Its position, at the point where the Volsci from the Po reach the Mare, had a wide field for seas and land, leading to the building of the Terracine line, 320 B.c., added to its importance: the road at first crossed the hill at the back of the promontory by a steep ascent and descent. An attempt was made in 184 B.C. to get round it by an embankment thrown out into the sea: but it was probably not until early in the imperial period that a cutting in the rocks at the foot of the promontory (Pisco Montano) finally solved the problem. The depth of the cutting is indicated by marks on the vertical wall at intervals of 10 Roman ft.—figures encased in large swallow-tail tablets—the lowest mark, 3 or 4 ft. above the present road, is CXX. Not far off are mineral springs by the side of the Via Appia, called Tarracine (Terme Tarracine), known to have been in use—except one containing arsenic which was blocked up both by the ancients and again in 1839 as a precaution. The two roads met some few miles E. of Tarracina, and the Via Appia then traversed the pass of Lautulae, between the mountains and the Lake of Fondi, where the Sammites defeated the Romans with loss in 315 B.C. This pass, the frontier between the Papal States and the kingdom of Naples, was also fortified in modern days. It was probably in consequence of the cutting just mentioned that some of the more important buildings of the imperial period were erected in the low ground by the shore, and near the small harbour. The construction of the coast road, the Via Severiana, from Ostia to Tarracina, added to the importance of the place; and the beauty of the promontory with its luxuriant flora and attractive view had made it frequented by the Romans as early as 200 B.C. Galba and Domitian possessed country houses here. It appears in the history of the Gothic wars, and Theodoric is said to have had a palace here. It was sacked in 409 and 505. In 872 John VIII. brought it under the domination of the Holy See.

The picturesque modern town occupies the site of the old; the present piazza is the ancient Forum, and its pavement of slabs of travertine with the inscription "A. Aemilius A. F.," in letters once filled in with bronze, is well preserved. It is supported by massive arched substructures, which extend under the surrounding houses. The cathedral of SS. Pietro e Cesareo, fronting upon it, is ensclosed in a temple of Rome and Augustus, part of the side wall of which, with engaged columns, is still visible. The vestibule, in the Cosmatesque style, is supported by ten ancient columns resting upon recumbent lions, with a mosaic frieze upon them. The brick campanile has small columns with little pointed arches. The interior has a fine Cosmatesque pulpit supported by ancient columns resting on lions, a Paschal candlestick of 1245, and a good pavement of the same period with beasts and dragons. The sacristy contains a carved wooden nuptial chest of the 10th or 11th century. There are also remains of the town wall in the "polygonal" style, and above the town are several massive platforms for supporting buildings, in a more archaistic form of this style; these may well belong to the Roman period, and the latter even to the empire. The summit of the promontory (548 ft.) is reached by the old line of the Via Appia, which is flanked by tombs and by remains of an ancient defensive wall with circular towers (currently attributed to Theodoric, but probably a good deal earlier in date). The summit is occupied by a massive terrace, supported by arcades of fine opus incertum (traditionally, but wrongly, called the palace of Theodoric) on all sides except the E., and commanding a magnificent view seaward over the coast and over the Pompejane Marshes. On the terrace, as was ascertained in 1804, stood a Corinthian temple of the early imperial period, 110 by 65 ft.; the cela was decorated in mosaic, the engaged columns supporting an altar; the pediment, with the statue of the deity, according to some authorities Venus, but more probably Jupiter Anxur worshipped as a child—a theory confirmed by the discovery of many curious leaden toys, like those made for dolls' houses at the present day, in the fossae on the E. of the temple. Of the lower town by the harbour, which had buildings of some importance of the imperial period (amphitheatre, baths, &c.), little is now visible, and its site is mainly occupied by a new quarter built by Pope Pius VI., who restored the Via Appia through the Pompejane Marshes. The W. hill, one of the S.W. and N.W., is a group of huts inhabited in winter by labourers from the Abruzzi, as is the case in many other parts of the Campagna. Of the ancient harbour constructed by Antoninus Pius (M. R. de la Blanchère in Mélanges de l'école française de Rome, i. 322; 1881) insignificant remains exist, and it is largely silted up. Close to it is the small modern port.

The ancient site of Terracina includes a considerable extension of territory towards the N.W. with much undergrowth (macchia) valuable for charcoal burning, and a considerable extent of pasture and arable land. The ancient aqueduct, bringing water some 35 m. from the slopes of the Volscian Hills, has been repaired and is in use. Three miles to the N.W., at the foot of the Monte Leano, was the shrine of the nymph Feronia, where the canal following the Via Appia through the marshes ended. Along these 3 m. of the Via Appia are numerous ancient tombs, and the fertile valley to the N.E. was thickly populated in Roman days.

See M. R. de la Blanchère, Tarracina (Paris, 1884). (T. As.)

TERRACOTTA. Greek.—The use of clay amongst the Greeks was very varied and extensive, but we are here only concerned with one aspect of it, that in which the clay was baked without glaze, whether employed for utilitarian or ornamental purposes. The Greek term for this is ἀπόστρη σκόνη, "baked earth"; the word πτερών when applied to worked clay signifies "sun-dried" only. Among the manifold purposes to which terracotta was put by the Greeks may be mentioned parts of public and private buildings, such as bricks, roof tiles, drain and flue tiles, and architectural ornaments; tombs and coffins; statues and statuettes, for votive or sepulchral purposes or for the decoration of houses; imitations of metal vessels and jewelry; and such everyday objects as spindle whorls, theatre tickets, lamps, braziers and domestic utensils. It also supplied the potter with moulds and the sculptor with models of works of art, especially in bronze.
Use in Architecture.—In architecture terracotta was extensively employed for roof tiles and other decorative details, as has been shown by many recent discoveries, especially at Olympia. In the Heraion we have the oldest example of a terracotta roof. A 6th-century temple at Thermon in Arcacarnia is also constructed of wood and terracotta, with painted terracotta slabs in wooden frames for metopes. The generic term for the roof tile was κόραιν, and these are classified as flat square tiles (σεργαστήρια or σωλήνες) and semi-cylindrical covering tiles (καλυπτέρια). Other varieties of ornamental tiles used in buildings are (1) the covering slabs along the raking-cornice (ψείδον) of the pediment; (2) the κυμάτια or cornice above the γέφυρων; (3) the cornice along the sides with lions' head spouts to carry off rain-water; (4) the έκρυορίνα or antefix ornaments surmounting the side-tiles. These latter varieties were usually enriched with decoration in colour, the κυμάτια being painted with elaborate patterns of loto-and-honeysuckle or Greek key-pattern, in red, blue, brown and yellow, curvilinear patterns being restricted to curved, rectilinear to flat surfaces. The antefix ornaments were usually modelled in the form of an anthemion or palmette, but were sometimes adorned with reliefs or sculptured groups, as in the case of the temple of Zeus at Olympia, which has figures of Victory along the cornice. The British Museum has an interesting series of 6th-century date from Capua, with gorgons' heads, female busts, and other subjects in relief, and others come from an early 5th-century temple at Civita Lavinia. Many coloured roof tiles have been found at Olympia, and Sicily and at Naples, Italy a fashion prevailed of nailing slabs of terracotta over the surface of the stonework (a legacy from the epoch of wooden buildings which required protection from the weather). These were ornamented with loto-and-honeysuckle and other patterns, sometimes in relief but always richly coloured. They occur at Olympia in the Treasury of Gela, by a Sicilian architect, and also in a temple at Selinus. The best example of this practice is the temple at Civita Lavinia already cited, the remains of which belong partly to the 6th, partly to the 4th century B.C.

Sculpture.—The subject of Greek sculpture in terracotta is a large one, and only its brief outlines can be given here. Of large or life-size statues comparatively few examples are known, and they can only be said to be common in Cyprus, where marble was difficult to procure; they are also more frequent in Italy, as will be seen later. But the use of clay for the reproduction of the human figure was one of the earliest instincts of the race, and may be traced back as far as archaeo- logical records exist, to the days of the Minoan and Aegean supramacies. Terracotta figures of a very primitive character have been found in Crete, in Melos and at Olympia, and one series of figures from Petasos in Crete is remarkable for the very modern fashions of head-dress and costumes. Terracotta figures of more advanced style have also been found in Rhodes and other places dating from the Mycenaean period.

Greek traditions on the subject go back to one Butades of Sikyon, a potter who was credited with the invention of modelling clay in relief; and the Samian sculptor Thedorus and Rhokos, who lived about the end of the 7th century B.C., were said to have been the first to use clay models for statues. As they were supposed to have introduced hollow casting in bronze, it was obviously for this purpose that they employed clay. But this material was later superseded by wax, and for marble statues was not used until Roman times.

The small terracotta figures used as ornaments or household gods, buried in tombs or dedicated in temples, trace their pedigree from the prehistoric examples already mentioned. They have been found in large numbers on nearly all the well-known sites of antiquity, the most fruitful being Tanagra in Boeotia, Myrina in Asia Minor, Rhodes, the Cyrenaica, Athens, Sicily, and some of the towns of southern Italy. They are also found in Cyprus and Sardinia, where, as to some extent in Rhodes, they follow a peculiar development, under the domination of Phoenician influence, and many of the earlier types have a markedly oriental character. But in the Greek terracottas we may trace a steady development from the primitive types which correspond to the ἔξωάθια of primitive Greek religion, and for the most part represent actual deities, down to the purely genre figures of Tanagra and other Hellenistic products of highly-developed beauty. For beauty and charm the palm has by general consent been given to the Tanagra figures of the 5th century, which are also known as "maiden figures," as κόραι or "maidsens," from the presence of seated or standing types of girls in various attitudes. The makers of these figures were known as κορσάλλατα or κορσαλάτου, and are spoken of in literature, together with their wares, with some contempt.

Manufacture.—The processes employed in the manufacture of terracottas are five in number: (1) the preparation of the clay; (2) moulding; (3) retouching; (4) baking; and (5) colouring and glazing. The last named, though not essential, was almost universal in the earlier or archaic terracottas.

The clay used for the statuettes varies greatly in different localities, and this is an important criterion for distinguishing the different kinds of manufacture. It ranges in colour from a deep red (as in the brick-like terracottas of Naukratis) to a pale buff or drab as in Cyprus, and the fired product is generally softer than that of the painted vases. It was prepared by washing the local clay free from impurities and then adding water in the required quantity. The water was used not only for the clay as such, but also for facilitating the modelling. The modelling was done by hand in the case of the earlier figures, and small objects such as toys and dolls, which are solid; the larger ones were put up into a mass with the fingers, the marks of which may often be seen. Sometimes a base was used, and then the mould became universal, the final touches being given to the figure either with the fingers or with a graving tool. The finer statuettes, such as those of Tanagra and Naukratis, were generally modelled as small groups, and the arms and legs of the figures show traces of very careful retouching. The advantage of moulding was that the "walls" of the figure could be brought to a very regular thickness, obviating the danger of shrinkage in the baking; it also rendered them very light, and permitted great accuracy in detail. A model (σφαίρος) was first made in terracotta with modelling tools, from which the mould (σφαιρός) was taken, also in clay, and wrapped in a piece of linen. This was then baked, with the addition of a lower thickness of mould to which the machine was attached, and in this way the whole was fired. The base was usually left open, and a vent hole was left in the back, which aided the clay to dry and to be re-fired without cracking, and was also used for suspending the figure when finished. The head and arms were usually moulded separately, and attached or luted to the body with soft clay. Greek moulds for statuettes are somewhat rare. There are examples from Aegina, Smyrna, Girgenti and Tarentum; the British Museum has a series from the Orkhomenian site (PI. I. fig. 3). Most of these are for small figures only.

The shrinkage of the clay as it dried permitted the figure to be fired more quickly (from 12 hours to two days) than was possible for retouching. It is obvious, from a glance at any collection of terracottas, that there is a great similarity between the various examples of any one type, and that many are virtually, if not actually, models of each other. This is especially true of the fact that only a limited number of moulds were used, corresponding to the various types. The minute differences between them, which constitute the charming variety found amongst these figures, and prevent monotony even where the type is constant, were obtained by the process of retouching, as well as by varying the pose of the head or limbs, or by differences of attributes and colourings. Actual retouching by a skilled modeler is seldom found except in the finer examples.

The process of baking required great care and attention, for if no allowance were made for the evaporation of moisture, or if too rapid a degree was used, the figures were liable to be disfigured. The clay was exposed against drying too rapidly by preliminary exposure to air and sunshine, while the temperature employed in firing was low even lower than that used for painted vases.

The colouring of the baked statuettes was fairly universal, the chief exceptions being some of the more archaic examples, and many of the small ones. The surface on which the colour was laid was formed by a white slip or engebe of a creamy colour and consistency, with which the whole front of the figure was coated. This when dry became very flaky and has often fallen off, carrying with it the colour they had received. The fewest traces of this treatment with slip. It is very unlikely that this slip-coating was fired at all. On the white slip-facing opaque

1 Clever forgeries of Greek terracotta figures are now being produced both in France and Italy. Admitted copies are also made in Berlin and Vienna, but these are generally so inferior in artistic merit as not to deceive any one who knows the genuine article.
TERRACOTTA

Fig. 1.—ETRUSCAN SARCOPHAGUS, 2nd century B.C.

Fig. 2.—ARCHAIC RELIEF FROM RHODES, about 480 B.C.

Fig. 3.—MOULD FOR TERRACOTTA FIGURE, FROM TARENTUM.
Fig. 4.—Greek Terracotta Statuettes.
1–3, from Tanagra (3rd century B.C.), 4–7, from Rhodes and Sicily (Archaic period).

Fig. 5.—Vase with Terracotta Figures from Southern Italy, 2nd century B.C.

Fig. 6.—Roman Bas-Relief for Mural Decoration.
colours were painted in tempera colours. The colouring was usually conventional, and only aimed at imparting a certain atmosphere perhaps to the drawing. The eyes and the face were often adhered, and the form was built up by the application of the colors. The colors used were as follows: red and black were the most commonly used, the white slip serving for the nude parts and generally also for the ground-work. Blue and red were especially favoured for drapery, as in many of the Tanagra figures; the red was added either to black paint, or to a black ground. Blue was used for the eyes or details of features; yellow (varying to deep brown) for the hair, and also for jewelry. Gilding is rare but was occasionally used for heraldic or military heads, for instance in the Charlesworth collection.

In the imperial period terracottas and those of Cyprus or other centres which adhered to primitive methods, the decorrations in stripes of mat black and red paint applied in a conventional manner to their figures have been found. The types which have been advanced on this subject, some authorities having maintained that their meaning was exclusively religious or mythological, their significance is considerably complicated by the fact that these religious types were afterwards adopted for ordinary human figures symbolizing the life of the deceased beyond the tomb. The gradual change in popular taste from figures of deities to types of the human image, certainly indicates the development of this branch of art, but that the development was affected by religious ideas is more open to doubt. It is more probable that it followed the lines of artistic evolution, and that the continued usage of certain types did not as the result of religious influence less a convention. In fact, the identity of the types, under whatever circumstances they are found, seems to indicate that the significance was given to them by the purchaser, who would decide for himself whether he offered them to some appropriate deity, deposited them in the tomb of some relative, or kept them for use and decoration in his own house.

Types—The earliest beginnings of the statuettes proper show, as might be expected in primitive Greek art, a very limited range of subjects. As in other materials, so also in clay, the female deity reigns supreme. The primitive Helenic type of goddess is characterized by both determinate features, with the board-form $\sigma\nu\iota$, and the column form $\varepsilon\kappa\iota$ or $\varepsilon\sigma\kappa\ion$, both of which we find also in sculpture. The limbs are wanting, or are an imposition. The types are a development of the primitive, and the style of the local vases. Both types are found in Rhodes, but on the mainland of Greece the columnar type died out after the Mycenaean period, and only the board-type remained, being specially popular in Bosporus and at Ephesus. These figures are almost all seated and have the same style as the local vases. This type was adhered to for the bodies of figures even when the head was modelled in a more advanced style of art. The column-type is also well exemplified in the statues which stood and seated goddesses are the two principal types in archaic Greek art (Pl. II. fig. 4), and are widely distributed and of universal popularity; though the conception of the goddess may vary with the locality, the types are almost identical, and the attributes are but slightly varied. A certain proportion of these deities are differentiated as nature-goddesses, either as a nude goddess in a shrine or a seated figure with a child in her lap who may represent her in a more maternal or hispanic aspect (see Melpomene and Terpsichore). Another common archaic type is the funeral mask or bust, hollow at the back, which is found both in central Greece and Rhodes. Being almost always feminine it seems probable that these masks were worn by women at the time of the death of Demeter and Persephone, playing in the tombs the role of protectors against evil influences. We may also mention here the little figurine of a girl. These are often seen in groups of three or four, and joined dolls (μεazoγατρα) which can only have served the purpose of children's toys. In Athens, Melos and Rhodes, many of these have been found in children's graves. The evidence of finds with grave goods shows that they were also used in ordinary life, and many figures of archaic type can be shown from the contents of the tombs in which they are found not to be earlier than the 5th century B.C. The reason for this is probably hieratic. Owing to the religious associations of the types they were continued in use, whereas painted vases and the majority of sculptures of other class were not affected by such considerations. Therefore we are not surprised when we come to the later terracottas of the fine art of the 4th century B.C. to find that the old archaic types are still prominent. But the change in style is also accompanied by a change in conception, and in place of the goddesses now we have the Greek lady—in place of the mythological the genre. The tendency was not to convert a nursing goddess into a mother with her little one, or a Persephone holding a flower into a girl of Tanagra. The change in style is rather in the sense of developing a type rather than a revolution. The figures were still placed in tombs and shrines, though the old associations were less strongly felt.

In order to know what were the characteristics of the best Greek terracottas we might take three types of development: one of these which are limited products, the Tanagra statuettes (Pl. II. fig. 4). Here we have an almost unlimited variety of feminine figures illustrating the daily life of Greek women. In most cases the arms are more or less concealed by the mantle which is drawn closely across the figure, even covering the hands; but many hold a fan, a mirror, a wreath, or a theatrical mask in one hand, while with the other they gather together the tresses of coloured drapery. The lost type is called and the other type or himation, which all without exception wear, formed the typical dress of the Greek matron and girl; and to this was added for outdoor wear a large shady hat. The seated types follow on the female type illustrated above, and are also of a very limited range. From about 350 to 200 B.C., and their inspiration is probably drawn rather from the painting than the sculpture of the period. The terracottas of Etruria in Euboea and and of Myrina in Asia Minor and of Lampsakus in Asia Minor. These figures can be divided into two classes: they are freer from ancient tradition, but tend to degenerate into exaggeration of pose and conception. Here the types are mostly, but not exclusively, goddesses. One form is of particular Eros or Cupid, the one deity who exclusively taught the popular taste in the Helenic age, and in the many representations of whom we see the prototypes of the Pompeian Amorettes; other types are of Apollo, Venus and eros. Moreover, and at some times the Tanagra types are repeated here, as, with varying artistic success, in other parts of the Mediterranean littoral.

Though no Greek site has produced terracottas of such artistic quality as the Tanagran type, the art of terra cotta enjoyed great popularity, either for a comparatively brief period or through the whole history of Greek life. Some of these centres of manufacture have already received mention or less than allusion, but we may briefly call attention to a few others. From Sicily we possess a complete series, from archaic to later times, the earlier being best represented at Selinus, where a great variety of pottery was manufactured. Dionysos and Heracles are also popular types, and at times some of the Tanagra types are repeated here, as, with varying artistic success, in other parts of the Mediterranean littoral.

T erracotta work in relief, apart from definitely architectural examples, is almost limited to two small classes, both belonging to the beginning of the 5th century. These groups, known respectively as "Melian" and "Locrician" reliefs, consist of small plaques, possibly intended to be inserted in the walls of temples or shrines. The subjects of the Locrician reliefs, which relate to the myth and cult of Persephone, seem to indicate that they at least were of a votive character. They occur at Locri in Southern Italy, and similar examples dedicated to Athena have been found at the Acropolis at Athens. The Melian reliefs exhibit a wider scope of scenes of local life, but the figures are often crude and unrefined in character. Some are simple plaques; others have the figures cut out without background, or only the outer contours. They have been found on various Greek sites, the majority in Southern Italy, and belong to the Helenic period (Pl. 11. fig. 5).

There is a class of vases which comes rather under the heading of terracotta than of pottery, from its technical character and general appearance. These are found particularly in Southern Italy, and belong to the Helenic period (Pl. 11. fig. 5). They combine in a marked degree the characteristics of the vase and the statuette, some being vases with moulded reliefs or small figures in relief, while others figures in relief, while others are bowls with figures in relief or moulded. Many of the figures in relief are carefully modelled in vases form, with the addition of mouth, handle, and base. They are often of gigantic size, and do not appear to have served any practical purpose; probably they were made to express a certain mode of taste or to imitate the literary art, and among those moulded are those in the shape of the statuettes, and are often richly coloured. Some have even subjects painted in some permanent process like encaustic.
TERRACOTTA

form usually adopted is that of a spherical vase with a flat handle on the top and three tall mouths.

Etruscan Terracotta. — Some features of terracotta work are characteristic of Etruria, who employed this material both for finer works of art and for more utilitarian purposes. Several ancient writers speak of their preference for clay and their skill in its use, and Pliny, who speaks of the elaborate vases made in the 7th century, and states that the art of modelling in clay was in Etruria. Certainly for their statues the Etruscans appear to have preferred clay for the most delicate and finish. They also used clay in architecture. The Romans employed Etruscan artists to decorate their temples, and the statue of Jupiter on the Capitol was made by Volci a terracotta artist. This was in an elaborate version also of a centaur on the pediment of the temple. For the decoration of temples terracotta remained in use even down to Roman times; these buildings being usually of wood covered with slabs of marble or other material. Some terracotta remains were found in the 1st century in the temple of Diana in the Roman Forum.

Terracotta mural decoration was also largely employed by the Romans for the interior and exterior of their buildings; in the form of slabs ornamented with figures, and for graves. Cicero speaks of fixing the bas-reliefs (types) "on the cornice of his little atrium." These slabs usually measure about 18 by 9 to 12 in., and have nearly all been found in Rome, though some are also from temples in other parts of Rome and various parts of Greece.

Pompeii, it is true, has few examples of terracotta decoration; in the Roman Forum, however, there is a fine frieze of reliefs sculptured in terra-cotta, 160 in. long, which are in the British Museum. A number of other examples have been found at Rome by Charles Towneley, and there is another large collection in the Louvre. Others from the 2nd and 3rd centuries are still in situ on the Capitoline.

These terracotta reliefs were pressed in moulds, as is shown by the frequent repetition of certain subjects with at most only slight differences; moreover the relief is low, the shape and outline of figures was deliberately simplified, and a mould would produce them. They were sometimes retouched before baking, hence the variations. Reliefs entirely modelled are much rarer, but some examples exist, of considerable artistic feeling and the decoration; they are found in the Roman Forum, at Siena, and at Porta Latina in Rome.

The Roman Terracotta Work. — The Romans, who were Tarentines, and who adopted in the 3rd century B.C. the processes of the Etruscans, developed terracotta work in all its aspects and utilized it much more than the Etruscans themselves. The ground was as highly coloured as possible, and there was less use of fire, the clay being used for ornamental work; the figures were still executed in a more or less barbarian way, and to a certain extent the Greeks, and especially the Etruscan artists, had a great influence on its development.

The form of ornament which best exhibits the Etruscan fondness for terracotta as a material for sculpture is the sarcophagus, of which the Romans made a great number of perfectly fine pieces and which are the only sarcophagi of that time which survive. The sarcophagi of the Ist century B.C. are the work of a group of a man and a woman reclining, executed in the round life-size. These figures are undoubtedly genuine native work, and in the obvious inability of the sculptor to achieve success in large scale works; the reliefs of Augustan art is that it is not devoid of dignity and beauty. The figures are purely designed for beauty and the reliefs are painted in tempera, and their use is purely conventional. The figures are not usual characteristics of egg-patterns and the reliefs are painted red, yellow, purple or white, and with an edge of open-work.

The figures are mostly in low relief, grouped with large, flat surfaces between the manner of contemporary Roman art; in the 1st century B.C. terracotta work was by no means confined to the decoration of places. Some terracotta examples are found in the Louvre, and in the Metropolitan Museum, and in the British Museum. The subjects are always those of the ancient art; the subjects are mostly of Roman life and of the reign of Augustus. The reliefs are mostly of the 3rd and 4th centuries, and are executed in a more or less conventional style, and for the sake of economy and proper, more or less conventionalized. The compositions consist either of narrow friezes with rows of Cupids or masks, or groups of two or three figures resembling temple-metopes. The decoration of the whole is that of the 3rd century B.C., and the reliefs are of a more or less barbarian work; the figures are not usually painted red, yellow, purple or white, and with an edge of open-work.

The subjects cover a very wide field. Many are no doubt inspired by well-known works of art; others are closely related to the "New Art" types, including dicing and braziers, and the seasons. Others again, reflecting the spirit of the time, reproduce Egyptian landscapes. Scenes from the circus or arena, or the chariot-race, are found in terracotta. But the images of the most popular are Dionysiac scenes. Satyrs gathering and pressing grapes, and Victory slaying a bull; figures illustrating the legend of Admetus and Alcestis. They are usually painted "in tempera on a white ground, the bright colouring having a very vivid effect.

By far the finest examples of this class are those from Cervetri, where the sarcophagus which belongs to the 3rd century B.C. follow on the same lines. They invariably consist of a rectangular body or coffin with sculptured reliefs on the front and sides, and a flat cover on which rise a figure representing the deceased person. They are usually of small size, measuring not more than 18 by 12 by 2 in.; but some are large enough for a body to lie in at full length. The reliefs are executed in the style of the later Etruscan art, and are often very fine, and sometimes very beautiful. The Roman terracottas of this period are executed in relief, and exhibit the most obvious difference in style from the terracotta of the 4th century, the reliefs are all those of Augustan art; and the conventional, not to say archaic, corresponding to the classicist tendencies of another school of Augustan artists represented by the New Art" reliefs. Both groups find close parallels in the metalwork and pottery of this period, to which date they may therefore be assigned.

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Roman Sculpture in Terracotta. — Few allusions in classical writers indicate that the ancient statues of the Romans were mostly of terracotta, and Pliny notes that even in his day statuettes of clay were still preferred for temples. There are also references to terra-cotta placed on pedestals of buildings such as the Capitol of the Republic, Rome was indebted for these to Etruscan artists, but the style of the figures was probably more Greek than Etruscan. In 493 B.C. Gorgasus and Damophilos of Himera in Sicily, who had exhibited their works at the Olympic games, were presented with the prize to which they were entitled. They were awarded for their "Amuletic type" of medium holding the examples were found among the ruins at Pompeii, having formed the cult-statues of a temple; others were employed for adornment gardens, like the series from Rome known as the "Serapeum," and other series. The most interesting have been found in the Temple of Apollo in the Roman Forum, and in the Temple of Minerva Medica in the Forum. Many of these figures are of considerable size, and were found in the Russian Museum, and in the Louvre. Several were discovered in the Temple of Minerva Medica in the Forum.
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offerings on sacred sites. They were known to the Romans as Sigilla, and were used for religious or funerary purposes, particularly in shrines. Some 200 were found in the poorer quarters of Pompeii, implying that they took the place of the marble and bronze figures which the wealthier inhabitants alone could afford. At the festival of the Lupercalia on February 15th, the Luperci would battlebac and masks were in great demand. Originally these were votive offerings to Saturn, but later the custom degenerated into that of giving them as presents to friends or children, a practice indolent in the instance and of course, with the passing of time was often abused.

The makers of these figures were known as sigillari or sigillatores, and they lived in the Via Sigillaria. Their social position seems to have been rather low, for it is believed that they were chiefly patronized by the lower classes; probably many of them were slaves. The technical processes which they employed were probably those of the Greek craftsmen. Large quantities of them have been found from many places, often on a wooden frame-work known as crux or stipes; but the smaller ones were made from moulds. The range of subjects is much the same as in the later Greek terracottas. At Pompeii genre subjects, such as gladiators, athletes and slaves, and in general there is a preference for portraits and grotesques. On the whole these late works have little artistic merit. Votive figures have been found at Praeneste on the site of the temple of Fortune, and also at Nemi and Gabii.

This industry also extended from Rome to the provinces, and terracotta statuettes of local make have been found even in Britain, and on the Iberian peninsula and in the Rhine district. In northern Italy and in the Rhine district, there were very extensive manufactures of terracotta after the conquest of Julius Caesar in 58 B.C. They were made by local craftsmen for the Roman colonists, with imports from Italy. The city of Ravenna was the centre of manufacture. The district of the Allier was central to France. Pottery has been found at Moulins, as well as in other parts of France, in England, and in the Low Countries. The clay used in these areas is of a peculiar white clay, the technique resembling that of Roman work, but the modelling is heavier and often barbaric. Numerous moulds have also come to light which shows that a great number were manufactured in two pieces, and that these moulds the potters' names have frequently been scratched (to indicate ownership). Names appear on the figures as well as on the moulds, and many of these are of Gaulish origin. The centres of production are those of Pictet, Reims, and Moulins, in the north of west France, and Vindex of the Rhine. The troubles include divinities, genre figures, and animals; among these the pre-eminent type is that of a Nature-Goddess, characterized either as Venus Genetrix or as a Mother with a Child (genetrix, varia genetrix, or genetrix vulga). Both in subject and in artistic character these statuettes appear to have largely been influenced by the Graeco-Egyptian art of Alexandria during the Hellenistic period. They appear to have been used for domestic and funerary purposes and as votive offerings.

After the downfall of the Roman Empire in the west, the artistic use of terracotta was abandoned for many centuries, though, here and there, both in Italy and in the districts that had been once Roman provinces, decorated terracotta work was carried on sporadically. In the time of the Northumbrian kings, and in the eleventh century of its use came during the 14th and 15th centuries, when it was adapted once more to architectural service in the Gothic buildings of northern Italy and of Germany. In Germany the mark of Brandenburg is still to be seen on some of the works, and in England of the marquis of Northampton. England is still the centre of terracotta. The church of St. Catherine in the town of Brandenburg is decorated in the most lavish way with delicate tracery and elaborate string-courses and cornices enriched with foliage all modelled in clay; the town-hall of Brandenburg is another instance of the same use of terracotta. At Tangermunde, the church of St Stephen and other buildings of the beginning of the 15th century are wonderful examples of this method of decoration; the north door of St Stephen's especially being a masterpiece of rich and effective moulding. In northern Italy this use of terracotta was carried to an equal high pitch of perfection. The western façade of the church of St. Mary at Bologna and the Church of the Gesù at Rome are other examples of this use. Bologna and S. Maria delle Grazie in Milan are all striking examples of the extreme splendour of effect that can be obtained by terracotta work. The Certosa near Pavia is a gorgeous specimen of the early work of this kind. There is much use of terracotta in the church of St. Maria della Grazie and S. Maria degli Scalzi, built in 15th century dating from the 14th and 16th centuries, as for example, the rich cornices of the south aisle of S. Maria in Ara Coeli, c. 1300; the front of S. Cosimato in Trastevere, built c. 1490; and the monumental niche, near the Via di Tordino, which dates from the 14th century.

With the revival of terracotta as an adjunct to medieval architecture we find the sculptors of the Italian Renaissance turning to this material, and in the works of Donatello and Querchi, Donatello, and the sculptors of the next generation. For life, spirit, and realistic truth, combined with sculptural breadth, these pieces are masterpieces of invention and manipulation. The portraits of Lorenzo de Medici by Donatello and that by Torrigiano are classic examples of this respect. The use of burnt clay for sculpture has great advantages as that of marble; the soft clay is easily and rapidly moulded into form while the sculptor's thought is fresh in his mind, and parts of the work can be finished and cast at a later stage which can hardly be reproduced in laboriously finished marble.

In the 16th century a more realistic style was introduced, and this was much more in evidence by the end of the century. Many very two groups of this kind were produced by Ambrogio Poppa (Caradosso) for S. Satiro at Milan and by Guido Mazzoni and Begarelli (1479-1558) for churches in Modena. These terracotta figures are mainly in the Italian Renaissance style; but those of Begarelli were enthusiastically admired by Michelangelo. The introduction of enameled reliefs in terracotta which was closely associated with the Florentine sculptor Luca della Robbia and his descendants, is specially treated in the article DELLA ROBBIA (g.v.).

From these two centres the development of architectural terracotta spread over western Europe. The Germans have influenced the work done in the Low Countries and finally in England, where it also met the direct influence of the Italian school due to the invasion of England by Italian artists such as Terrigliano and other Florentines. At Enfield, in London, in the reign of Elizabeth, and Henry VIII. It is only in the eastern and southern counties of England that we find instances of the terracotta work of this period, and much of it is in-English in style (most-autho- rious of these terracottas is that at St. John's College, Cambridge). In Essex possesses the finest examples: such as those to be found in the Manor House at Layer Marney, and at the Church of St. Peter of St. John the Baptist, encircled by a Gothic inscription, which was evidently made at Lyon during the 16th century. The very moulds, though, together with other objects of similar type, was executed at Lyon, while in its robot it is apparent that it was Italian, the style of the modelling is entirely French in character.

France.—At about the same period the Italian modellers or sculptors carried the art into Spain, and many extraordinary works are still extant in various Spanish churches remarkable for their vivid realism and for a too pictorial style which degrades them from their true rank as architectural decoration.

During the 17th and 18th centuries the architectural use of terracotta again fell away owing to the increasing use of marble, but that the art still survived in other forms is shown by the portrait busts of Dwight (17th century), though they were made in stoneware and not in unglazed terracotta; and the charming little statuettes and groups made in Lorraine and the adjacent parts of France. In the 18th century, sculptors employed at some of the pottery factories of the period. It should be mentioned that during the 18th century ordinary clay had fallen into disuse, but the porcelain figures made at Meissen (1709) and at Mochel's factory, and the figures of Mikale and of Poldo, both by the workshop of Albert, have the same form of manufacture, clay and unglazed. We have in England, for example, some very important buildings, such as the Natural History Museum, the Albert

1 The Victoria and Albert Museum has a splendid and representative collection of these Italian terracottas.

This last and most extensive of the works in terracotta executed for the Royal Palace at Madrid during the French Revolution in 1792, but exact drawings of it are still in existence showing all the necessary details.
TERRAMARA (from Ital. terra marina, "marl"), the name given by archaeologists\(^4\) to a type of primitive culture mainly of the early bronze age, but stretching back into the later stone age. This civilization is represented by a number of mounds, formerly thought (e.g. by Venturi) to be sepulchral, but really the remains of human habitations, analogous to shell heaps (q.v.) or kitchen middens. They are found chiefly in north Italy, in the valley of the Po, round Modena, Mantua and Parma. A summary of early results as to these mounds was published by Munro (Lake Dwellings) in 1890, but scientific investigation really began only with the excavation of the terramara at Castellazzo di Fontanellato (province of Parma) in 1889. From this and succeeding investigations certain general conclusions have been reached. The terramara, in spite of local differences, is of typical form; it is a settlement, trapezoidal in form, built upon piles on dry land protected by an earthwork strengthened on the inside by buttresses, and encircled by a wide moat supplied with running water. The east front of these are parallel, and two roads at right angles divide the settlement into four quarters. Outside are one or two cemeteries. Traces of burning which have been found render it probable that, when the refuse throw down among the piles had filled the space, the settlement was burned and a new one built upon the remains. The origin of the terramara type is not definitely ascertained. The most probable inference, however, is that these settlements were not built to avoid the danger of inundation, but represent a survival of the ordinary lake dwellings.

The occupants of the terramara people as compared with their neolithic predecessors may be inferred with comparative certainty. They were parallel, still hunters, but had domesticated animals; they were fairly skilful metallurgists, casting bronze in moulds of stone and clay; they were also agriculturists, cultivating beans, the vine, wheat and flax. According to Prof. W. Ridgeway (Who were the Romans? p. 16; and Early Age of Greece, i. 496) burial was by inhumation; investigation, however, of the cemeteries shows that the bodies were burned and the ashes placed in ossuaries; practically no objects were found in the urns.

Great differences of opinion have arisen as to the origin and ethnographical relations of the terramara folk. Brizio in his *Epoca Preistorica* advances the theory that they were the original Ibero-Ligurians who at some early period took to erecting pile-dwellings. Why they should have done so is difficult to see. Some of the terramare are clearly not built with a view to avoiding inundation, inasmuch as they stand upon hills. The rampart and the moat are for defence against enemies, not against floods, and as Brizio brings in no new invading people till long after the terramara period, it is difficult to see why the Ibero-Ligurians should have abandoned their unprotected hut-settlements and taken to elaborate fortifications.

Pigerini regards the terramara people as an Aryan lake-dwelling people who invaded the north of Italy in two waves from Central Europe (the Danube valley) in the end of the stone age and the beginning of the bronze age, bringing with them the building tradition which led them to erect pile-dwellings on dry land. These people he calls the Italici, to whom he attributes also the culture known as Villanovà (q.v.). This view

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\(^4\)Since the International Congress of Prehistoric Archaeology at Bologna in 1871, when the shortened form *terramara* (plur. *terramari*) was adopted.
is regarded as falling in with discoveries (somewhat incomplete, it is true) in Hungary and Bosnia.

**TERRANOVA**—**TERRISS**

is the seat of the Indiana State Normal School (1870), which had in 1909 a library of about 50,000 volumes, 52 instructors and an average term enrolment of 988 students, and of the Rose Polytechnic Institute, which was founded in 1874 by Chauncey Rose (1794–1877), was opened in 1883, offers courses in mechanical, electrical, civil and chemical engineering and in architecture, and in 1909 had 22 instructors and 214 students. About 4 m. W. of Terre Haute is Mary-of-the-Woods (founded in 1840 by the Sisters of Providence, and chartered in 1846), a school for girls. The Emeline Fairbanks Memorial Library (1882) contained 30,000 volumes in 1910, housed in a building erected in 1903 by Mr Crawford Fairbanks in memory of his mother. Terre Haute's industrial and commercial importance is largely due to its proximity to the valuable coal-fields of Clay, Sullivan, Park, Vermillion, Greene and Vigo counties. The total value of its factory product in 1905 was $29,291,654; both in 1900 and in 1905 it ranked second among the manufacturing cities of the state. It is the largest distilling center, and one of the largest in the country, the value of the output of this industry in 1905 being more than half the total value of the city's factory product for the year. The value of the glass product in 1905 was 4.4 per cent. of the value of all factory products of the city, and 1.6 per cent. of the value of all glass manufactured in the United States.

The first settlers at Terre Haute built their cabins near Fort Harrison, which was erected by command of Governor William Henry Harrison in the winter of 1810–11. In 1812 the fort was successfully defended by the citizens of the Indians by its commander Captain Zachariah Taylor, and in 1817 was abandoned. After the close of the War of 1812 the town grew rapidly and became an important commercial centre, owing to its river connections and to the fact that the National (or Cumberland) Road crossed the Wabash here. Terre Haute was incorporated as a town in 1838, became a city in 1853 (under a general state law of June 1852), received a special city charter in 1899, in 1905 was organized as a city of the third class, and became a city of the second class in 1909.

**TERRELL** a city of Kaufman county, Texas, U.S.A., about 32 m. E. of Dallas, and one of the largest in the country, the value of the output of this industry in 1905 being more than half the total value of the city's factory product for the year. The value of the glass product in 1905 was 4.4 per cent. of the value of all factory products of the city, and 1.6 per cent. of the value of all glass manufactured in the United States.

**TERRISS, WILLIAM** (1847–1897), English actor, whose real name was William Charles James Lewin, was born in London on the 20th of February 1847. After trying the merchant service, medicine, sheep-farming in the Falkland Isles, and tea-planting in Bengal, in 1867 he took to the stage, for which his handsome presence, fine voice and gallant bearing eminently fitted him. His first appearance in London was as Lord Cloudrays in Robertson's *Society*, at the old Prince of Wales's theatre. He quickly came into favour in "hero" parts, and appeared at the principal London theatres from 1868 onwards. In 1880 he joined Irving's company at the Lyceum, playing such parts as Cassio and Mercutio, and in 1885 he acted there with Mary Anderson as Romeo and Juliet, in 1886 to 1887 he then engaged to take the leading parts in Adelphi melodrama, and it was in this capacity that for the rest of his career he was best known, though he occasionally acted elsewhere, notably with Irving at the Lyceum. His last appearance was in *Secret Service*. On the 10th of December 1897, as he was entering the Adelphi theatre, he was stabbed to death by a madman, Richard Arthur Prince. Terriss married Miss Isabel Lewis, and his daughter Ellaline Terriss (Mrs Scymour Hicks) became a well-known actress in musical comedy, in association with
her husband Edward Seymour Hicks (b. 1871), proprietor of the Aldwych and Hicks theatres in London.


**TERRY, EDWARD O'CONNOR** (1844– ), English actor, was born in London, and began his stage career in a small and struggling way in the provinces. Between 1868 and 1875 he was the leading comedian at the Strand theatre, London, but it was not till he joined Hollingshead's company at the Gaiety in 1876 that he became a public favourite in the burlesques produced there during the next eight years. With Nellie Farren and Thorne, he formed the popular trio of Nellie Farren and Thorne. When in 1878 the house, his eccentric acting and singing creating a style which had many imitators. In 1887 he went into management, opening Terry's theatre, where his production of Pinero's *Sweet Lavender* was a great success. But in subsequent years he was only occasionally seen at his own theatre, and made many tours in the provinces and in Australia, America and South Africa. Off the stage he was well known as an ardent Freemason, and an indefatigable member of the councils of many charities and of public institutions.

**ALICIA** (1848– ), English actress, was born at Coventry on the 27th of February 1848. Her parents were well-known provincial actors, and her sisters Kate, Marion and Florence, and her brother Fred, all joined the theatrical profession, and her own first appearance on the stage was made on the 28th of April 1856, under the Kean's management, as the boy Mamillus in *The Winter's Tale*, at the Princess's theatre, London. Two years later she played Prince Arthur in *King John* with such grace as to win high praise. From 1860 to 1863 and again from 1867 to 1868 she acted with various stock companies. During this period she played, on the 26th of December 1869, for the first time with Henry Irving, being cast as Katharine to his Petruchio in Garrick's version of *The Taming of the Shrew* at the Queen's theatre. When quite a girl she married G. F. Watts the painter, but the marriage was soon dissolved. Between 1868 and 1874, having married E. A. Wardell, an actor whose professional name was Charles Kelly, she was again absent from the stage, but she reappeared in leading parts at the Queen's theatre under Charles Reade's management. On the 17th of April 1875 she played Portia for the first time in an elaborate revival of *The Merchant of Venice* under the Bancrofts' management at the old Prince of Wales's theatre. This was followed by a succession of smaller triumphs at the Court theatre, culminating in her beautiful impersonation of Olivia in W. G. Wills's dramatic version of Goldsmith's *Vicar of Wakefield*, in 1878, the result of which was her engagement by Henry Irving as his leading lady for the Lyceum theatre, and the beginning of a long artistic partnership, in the success of which Miss Terry's attractive personality played a large part. Her Shakespearean impersonations at the Lyceum were Ophelia in 1878, Portia in 1879, Desdemona in 1881, Juliet and Beatrice in 1882, Viola in 1884, Lady Macbeth in 1888, Katherine, in *Henry VIII.*, and Cordelia in 1892, Imogen in 1896, and Volumnia, in *Coriolanus*, in 1901. Other notable performances were those of the Queen in Wills's *Charles I.* in 1879, Camma in Tennyson's *The Cup* in 1881, Margaret in Wills's *Faust* in 1885, and the title-part in Charles Reade's one-act play *Nance Oldfield* (1893), Rosamund in Tennyson's *Becket* (1893), Madame Sans-Gêne in Sardou's play (1897), and Carlisse in *Robespierre* (1898). With the Lyceum company she several times visited the United States. In 1902, while still acting with Sir Henry Irving, she appeared with Mrs Kendal in Beerbohm Tree's revival of *The Merry Wives of Windsor*, at His Majesty's theatre, and she continued, after Sir Henry Irving's death, to act at different theatres, notably at the Court theatre (1905) in some of G. Bernard Shaw's plays. In 1906 her stage-jubilee was celebrated in London with much enthusiasm, a popular subscription in England and America resulting in some £800 being raised. In 1907 Miss Terry married James Carew, an American actor.

Her sister Marion Terry (b. 1850) became only less distinguished on the English stage than herself; and her brother Fred Terry (b. 1865) also became a leading actor, and a successful manager in association with his wife, the actress Julia Neilson.

See Charles Hiatt, *Ellen Terry and her Impersonations* (1898); Clement Scott, *Ellen Terry.*

**TERSTEEGEN, GERHARD** (1667-1769), German religious writer, was born on the 25th of November 1667, at Mörs, at that time the capital of a countship belonging to the house of Orange-Nassau (it fell to Prussia in 1702), which formed a Protestant enclave in the midst of a Catholic country. After an academic career at the gymnasium of his native town, Tersteegen was for some years apprenticed to a merchant. He soon came under the influence of Wilhelm Hoffman, a pietistic revivalist, and devoted himself to writing and public speaking, withdrawing in 1728 from all secular pursuits and giving himself entirely to religious work. His writings include a collection of hymns (*Das geistliche Blumengärtlein*, 1729; new edition, Stuttgart, 1868), a volume of *Gebeite*, and another of *Briefe*, besides translations of the writings of the French mystics. He died at Mühlheim in Westphalia on the 3rd of April 1769.


**TERTIARIES** (Lat. *tertiiarii*, from *tertius*, third), associations of lay folk in connexion with the Mendicant Orders. The old monastic orders had had attached to their abbeys confraternities of lay men and women, going back in some cases to the 8th century. The Confraternity Book of Durham is extant and embraces some 20,000 names in the course of eight centuries. Emperors and kings and the most illustrious men in church and state were commonly confraters of one or other of the great Benedictine abbeys. (On this subject see article by Edmund Louis Bevan in *Downside Review*, 1886.) The confraters and consores were, made partakers in all the religious exercises and other good works of the community to which they were affiliated, and they were expected in return to protect and forward its interests; but they were not called upon to follow any special rule of life.

Although something of the kind existed among the Humiliati in the 12th century, the institution of Tertiaries arose out of the Franciscan movement. It seems to be certain that St Francis at the beginning had no intention of forming his disciples into an Order, but only of making a great brotherhood of all those who were prepared to carry out in their lives certain of the greater and more arduous of the maxims of the Gospel. The formation of the Franciscan Order was necessitated by the success of the movement and the wonderful rapidity with which it spread. When the immediate disciples of the saint had become an order bound by the religious vows, it became necessary to provide for the great body of laity, married men and women, who could not leave the world or abandon their avocations, but still were part of the Franciscan movement and desired to carry out in their lives its spirit and teaching. And so probably in 1221 St Francis drew up a Rule for those of his followers who were beheaded from being members of the order of Friars Minor. At first they were called "Brothers and Sisters of the Order of Penance"; but later on, when the Friars were called the "First Order" and the nuns the "Second Order," the Order of Penance became the "Third Order of St Francis"—whence the name Tertiaries: this threefold division already existed among the Humiliati.

In 1901 Paul Sabatier published a "Rule of Life of the Brothers and Sisters of Penance," which probably contains, with additions, the substance of the original Rule of 1221. It prescribes severe simplicity of dress and of life, and certain abstinences and prayers and other religious exercises, and forbids the frequentation of the theatre, the bearing of arms and the taking of oaths except when administered by magistrates. In 1289 Nicholas IV. approved the Third Order by a Bull, but made some alterations in the Rule, and this form of the Rule remained in force until our own day.

Immediately on its establishment in 1221 the Third Order
TERTIARY—TERTULLIAN

spread with incredible rapidity all over Italy and throughout western Europe, and embraced multitudes of men and women of all ranks from highest to lowest. Everywhere it was connected closely with the First Order, and was under the control of the Frisians Minor.

In time a tendency set in for members of the Third Order to live together in community, and in this way congregations were founded which in the usual course of things grew into a fully organized religious life based on the Rule of the Third Order with supplementary regulations. These congregations are the "Regular Tertiaries" as distinguished from the "Secular Tertiaries," who lived in the world, according to the original idea. The Regular Tertiaries are in the full technical sense "religious," and there have been, and are, many congregations of them, both of men and of women.

There can be little doubt, whatever counter claims may be set up, that the Third Order was one of St. Francis' creations, and that his Third Order was the exemplar after which the others were fashioned; but at an early date one of the ancient orders formed Third Orders on the same lines, and so there came into being Dominican Tertiaries, and Carmelite, and Augustinian, and Servite, and also Premonstratensian and many others. These followed the same lines of development as the Franciscan Tertiaries, and for the most part divided into the two branches of regular and secular Tertiaries. The Rules of the various Third Orders have proved very adaptable to the needs of modern congregations devoted to active works of charity; and so a great number of teaching and nursing congregations of the Third Order have been founded, and it received a great impetus and a renewed vogue from Leo XIII., who in 1883 caused the Rule to be recast and made more suitable for the requirements of devout men and women at the present day. In consequence it is estimated that the number of lay Franciscan Tertiaries now exceeds two millions.

BIBLIOGRAPHY.—The most serviceable authority on the Franciscan Tertiaries is probably Max Heimbucher, Orden und Kongregationen (1907), lii. §§ 103, 104, 105, where an ample bibliography is supplied. The same work gives information on the other Tertiaries at the end of the sections on the various Orders. Similarly information will be found in Tertiaries of the provinces of the different Orders. Heimbucher names Tachy, Les Tiers Ordres (1897), and Adderley and Marson, Third Orders (1917) (E. C. B.)

TERTIARY, in geology, the time-division which includes the Eocene, Oligocene, Miocene and Pliocene periods, in other words, it is the earlier portion of the Cainozoic era. By some authorities the term Tertiary is made to embrace in addition to the foregoing periods those of the Quaternary (Pleistocene and Holocene), i.e. "Tertiary" is made the equivalent of Cainozoic. On logical grounds there is much in favour of this interpretation; but having in view the 'state of geological literature, it is certainly better to restrict the use of the term in the manner indicated above. Tertiary rocks were among the latest to receive the careful attention of geologists, and the name was introduced by G. Cuvier and H. Brongniart in 1810 (Essai sur la geographie stratigraphique des environs de Paris, 1810-11, 1st ed.).

Deshayes (1839) worked out the percentages of recent fossils found at several horizons in those strata, and upon this Sir C. Lyell (1832) founded the main periods, viz. the Eocene with 31 per cent. of recent forms, the Miocene 17 per cent., the Pliocene 35 to 59 per cent. Subsequent investigations naturally modified the numerical values upon which this nomenclature was based, but without altering the order of the periods. Later, E. Beyrich introduced the Oligocene period, and some geologists recognize a Palaeogen or earlier period. European geologists very generally use the grouping adopted by R. Hörnes:—


The great number and variety of mammalian remains has made it possible for the Tertiary rocks to be classified by their means:—we may say, Les encacllements des mammifères—les Tertiaries (1857), by J. B. de C. Quenstel; Q. Geo. Soc. Lond. (1860); Forsyth Major, Geol. Mag. (London, 1889); and H. F. Osborn, J. L. Wortman, G. F. Matthew, for western North America, Bull. Am. Mus. Nat. Hist., xii. (1899).

During the Tertiary era the geographical configuration of the globe was steadily approaching that of the present day; but in part of the time there still existed the great equatorial ocean "Tethys," and in the present level of the sea, the world of the Pliocene ("Tethys") the crust began to be folded up, giving rise to the Alps, Carpathians, Caucasus, Himalayas and other mountains, some of the early Tertiary marine formations being now found raised more than 100 fathoms above the modern level. In the seas, bony fish and crab-like decapods increased in numbers and variety; while pelagics and gastropods took the prominent place previously occupied by ammonites and belemnites, and, leaving behind such forms as Rusistes, Mecoceras, etc., they generally developed in the direction of the modern regional groups. In the plant world, the dicotyledonous angiosperms generally assumed the leading rôle which they occupy to-day.

The climate in northern latitudes seems to have passed from temperate to sub-tropical, with minor fluctuations, until at the close a rapid lowering of temperature ushered in the glacial period (J. A. H.).

TERTULLIAN (c. 155-c. 222), whose full name was QUINTUS SEPTIMIUS FLORENS TERTULLIANUS, is the earliest and after Augustine the greatest of the ancient church writers of the West. Before him the whole Christian literature of the Latin language consisted of a translation of the Bible, the Octavians of Minucius Felix (q.v.—an apologetic treatise written in the Ciceronian style for the higher circles of society, and with no evident effect for the church as a whole, the brief Acts of the Scillitan martyrs, and a list of the books recognized as canonical (the so-called Muratorian fragment). Whether Victor the Roman bishop and Apollonius the Roman senator ever really made an appearance as Latin authors is quite uncertain. Tertullian in fact created Christian Latin literature; one might almost say that that literature sprang from him full-grown, alike in form and substance, as Athena from the head of Zeus. Cyprian polished the language that Tertullian had made, sifted the thoughts he had given out, rounded them off, and turned them into current coin, but he never ceased to be aware of his dependence on Tertullian, whom he designated as kai 'Egwy, his master (Jér., De vir. ill. 53). Augustine, again, stood on the shoulders of Tertullian and Cyprian; and these three North Africans are the fathers of the Western churches.

Tertullian's place in universal history is determined by (1) his intellectual and spiritual endowments, (2) his moral force as a personal figure, (3) the course of his personal development, (4) the circumstances of the time in the midst of which he worked.

(1) Tertullian was a man of great originality and genius, characterized by the deepest pathos, the liveliest fancy, and the most penetrating keenness, and was endowed with ability to appropriate and make use of all the methods of observation and speculation, and with the readiest wit. His writings in tone and character are always alike "rich in thought and destitute of form, passionate and hair-splitting, eloquent and pithy in expression, energetic and condensed to the point of obscurity. His style had been characterized with justice as dark and resplendent like ebony. His eloquence was a vehement order; but it wins hearers and readers by the strength of his passion, the energy of its truth, the pregnancy and elegance of its expression, just as much as it repels them by its heat without light, its sophistical arguments, and its elaborate hair-splittings. Though he is wanting in moderation and in luminous warmth, his tones are by no means always harsh; and as an author he ever aspired with longing after humility and love and patience, though his whole life was lived in the atmosphere of conflict. Tertullian both as a man and as a writer had much in common with the apostle Paul.

(2) In spite of all the contradictions in which, he involved
himself as a thinker and as a teacher, Tertullian was a compact ethical personality. What he was he was with his whole being. Once a Christian, he was determined to be so with all his soul, and to shape himself to love all things divine and philosophical with the world. It is not difficult to lay one's finger upon many obliquities, self-deceptions and sophisms in Tertullian in matters of detail, for he struggled for years to reconcile things that were in themselves irreconcilable; yet in each case the perversities and sophisms were rather the outcome of the peculiarly difficult circumstances in which he stood. It is easy to convict him of having failed to control the glowing passion that was in him. He is often outrageously unjust in the substance of what he says, and in manner harsh to cynicism, scornful to grumeterners. He was in no battle that he forsook, was ever actuated by selfish interests. What he did was really done for the Gospel, as he understood it, with all the faculties of his soul. But he understood the Gospel as being primarily an assured hope and a holy law, as fear of the Judge who can cast into hell and as an inflexible rule of faith and of discipline. Of the glorious liberty of the children of God he had nothing but a mere presentiment; he looked for it only in the world beyond the grave, and under the power of the Gospel he counted as loss all the world could give. He well understood the meaning of Christ's saying that He came not into the world to please men, but to be reviled. Whence, when he had introduced into the church that conformity to the world which had seized the churches he maintained the "vigor evangelicus" not merely against the Gnostics but against opportunists and a worldly-wise clergy. Among all the fathers of the first three centuries Tertullian has given the most powerful expression to the terrible earnestness of the Gospel.

(3) The course of Tertullian's personal development fitted him in an altogether remarkable degree to be a teacher of the church. Born at Carthage of good family—his father was a "centurio pro consularis"—he received a first-rate education both in Latin and Greek. He was also a man of the world, and gives evidence of familiarity alike with its prose and with its poetry; and his excellent memory—though he himself complains about it—enabled him always to bring in at the right place an appropriate, often brilliant, quotation or some historical allusion. The old historians, from Herodotus to Tacitus, were familiar to him, and the accuracy of his historical knowledge is astonishing. He studied with earnest zeal the Greek philosophers; Plato in particular, and the writings of the Stoics, he had fully at command, and his treatise De Anima shows that he himself was able to investigate and discuss philosophical problems. From the philosophers he had been led to the medical writers, whose treatises plainly had a place in his working library. But no portion of this rich store of miscellaneous knowledge has left its characteristic impress on his writings; this influence was reserved for his legal training. His father, whose military spirit reveals itself in the whole bearing of Tertullian, to whom Christianity was above everything a "milicia," had intended him for the law. He studied in Carthage, probably also in Rome, where, according to Eusebius, he enjoyed the reputation of being one of the most eminent jurists of the time. This statement derives confirmation from the Digest, where references are made to two works, De Castroini Peculio et Quaestionum Libri VIII., of a Roman jurist named Tertullian, who must have flourished about 180 A.D. In point of fact the quondam advocate never disappeared in the Christian presbytery. This was at once his strength and his weakness: his strength, for as a professional pleader he had learned how to deal with an adversary according to the rules of the art—to pull to pieces his theses, to reduce him ad absurdum, and to show the defects and contradictions of his statements,—and was specially qualified to expose the irregularities in a lawsuit taken by the state against the Christians; but it was also his weakness, for it was responsible for his litigiousness, his often doubtful shifts and artifices, his sophisms and argumentationes ad hominem, his fallacies and surprises. At Rome in mature manhood Tertullian became a Christian, under what circumstances we do not know, and forthwith he bent himself with all his energy to the study of Scripture and of Christian literature. Not only was he master of the contents of the Bible: he also read carefully the works of Herma, Justin, Tatian, Melitides, Minucius, Irenaeus, Tertullian, Chrysostom, as well as many Gnostic treatises, the writings of Marcin in particular. In apologetics his principal master was Justin, and in theology proper and in the controversy with the Gnostics, Irenaeus. As a thinker he was not original, and even as a theologian he has produced but few schemes of doctrine, except his doctrine of sin. His special gift lay in the power to make what had been traditionally received impressive, to give it to its proper form, and to gain for it new currency. From Rome Tertullian visited Greece and perhaps also Asia Minor; at any rate we know that he had temporary relations with the churches there. He was consequently placed in a position in which he could check the doctrine and practice of the Roman church. Thus equipped with knowledge and experience, he returned to Carthage and there laid the foundation of Latin Christian literature. At first, after his conversion, he wrote Greek, but by and by Latin almost exclusively. The elements of this Christian Latin language may be enumerated as follows:—(i.) it had its origin, not in the literary language of Rome as developed by Cicero, but in the language of the people as we find it in Plautus and Terence. (ii.) it has an authority derived by Greek, particularly through the Latin translation of the Septuagint and of the New Testament, besides being sprinkled with a large number of Greek words derived from the Scriptures or from the Greek liturgies; (iv.) it bears the stamp of the Gnostic style and contains also some military expressions; (v.) it owes something to the original creative power of Tertullian. As for his theology, its leading factors were: (i.) the teachings of the apologists; (ii.) the philosophy of the Stoics; (iii.) the rule of faith, interpreted in an anti-Gnostic sense, as he had received it from the Church of Rome; (iv.) the Soteriological theology of the Council of Nice; and (v.) the Montanist prophets (in the closing decades of his life). This analysis does not disclose, nor indeed is it possible to discover, what was the determining element for Tertullian; in fact he was under the dominion of more than one ruling principle, and he felt himself bound by several mutually opposing authorities. It was his desire to unite the enthusiasm of primitive Christianity with intelligent thought, the original demands of the Gospel with every letter of the Scriptures and with the practice of the Roman church, the sayings of the Paraclete with the authority of the church, the law of the Gospel with the law of the Montanist with all the utterances of the New Testament and with the arrangements of a church seeking to set itself up within the world. At this task he toiled for years, involved in contradictions which it took all the finished skill of the jurist to conceal from him for a time. At last he felt compelled to break off from the church for which he had lived and fought; but the breach could not clear him from the contradictions in which he found himself entangled. Not only did the great chasm between the old Christianity, to which his soul clung, and the Christianity of the Scriptures as juristically and philosophically interpreted remain unbridged; he also clung fast, in spite of his separation from the Catholic church, to his position that the church possesses the true doctrine, that the bishops per successionem are the repositories of the grace of the teaching office, and so forth. The growing violence of his latest works is to be accounted for, not only by his burning indignation against the ever-advancing secularization of the Catholic church, but also by the incompatibility between the authorities which he recognized and yet was not able to reconcile. After having done battle with heathens, Jews, Montanists, Gnostics, Monarchians, and the Catholics, he died an old man, carrying with him to the grave the last remains of primitive Christianity in the West, but at the same time in conflict with himself.

(4) What has just been said brings out very clearly how important in their bearing on Tertullian's development were the circumstances of the age in which he laboured. His activity
Respecting its relation to the Octavius of Minucius Felix much has been written; to the present writer it seems unquestionable that Tertullian’s work was De spectaculis, see his De spectaculis haereticorum, in which the jurist is more clearly heard than the Christian. It is the chief of the dogmatic or theological works, and Tertullian does not use it as much more tolerant than his latter. To learn something of his Christian temper we must read the De oratione and the De patre.

2. Tertullianus, De spectaculis haereticorum, is of special interest from the archaeological point of view.

II. Works written between 202–203 and 207–208.—De virginibus velandis, De corona militis, De juxta persecutione, De exhortatione presbyterorum, De spectaculis haereticorum, De spectaculis. In his De spectaculis he compares to scorpions; it is written in praise of martyrdom.

Adversus Heresem, De censu animae adv. Heresem (lost), Adv. Valentinianos, Adv. Apelleias (lost), De paradiso (lost), De jure (lost), De anima (the first book on Christian psychology), De carnis Christi, De resurrectione carnis, and De spe fideliem (lost), were all written after Tertullian had the prophetic claim of the Montanists, but before he had left the church.

III. Works later than 207–208.—To this period belong the five books Adv. Marcionem, his main anti-Gnostic work (in the second form—the first of the five was written in 207–208), Ad Scapulam (190), De spectaculis (190), De spectaculis haereticorum, De spectaculis, and two praescriptione; we also know that he became a presbyter in Carthage and was married. His recognition of the Montanist prophecy in Phrygia as a work of God to which all others who suffered and died for the church was the doctrine of his conversion to Christianity is quite certain; there is much in favour of the years between 190 and 195. How long he remained in Rome after becoming a Christian, whether he had any influence on the church, and where he was when the event of his conversion happened, is a problem yet unsolved. The date of his visit to Greece—on these points also we remain in ignorance. It is certain that he was settled in Carthage in the second half of 197, the date of his writing his Apologiae and (shortly after) his other works. We also know that he became a presbyter in Carthage and was married.

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the Tagus (q.v.); the Guadalaviar, which rises in the Montes Universales and flows south-east to enter the Mediterranean at Valencia; the Jıloca, which flows north from the lake of Cellla to join the Jalón at Calatayud; the Guadalo, Martin and Matarraña, tributaries of the Ebro.

Notwithstanding the fertile character of the plains and the abundance of mineral wealth, the trade of the province is unimportant and civilization in a backward state, owing to the lack of means of transport, want of enterprise and imperfect communication with the outer world. Much land is devoted to pasture that could be cultivated. Extensive forests with fine timber are neglected, as are some important coal beds in the eastern districts. The chief products are corn, wine, oil, cheese, fruits, timber, flax, hemp, silk, wool and saffron, together with cattle, sheep and swine; while in the busier centres some slight manufacture of coarse cloth, paper, leather, soap, pottery and esparto goods is carried on. The road from Murviedro, on the Gulf of Valencia, to Calatayud.

TERUEL, the capital of the Spanish province of Teruel; on the left bank of the river Guadalaviar, at its confluence with the Alfamba, and on the Murviedro-Calatayud railway. Pop. (1900) 10,797. The older part of Teruel is a walled city with narrow gloomy streets and crumbling medieval houses, but modern suburbs have been built outside the walls. Some of the numerous churches are worth seeing, with their paintings by the 17th-century artist Antonio Visquert. In the cloisters of San Pedro lie the remains of the celebrated “lovers of Teruel,” Juan de Marcilla and Isabella de Seguca, who lived in the 13th century and whose pathetic story has formed the subject of many songs and romances. The place is called Terz de Salas, Hartzenbusch and others. The cathedral dates from the 13th century. The great aqueduct of 140 arches was erected in 1555-60 by Pierre Bedel, a French architect. Teruel has several good hospitals and asylums for the aged and children, an institute, a training school for teachers, primary schools, a public library, an atheneum, a meteorological station, and a large prison. The see was created in 1577, and forms part of the archiepiscopal province of Saragossa.

TERUVEREN, a small town in Belgium in the province of Brabant, midway between Brussels and Louvain. Pop. (1904) 4017. It contained an ancient abbey and a hunting château belonging to the dukes of Brabant. The fine park of Teruveren is really part of the forest of Soignes. The Colonial Museum and World’s Colonial School are established here, and Teruveren is connected with Brussels by a fine broad avenue, traversed by an electric tramway as well as by carriage and other roads, and between 6 and 7 m. in length.

TERZA RIMA, or “third rhyme,” a form of verse adapted from the Italian poets of the 13th century. Its origin has been attributed by some to the three-lined ritornel, which was an early Italian form of popular poetry, and by others to the sirventes of the Provencal troubadours. The sorventese incatenato of the latter was an arrangement of triple rhymes, and unquestionably appears to have a relation with terza rima; this connexion becomes almost a certainty when we consider the admiration expressed by the Tuscan poets of the 13th century for the metrical inventions of their forerunners, the Provençals. In Italian, a stanza of terza rima consists of three lines of eleven syllables, linked with the next stanza, and with the next, and so on, by a recurrence of rhymes; thus abs, bcd, ded, &c., so that, however long the poem is, it can be divided nowhere without severing the continuity of the rhyme. Schuchardt has developed an ingenious theory that these successive terzines are really chains of ritornel, just as ottava rima, according to the same theory, is a chain of rispetti. There were, unquestionably, chains of interwoven triple rhymed lines before the days of Dante, but it was certainly he who raised terza rima from the category of folk-verse, and gave it artistic character. What this character is may best be seen by an examination of the austere and majestic lines with which the Inferno opens, no more perfect example of terza rima having ever been composed:—

"Nel mezzo del camin di nostra vita
Mi retrovai per una selva oscura,
Che la diritta via era smarrita.
Ahi quanta a dir qual’era cosa dura!
Questà selva selvaggia ed aspra e forte,
Chè nel pensier rinnova la pauri!"

It is impossible, however, to break off here, since there is no rhyme to forte, which has to be supplicd twice in the succeeding terzina, whereby rhyme schemes are introduced, linking the whole to a still further terzina, and so on, indefinitely. The only way in which a poem in terza rima can be closed is by abandoning a rhyme, as at the end of Canto i of the Inferno, where no third rhyme is supplied to Pietro and dietro. Boccaccio wrote terza rima in close following of Dante, but it has not been a form very frequently adopted by Italian poets. Nor has the extreme difficulty of sustaining dignity and force in these complicated chains of verse made writers in other languages very anxious to adventure on terza rima. In the age of Elizabeth, Samuel Daniel employed it in his "Episoc to the Countess of Bedford," but he found no followers. Probably the most successfully sustained poem in terza rima in the English language is Mrs Browning’s Casa Guidi Windows (1851). The Germans have always had an ambition to write in terza rima. It was used by Paul Schele, a writer of whom little is known, before the close of the 16th century, and repeatedly by Martin Opitz (1597-1639), who called the form dritreime. Two centuries and a half later, W. Schlegel had the courage to translate Dante in the metre of the Italian; and it was used for original poems by Chamisso and Rückert. Goethe, in 1826, addressed a poem in terza rima to the praise of Schiller, but there is a possible in this metre at the beginning of the second part of Faust.

See Hugo Schuchardt, Ritournell und Terzine (Halle, 1875).

TESCHEN (Czech, Těšín; Polish, Cieszyn), a town in Austria, in Silesia, 50 m. E. of Troppau by rail. Pop. (1900) 19,142, of which over half is German, 43 per cent. Polish and the remainder Czech. It is situated on the Olsa, a tributary of the Oder, and combines both Polish and German peculiarities in the style of its buildings. The only relic of the ancient castle is a square tower dating from the 15th century. There are several furniture factories and large saw-mills.

Teschin is an old town and was the capital of the duchy of Teschin. It was at Teschen that Maria Theresa and Frederick II. signed, in May 1779, the Peace, which put an end to the war of Bavarian succession. The duchy of Teschen comprises Upper Silesia, and since 1919 it stood under the suzerainty of Bohemia. It became a direct anappage of the Bohemian crown in 1625 at the extinction of the male line of its dukedom, and since 1767 it has borne the name of Count of Teschen. Under the taxing of his eldest son, and, at his death, in 1805 it passed into the hands of his nephew, the Archduke Frederick.

TESSELLATED (Lat. tessellatus), formed of tessellae, or small tesserae, cubes from half an inch to an inch square like dice, of pottery, stone, marble, enamel, &c. (See Pavement and Mosaic.)

TESSIN, CARL GUSTAF, Count (1695-1770), Swedish statesman, son of a great architect, Nicodemus Tessin, began his public career in 1723, at which time he was a member of the Holstein faction. In 1725 he was appointed ambassador at Vienna, and it is said that he counteracted the plans of the Swedish chancellor, Count Arvid Horn, who was for acceding to the Hanoverian Alliance. During the riksag 1726-27 and 1731 he fiercely opposed the government, and his wit, eloquence and imposing presence made him one of the foremost protagonists of the party subsequently known as "The Hats" (see Sweden: History). From 1735 to 1736 he was again Swedish ambassador at Vienna. During the riksag 1738 he was elected marshal of the diet and contributed more than anyone else to overthrow the Horn administration the same year. On the division of the spoil of patronage he chose for himself the post of ambassador extraordinary at Paris, and from 1739 to...
TEST ACTS

1743 delighted Versailles with his brilliant qualities of grand seigneur, at the same time renewing the traditional alliance between France and Sweden which had been interrupted for more than sixty years. His political ability, however, was by no means commensurate with his splendid social qualities. It was his sanguine credulity which committed the "Hats" to their rash and unprecedented war with Russia in 1741-42, though in fairness it must be added that Tessin helped them out of their difficulties again by his adroitness as a party leader and his stirring eloquence. He gained his arm-chair in the senate as a reward for his services on this occasion. In 1743 Tessin composed the long outstanding differences between Sweden and Denmark in a special mission to Copenhagen. In the winter he kept the hounds at an extended residence to Berlin to escort to Stockholm Frederick the Great's sister, Louisa Ulrica, the chosen bride of the Swedish crown-prince, Adolphus Frederick. As overhofmarskyl of the young court, Tessin speedily captivated the royal pair. He also succeeded in withdrawing the crown-prince from beneath the influence of the Russian empress Elizabeth, to whom Adolphus Frederick owed his throne when he became king of Sweden in 1713, thereby essentially contributing to the maintenance of the independence of Sweden. From 1746 to 1752 Tessin presided over the Royal Academy, and as a matter of fact the minister was called in those days His "system" aimed at a rospromotion with Denmark with the view of counterbalancing the influence of Russia in the north. It was a dignified and prudent policy, but his endeavour to consolidate it by promoting a matrimonial alliance between the two courts alienated the Swedish crown-prince, who, as a Holstein, nourished an ineradicable hatred of everything Danish. As, moreover, on the accession of Adolphus Frederick in 1751, Tessin refused to countenance any extension of the royal prerogative, the rupture between him and the severe penalties imposed on him by the occasion of the coronation (1752) he resigned the premiership, and in 1754 the governorship of the young crown-prince Gustavus also, spending the rest of his days at his estate at Åkerö. Tessin was one of the most brilliant personages of his day, and the most prominent representative of French culture in Sweden. He was also a fine orator, and his literary style is excellent.

His principal works are his autobiographical fragments (1st ed. Stockholm, 1809) and his Frälsningsrecensionen, 3 vols. (Stockholm, 1822), both of them extracts from his voluminous MS. memoirs in 29 volumes; and his famous En gammal mans bref til en ung Prins (Stockholm, 1753; English edition, 1755 and 1759), addressed to his pupil, afterwards Gustavus III., one of the most delightful books for the young that ever saw the light.

See R. Nisbet Bain, Gustavus III. and his Contemporaries (London, 1895), vol. 1; Bernhard von Beskow, Minne of Griefe K. G. Tessin (Stockholm, 1886) and Bernhard Elis Malmskog, Sveriges publika historia från Konung Karl XIII.'s död till statsflykningen, 1772 (Stockholm, 1893-1901).

TEST ACTS. The principle that none but persons professing the established religion were eligible for public employment was adopted by the legislatures of both England and Scotland soon after the Reformation. In England the Acts of Supremacy and Uniformity, 1558, were a notable instance of this principle. The Scottish Test Act was 1681, c. 6, rescinded by 1690, c. 7. Re-nunciation of popery was to be made by persons employed in education (1708, c. 3). A motion to add, after the 18th article of the 1709 Act, the words: "and the saecular as well as the spiritual offices of the United Kingdom were negatived by the Scottish parliament. A similar fate awaited a proposal that while a sacramental test was in force in England all persons in public office in Scotland should subscribe their adhesion to the Presbyterian Church government. By 1707, c. 6, all professors, principals, regents, masters or others bearing office in any university, college or school in Scotland were to profess full subscription to the Confession of Faith. All persons were to be free of any oath or test contrary to or inconsistent with the Protestant religion and Presbyterian Church government. The reception of the communion was never a part of the test in Scotland as in England and Ireland. The necessity for subscription to the Confession of Faith by persons holding a university office (other than that of principal or professor of theology) was removed by 16 & 17 Vict. c. 89. The act provided that in place of subscription every person appointed to a university office was to subscribe a declaration according to the form in the act, promising not to teach any opinions opposed to the divine authority of Scripture or to the Doctrines and Covenants of the Presbyterian Church of Scotland or its doctrines and privileges. All tests were finally abolished by an act of 1889 (52 & 53 Vict. c. 59). Ireland.—An oath of allegiance was required by the Irish Act of Supremacy (o Eliz. c. 1). The English Act of 1712 (Will. & M. c. 2) substituted other oaths and enforced in addition on peers, members of the House of Commons, bishops, baronets, attorneys and others a declaration against transubstantiation, invocation of the Virgin Mary and the saints, and the sacrifice of the mass—a special exception being made in favour of the duke of York. The provisions of the Test Act were violated in 1742 by the late James II., and the Earl of Derwentwater's declaration against transubstantiation, &c., were repealed by the Roman Catholic Relief Act of 1829 (10 Geo. IV. c. 7). This general repeal has been followed by the special repeal of the Corporation Act by the Promissory Oaths Act 1871, of the Test Act by the Statute Law Revisio Act 1863, and of the act of 1678 by an act of 1866 (29 & 30 Vict. c. 19). Religious tests remained in the English universities until 1871, in Dublin University until 1873, and the Scottish universities until 1889. To be a member of the Church of England was a necessary condition of holding any public or university college offices by the Act of Uniformity of 1662, and such official appointments were abolished by the Toleration Act of 1688 and the Roman Catholic Relief Act of 1829. In 1871 the University Tests Act abolished subscriptions to the articles of the Church of England, all declarations and oaths respecting religious belief, and all compulsory attendance at public worship in the universities of Oxford, Cambridge and Durham. There is an exception confining to persons in holy orders of the Church of England degrees in divinity and positions restricted to persons in holy orders, such as the divinity and Hebrew professorships.

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...author addresses two Messianic hymns. The writer already sees the Messianic kingdom established, under the sway of which the Gentiles will in due course be saved, Beliar overthrown, sin disappear from the earth, and the righteous dead rise to share in the blessedness of the living. Alas for the vanity of man's judgment and man's preciosity! Our book had hardly been published, when Hyrcanus, owing to an injury done him by the Pharisees, broke with their party, and, joining the Sadducees, died a year or two later. His successors proved themselves the basest of men. Their infamy is painted in lurid colours by contemporary writers of the 1st century b.c., and by a strange irony the work, or, rather, fragments of the work of one of these assailants of the later Maccabees, has achieved immortality by finding a covert in the chief manifesto that was issued on behalf of one of the earlier members of that dynasty. This second writer singles out three of the Maccabean priest kings for attack, the first of whom he charges with every abomination; the people itself, he declares, is apostate, and chastisement will follow speedily—the temple will be laid waste, the nation carried afresh into captivity, whence, on their repentance, God will restore them again to their own land, where they shall enjoy the blessedness of God's presence and be ruled by a Messiah sprung from Judah. When we contrast the expectations of the original writer and the actual events that followed, it would seem that the chief value of his work would consist in the light that it throws on this obscure and temporary religion, in which the Christian expectations of the world were born and developed to the close of the 2nd century. But this is not so. The main, the overwhelming value of the book lies not in this province, but in its ethical teaching, which has achieved a real immortality by influencing the thought and dictions of the writers of the New Testament, and even those of our Lord. This ethical teaching, which is indefinitely higher and purer than that of the Old Testament, is yet its true spiritual child, and helps to bridge the chasm that divides the ethics of the Old and New Testaments.13

In the early decades of the Christian era the text was current in two forms, which are denoted by H and Ap in this article and in the edition of the text published by the Oxford University Press. "The former of these was translated not later than A.D. 50 into Greek, and this translation was used by the scholar who rendered the second Hebrew recension into Greek. The first Greek translation was used by our Lord, by St Paul, and other New Testament writers. In the second and following centuries it was interpolated by Christian scribes, and finally condemned indiscriminately along with other apocryphs. For several centuries it was wholly lost sight of, and it was not till the 13th century that it was rediscovered through the apocryphal work of Robert Grosseteste, bishop of Lincoln, who translated it into Latin, under the misconception that it was a genuine work of the twelve sons of Jacob, and that the Christian interpolations were a genuine product of Jewish prophecy. The advent of the Reformation brought in critical methods, and the book was unjustly disparaged as a mere Christian forgery for nearly four centuries. The time has at last arrived for this book, so noble in its ethical side, to come into its own.17

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1 From § 1 of the Introduction to R. H. Charles's The Testaments of the Twelve Patriarchs, translated from the Editor's Greek Text (A. & C. Black, 1908).


3 Some of the evidence for this conclusion will be given later.
Again we have two recensions $S'$ and $S''$, but the one may be on the whole reasonably described as an abbreviation of the other.

The relations of the above authorities are too complicated to be treated of in detail, but they are represented on the subjacent diagram.

Original Language.—Apart from Grabe, till within the last fifteen years no notable scholar has advocated a Hebrew original. Nitzsche, Dillmann, RitcheI and Sinker were convinced that the book was not a translation but was written originally in Greek. To Kohler and Gaster belongs the honor of re-opening the question of the Hebrew original of the Testaments. Only the latter, however, offered any linguistic evidence. In his article on the question he sought to establish a Hebrew original of all the Testaments and to prove that the Hebrew text of Napthali which he had discovered was the original testament, and that the Greek Napthali was a late and corrupt reproduction of it with extensive additions from other sources. But he failed in establishing either thesis. The subject was next taken in hand by R. H. Charles, who in a preliminary form in the Enzyklopaedie Biblica (i. 241, 1890), and later, with considerable fullness, in his edition of the Greek text of the Testaments (1906), brought to light a number of facts that put the question of a Hebrew original beyond the range of doubt. We will now place a few of the grounds before the reader.

(a) Hebrew constructions and expressions are to be found in every page. Though the vocabulary is Greek the idiom is frequently HEBRATIC and foreign to the genius of the Greek language. Thus in T. Heb. vi. 11, in atov eljisth vj v. 12. In T. Jud. xx. 4, for sthe d4Tov avrov—an utterly unmeaning phrase—becomes intelligible on eterev (T. Jud. x. 11), e'v eljisth vj v. 14. "ye shall dwell securely with me"; for here is 'eljisth, as several times in the Septuagint, is a wrong rendering of nve.

(b) Differing renderings in the Greek of the same Hebrew expression—also differential expressions in the Greek implying differential in the Hebrew. See Introduction to R. H. Charles's Text, § 11.

(c) Paronomasia which are lost in the Greek can be restored by transliteration into Hebrew. There are over a dozen of such instances. We will now place a few of the grounds before the reader.

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When Hen was translated we have no definite meanings of determining. It was in all likelihood done subsequently to Hen. The translator of Hen appears to have had the translation of Hen before him, and to have followed it generally unless where there were marked differences between Hen and other versions.

Jewish Additions to the Text.—(a) A large body of these additions can be classed under one head as written with a well-defined object and at a definite period. This period was about 70-40 B.C., and the main points of additions were the kings of the本领—priestly high-priesthood, which in the 1st century B.C. had become guilty of every lewdness. T. Lev. x. xiv.—xvi.; T. Jud. xvii. 2—xviii. 1 (f., x., xvi., and xv.) and T. Zeb. iv. 1-21 (f., x., xii., and xiv.) contain a great deal of the later additions. T. Naph. iv.; T. Gad. viii. 2; T. Asb. vii. 4-7. These additions are identical in object and closely related in character and dictum with the Psalms of Solomon.

Christian Additions to the Text.—These additions are to be found in the Septuagint text as a regular practice made at different periods. The existence of these Christian elements in the text misled many scholars for the past four hundred years into believing that the book itself was a Christian apocrypha. To Grabe, Schnapp and Conybeare belongs the credit of showing that the Christian elements were interpolations—to Conybeare especially of the three, since, whereas the two others showed the high probability of their derivation on internal evidence, Conybeare proved by means of the Armenian Version that when it was made many of the interpolations had not yet found their way into the text. For a full treatment of these passages see R. H. Charles's Testament of the Twelve Patriarchs.

Influence on the New Testament.—We have already shown that St Paul twice quoted from the Greek text of the Testaments. These two quotations are interesting; first, on account of the degree of his indebtedness in thought and phraseology in several of his Epistles, especially that to the Romans. But of still greater interest are the passages in the Gospels which show the influence of the Testaments, and these belong mainly to the sayings and discourses of our Lord. We may mention two of the most notable of these. Thus Matt. xviii. 15, 35, which deal with the great question of forgiveness, are clearly dependent on our text.

Matt. xviii. 15. 'Εσάης δη διαρθήσθη ὁ ἄνδρος ὁ κατὰ σοῦ κατ᾽ τὸν κόσμον τὸν σωτῆρα, καὶ μετανοήσῃ καὶ ἀφεθήσῃ ὁ πατήρ σου. . . . καὶ ἐὰν μὴ μετανοήσῃ καὶ μὴ ἀφεθῇ, καὶ ἀποκαλόθησαι ὁ σωτήρ ὁ πατήρ σου καὶ ὁ κόσμος κατὰ τὸν κόσμον καταρρεῖ.'

T. Gad. vii. 3. 'Εαν μὴ διαρθησθήσθη ὁ ἄνδρος τῷ σωτῆρι τοῦ κόσμου καὶ μετανοήσῃ καὶ ἀφεθήσῃ ὁ πατήρ τοῦ κόσμου καὶ τῶν κόσμων κατὰ τοὺς κόσμους.'

v. 7. 'Αφεθήσετο ὁ πατήρ τῶν κόσμων.'

Next, the duty of loving God and our neighbour is already found in T. Dan. v. 3, which is the oldest literary authority which enjoin these two great commands. The form is very similar in Matt. xxii. 37-40, but the matter is already in the Test. Dan. See Intro. § 4 for the connection.

Literature.—(a) Texts.—Sinkier, Testamenta XII Patriarcharum (1866); [this work gives the text and a of the footnotes; subsequent, and with variations of the Greek versions]; Charles, The Greek Versions of the Testaments of the XII. Patriarchs from nine MSS., with the Variants from the Armenian and Slavonic Versions and the Hebrew Fragments (1968). Comentary.—On the T. The Testaments of the Twelve Patriarchs (1898). Critical Inquiries.—See Schürer, G. J. V. ill. 261-262: Charles, The Test. XII. Patriarchs, pp. xxxvi.-xlii. (R. H. C.)

TESTAMENTUM DOMINI (“The Testament of Our Lord”).

Extracts from the book which bears this title, contained in an 8th-century MS. at Paris, were published by Lagarde in 1856 (Reliquiae uris ecclesiasticæ antiquissimæ 80-89; and a Latin fragment, edited by Dr Montague James, appeared in 1893 (Texts and Studies, i. 154). The whole book was first published in 1886, with a Latin translation by J. M. Rahmani, the Uniat Syrian Patriarch of Antioch. His text is that of a 17th-century MS. at Mosul, the colophon of which says that the Syriac text was translated from the original Greek "a Jacobo pares," evidently James of Edessa, in A.D. 687; but he makes use of other material, including an Arabic version made from a Coptic copy written in A.D. 927. The Mosul MS. contains the whole Bible in the Peshito version, followed by the Syrian "Clementine Octateuch," i.e., the collection of ecclesiastical law, in eight books, which was used by the Nestorians and Jacobites.

Of this the Testament forms the first two books; and according to the title (which, apparently by an error, is written "Testamentum," and not "Testament," or words which Our Lord spake to His holy Apostles when He rose from the dead," Plainly, it is one of that series of writings, claiming to embody the fundamental rules of the Church, which culminates in the Apostolical Constitutions (q.v.).

It falls into three distinct parts: an apocalyptic introduction (book i., chapters 1-16; the division into books, however, is clearly that of a later editor); the narrative of the life of Jesus, with his appointment of the Twelve Apostles, his death, and his resurrection. He is represented as unfolding to them, at their request, the signs of the end, and giving them instruction on various other topics. Incidentally, the fact becomes plain that this section is composed from the standpoint of Asia Minor and Syria; it dates from soon after the time of Maximin (235-38) and Decius (249-51), and that it springs from a Christian community of a strictly puritan type. (b) The Church Order follows the general lines of the Canons of Hippolytus and similar documents. It describes the Church and its buildings (l. 19); the office of the bishop and his functions (l. 19-27); the mystagogic instruction (l. 28-30) common to all churches; the arrangements for the celebration of Pentecost (l. 31-33), and in an earlier form, and based in part upon the Gnostic "Acts of Peter"; the presbyter (l. 39-32): the deacon (l. 33-38); the deacons (l. 39-40); the succession of bishops (l. 40-43), apparently the same persons with different titles. Elsewhere as "presbyters" (l. 35, ii. 19); the subdeacon (l. 44) and the reader (l. 45), the order of whose offices seems to have been as follows, "first presbyter, then subdeacon, then charismata or spiritual gifts (l. 47). Next come the regulations for the laity, including the whole course of preparation for and admission to baptism (l. ii. 9), confirmation (l. 9), and the eucharist (l. 10); after which there follows a series of miscellaneous regulations for Easter and Pentecost (l. 11-12), the fasting (l. 13), the funds of the Church (l. 17-20), the visitation of the sick (l. 21), the distribution of the alms (l. 22-23), and the hours of prayer (l. 24). (c) The Conclusion (l. 25-27) repeats the entire book, in the first person, and comprises the salutations of the twelve Patriarchs, and Matthew, and sent to Jerusalem by the hands of Dosithaeus, Sillias, Magnus and Aquila.

In all this there is much that is peculiar to or characteristic of the Testament. First and foremost is its ascription to the Lord Himself, which we can hardly be mistaken in regarding as an attempt to claim yet higher sanction than was claimed by the various compilations which were styled "apostolic." It is true that it was once longer, and that portions of the book are manifestly, and of a certain of the latter. Again, the whole tone of the Testament is one of highly strung asceticism, and the regulations are such as point by their severity to a small and strictly organized body. They are "the wise," the "perfect," the "sons of light"; but this somewhat Gnostic phraseology is not accompanied with any signs of Gnostic doctrine, and the work as a whole is orthodox in tone. They are set in the midst of "wolves," despised and slighted by the careless and worldly; there is frequent mention of "the persecuted," and of the duty of "bearing the cross." These means to be no locus poenitentiarum for serious sins except in the case of catechumens, and there is a notable "perfectionist" tone in many of the prayers. Charismata, and above all exorcisms, occupy a very important place: there is a vivid realization of the ministry of angels, and the angelic hierarchy is very complete. Great stress is laid upon virginity (although there is not a sign of monasticism), upon fasting (especially for the bishop), upon the regular attendance of the whole clerical body and the "more perfect of the laity at the hours of prayer. The church buildings are very elaborate, and the baptismery is oblong, a form found apparently only here in the East, in the Arabic church. Those who are members of the church are the Epiphany, Easter and Pentecost. With regard to the prayers, they are based upon forms common to this and other Church orders, but have many lengthy interpolations of an inflated and rhapsodic kind. The bishop appears to rank far above the presbyters (more conspicuously so, for example, than in the Canons of Hippolytus), and the presbyters are still divided into two classes, those who are more learned and those
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who are of mature age. The deacons have functions in the Eucharist and about the altar which point to an early date; they have also much administrative work of an important kind, and especial provisions are made for the care of the sick and the dead, and the burial of those who perish by shipwreck. One of the deacons is to be chosen as “chief deacon” (protopsostoros, i. 19, cf. i. 34), and is charged with the care of pilgrims. There are no doorkeepers or singers, who begin to appear circa A.D. 345. The honour given to confessors is very conspicuous, and points back to an early date. But remarkable above all is the point of giving to three presbyters, three in number, deaconesses, virgins, and widows who are in receipt of the alms of the Church; and the first-named occupy a place of very great dignity, which is almost unequaled elsewhere (excepting in the earlier form of the apochryphal and Montanistic Acts and Martyrology of Matthew, where the relation of the psalms and deaconesses corresponds with that of the Testament), and which was formally condemned by the Council of Laodicea in Phrygia.

What conclusion is to be drawn, then, as to the age and character of the Testament? Mgr Rahmani’s view, that it is a work from the 2nd century, is generally discredited; nor has Funk’s contention found acceptance, that it and the Canons of Hippolytus are alike derived ultimately from the eighth book of the Apostolic Constitutions. Some scholars think that the Apocalypse at the beginning is pre-Nicene (A.D. 250–325), and that it originates from Asia Minor, probably from Montanistic circles. Harnack formerly contended that this was an independent work, upon which the Church Order had been grafted, and that as a whole it dated from circa A.D. 400. But the unity of thought and atmosphere is such as to show that the work is one whole (subject no doubt to a certain amount of redaction and interpolation), and that the apocalyptic part was composed as an introduction to the rest. As to the central portion (i. 19–ii. 24) it is a Church Order of the same kind as the Canons of Hippolytus (c. 220) and the Egyptian (c. 310) and Ethiopic (c. 335) Church Orders, standing nearer to the two latter than to the former, and especially to the Verona Latin Fragments, part iii. (c. 340), published in 1909 by Dr Hauler. The precise relation in which these documents stand to one another still remains in a measure doubtful, but it seems probable that they are based upon a lost Church Order, to which the inhabitants of the 4th century, in the reference to the Epiphany, which is first heard of elsewhere at the beginning of the 4th century. The suggestion has been hazarded that this revision was due to the school of Apollinaris of Laodicea (died circa A.D. 390).


TESTAMUR, Latin for “we testify” or “certify” (testari). The name given in English universities to a certificate given to a student signifying that he has passed an examination, so called from the word with which the certificate begins.

TESTER (Fr. têtre, head-covering, from tête), anything placed horizontally over the head, as the sound-board of a pulpit, the flat boards over an old-fashioned bed, &c.

TETANUS (from Gr. réwa, I stretch, on the tension of the fibres of the affected muscles), or LOCKJAW, a disease caused by the bacilli Tetani (see Parasitic Diseases). The home of these bacilli is the earth, and so it comes about that if a man is thrown off his bicycle and grazes his unglowed hand upon the road, or running without shoes cuts his foot, there is a curious fibre change. This (it has been called the lockjaw) is a disease, of the bacilli entering the wound and giving him lockjaw. It is popularly thought that wounds in the region of the thumb are most often followed by the disease, but this is not a fact. Wounds about the thumb are of common occurrence, but they are not, in proportion, more often the starting point of tetanus.

Acute traumatic tetanus is very deadly, and up to the present time nothing has been discovered to check or its almost certainly fatal course. It often picks out the young and vigorous as its victims—the athlete, for instance, who meets with some mishap in the field or on the road, the gardener who picks his hand with a gunshot wound, or the wounded soldier on the field of battle. The violent muscular contractions are distressingly painful; and the brain remaining perfectly clear throughout, the unhappy individual feels that the vice-like gripping of his muscles is steadily exhausting him and bringing him down. The spasms of tetanus differ from those caused by the administration of strychnine in that the muscles are all the time hard from rigid contraction, the acute spasmodic attacks being superseded, as it were. In poisoning by strychnine the muscles are quite relaxed between the spasmodic attacks.

Tetanus may follow a mere prick of scratch or a severe surgical operation. It is not seldom complicated by gunshot wounds and injuries caused by the untimely explosion of fire-works. It may be met with in the woman in child-bed or in the newly-born infant. But wherever it occurs it is due to one cause—to the reception into some wounded surface of the specific germs.

In hot countries tetanus is more common and more acute than it is in temperate climates, and a case has been recorded in which a man in the West Indies cut his hand on a broken plate at dinner and was dead of tetanus before the day was out. Prick is easily the swimmer who cuts his foot, to wound him with a gun-shot, and to give him lock-jaw in cold. It was formerly the custom to speak of idiopathic tetanus—that is to say, of the disease occurring without any wound having been received. But modern teaching is to the effect that there must have been some wound, however slight, by which the germs found entrance. Rheumatic tetanus is as unreal a disease as that just mentioned. The germs themselves do not wander from the wound to multiply in the blood as in infecting diseases, but remaining at the wound elaborate a terribly poisonous substance (a toxin) which makes its way along the nerve-tracks to the spinal cord. Even prompt amputation, however, is likely to prove ineffectual as regards cure, for the germs in the wound have in this growth set free so virulent a poison (toxin) that the nerves of the voluntary muscles all over the body are hopelessly under its influence.

The first symptom of the disease is discomfort in the back of the neck; the man waking up in the morning, for instance, complains of “stiff neck” and of obscure pains, and wonders if he has been lying in a draught. Then the muscles of the jaw and of the face become affected, there being a difficulty in opening the mouth, and the corners of the mouth are drawn downwards and backwards, and fixed in that position (rictus). The law is from hence that it is impossible to pass anything between the teeth. All food, therefore, has to be fluid, and being poured into the pouch of the cheek, finds its way into the mouth by the servicable gap which exists behind the wisdom-teeth. Soon, however, a difficulty in swallowing comes on because of the muscles of the throat being involved.

The muscles of the abdomen becoming contracted are rigidly fixed, and on laying the hand upon the front of the abdomen
they feel as "hard as a board." The muscles of the limbs are also attacked with fearful cramps, and, last of all, the muscles of the chest are involved. Though all these muscles are in a continuous state of contraction, spasmodic contractions, as already remarked, come on in addition, and occasionally with such distressing energy that the patient is doubled up forwards, backwards, or sideways, and, may be, some of the muscles tear across. The patient is bathed in perspiration, and sinks worn out and exhausted, or, perchance, slowly suffocated by the locking of the muscles of respiration.

As regards the prospect of recovery in tetanus it must be said that though the patient recovers he may suffer from the after-effects of an injury the prospect of recovery is extremely remote. If they occur within ten days the prospects are bad. But if there is an interval of three weeks or a fortnight before their occurrence the case may be regarded more hopefully.

In the treatment of tetanus the first thing to do is to try to make the wound by which infection has taken place surgically clean. For though a wound free from the germs of suppuration may be the inciting place of the bacilli of tetanus, in most cases there is also an invasion of septic germs, and the double infection makes the action of the tetanic poison the more virulent. In order to prevent the germs of the wound from the free use of the knife or of the cautery or of pure carbolic acid may be resorted to, or an amputation may be performed. But even the early amputation of the infected part may not avail for the presence of these germs in the wound have already set free a lethal dose of their toxin.

The wound having been cleansed the further treatment of the disease demands absolute quiet in a darkened room. There must be no slamming of the door, shaking of the bed, or the sudden bringing in of a light, for any such act might cause the outbreak of a violent spasm. Morphia may be given by the hypodermic syringe, and if the spasms are causing great distress chloroform may be administered; indeed, in certain severe cases it may be necessary to keep the patient almost continuously under its influence. If there is difficulty in swallowing fluid, rectal feeding must be employed. Though this present one is unenthusiastically or with confidence about the antitoxin treatment of lockjaw, still it is a method which should certainly be given trial and that early. The tetano-antitoxin is prepared from the blood of animals which have been rendered immune to repeated injections of the poison elaborated by the cultivation of the tetanus bacilli. The bacilli themselves are not injected, the injections being rendered sterile. By passing the sterile injections into one of the lower animals the blood of that animal prepares an antidote to them known as an antitoxin.

The antitoxin may be injected into the nerve trunks or into the meninges of the cerebrum or of the brain. But as much as the nerves and the nerve-ends are under the influence of the toxin before the antitoxin is administered—as evidenced by the occurrence of the symptoms—the injection-treatment has but a poor chance of producing a good effect. (E. O.)*

**TETRADYMITE**, a mineral consisting of bismuth telluride and sulphide, Bi₂TeS₅, also known as "telluric bismuth." Sometimes sulphur is absent and the formula is then Bi₂Te₅; traces of selenium are usually present. Crystals are rhombohedral, but are rarely distinctly developed; they are twinned together in groups of four; hence the name of the mineral, from the Greek, tetradymos, fourfold. There is a perfect cleavage parallel to the basal plane; and the mineral usually occurs in foliated masses of irregular outline. The colour is steel-grey, and the lustre metallic and brilliant. The mineral is very soft (H=1) and marks paper; the specific gravity is 7.2 to 7.6. It was first found, in 1815, at Telemarken in Norway; crystals are from Schubkau near Schenitz in Hungary. It often occurs in quartz associated with native gold. Other ore bodies similar to tetradymite, but with different formulae, are: josite, from San José near Marriana in Brazil; grünlingite (Bi₅S₅Te), from Coldbeck Fells in Cumberland; and wehrite, from Hungary. (L. J. S.)

**TETRAGRAMMATON** (τετράγραμμα, four; γράμμα, letter), a Greek compound, found in Philo and Josephus, which designates the divine name composed of the four Hebrew letters J H V H (יְהוָֹה). The derivation and pronunciation of the Tetragrammaton is still doubtful. The form "Jehovah" (q.v.) used in some of the English Versions is an error which arose in the 16th century. It is now generally assumed that the word is the causative form (ῥίπτον) and should be pronounced Yahweh or Yahweh (accent on second syllable). The Jews quite early ceased to pronounce the Tetragrammaton, substituting (as the Books of the Chronicles and the LXX translation already indicate) the word Lord ("Adonai"). The priests continued to use the name in the Benediction of the People (Numbers vi. 22–27), and on the Day of Atonement the High Priest pronounced it (Leviticus xvi. 30) amidst the prostrations of the assembled multitude. It is recorded in the Talmud that Rabbis communicated the true pronunciation to their disciples once in seven years (Qiddusin, 71a). The Jews called the Tetragrammaton by a Hebrew denomination, שֵׁם הָמוֹמֶרֶשֶׁךְ (יְהוָֹה יִהְיָה), i.e. the distinctive excellent name. It was considered an act of blasphemy for a layman to pronounce the Tetragrammaton. This avoidance of the original name was due on the one hand to reverence and on the other to fear lest the name be desecrated by heathens. Partly in consequence of this mystery and partly in accord with widespread superstitions, the Tetragrammaton figures in magical formulae from the time of the Gnostics, and on amulets. Many a medieval miracle-worker was supposed to derive his competence from his knowledge of the secret of the Name.

**TETRAHEDRITE**, a mineral consisting typically of copper sulph-antimonite, Cu₃Sb₅S₃, but often of complex composition. The copper is usually isomorphously replaced by variable amounts of silver, iron, zinc, mercury, lead or cobalt, and the antimony by arsenic or bismuth. In general, the formula is K₃Sb₅S₃+ₓ where x = Cu, Ag; X = Sb, As, Bi; R = Fe; Zn, and x is a small fraction, often ½ or ⅔. Numerous special names have been applied to varieties differing in chemical composition; the arsenic compound, Cu₃AsS₅, is known as tennantite (after Smithson Tennant). The old German name Fäbriers includes both tetrahedrite and tennantite, and so does the term "grey copper ore" of miners. Tetrahedrite is an important ore of copper, the formula Cu₃Sb₅S₃, corresponding with 57.5% of this metal; it is also largely worked as an ore of silver, of which element it sometimes contains as much as 30 per cent. Well-developed crystals are of frequent occurrence; they belong to the tetrahedral class of the cubic system, and their tetrahedral form is a very characteristic feature of the mineral, which for this reason was named tetrahedrite. Fig. 1 shows a combination of a tetrahedron and a triakis-tetrahedron [211], and fig. 2 a tetrahedron with the rhombic dodecahedron. Interpenetrating twinned crystals sometimes occur. The colour is steel-grey to iron-black, and the lustre metallic and brilliant. The streak is usually black; sometimes, however, it is dark cherry-red, and very thin splinters of the mineral then transmit a small amount of blood-red light. The hardness is 4½, and the specific gravity varies with the composition from 4.4 to 5.1. There is no cleavage, and the fracture is conchoidal. The material is very often impure owing to intimate inter-mixture with chalcocyprite.

Tetrahedrite occurs in metalliferous veins associated with chalcocyprite, pyrites, blende, galena, &c. Fine groups of crystals, coated on their surface with brassy or brilliantly tarnished chalcocyprite, were formerly found at Herodhos' mine, near Liskead in Cornwall. Good crystals are also met with at Kapnik-Hany in Hungary, in the Harz, Peru, and other places. Tennantite occurs as small crystals of cubic or dodecahedral habit in many
TETRAHEDRON, in organic chemistry, a group of compounds containing the ring system C-N-N C-N-C C-N-N C-N-C or N-N-C or N-N-N;

only derivatives of the first two types are known. The members of the first series may be prepared by oxidizing osazones (i.e., dihydroazones of a-diketones), dihydrotetrazines resulting. Dihydro-derivatives of the second type are formed by hydrazine and imino-ethers (A. Pinner, Ber., 1893, 26, p. 2126; 1894, 27, p. 984); these easily oxidize to the corresponding tetrazines, which are stable towards acids; their dihydro-derivatives, however, are decomposed by the group-NH-NH—being eliminated as hydrazine, and replaced by oxygen, with consequent formation of the five-membered oxybiazole ring. Concentrated acids convert the dihydro-tetrazines into isodihydtetrazines, thus:

\[ \text{R-CN-NH-NH} \rightarrow \text{R-CN-NH} \]

where R is the N-alkyl derivatives of which type may be prepared by the action of alcoholic potash and chloroform on aromatic hydrazines.

Much discussion has circulated about the decomposition of diazo-acetic ester, from which A. Hantzsch and O. Silberrad (Ber., 1900, 33, p. 58) obtained what they considered to be a dihydro-tetrazine, thus:

\[ \text{HCO-R} \rightarrow \text{HOC-CH-CN} \]

triazole derivative (I) being due to the ring opening on the addition of the elements of water and then closing again to the five-membered ring with elimination of water again. The decompositions of diazo-acetic ester were then again examined by T. Curtius and his students (Ber., 1907, 40, pp. 652, 350, 450, &c.), who showed that both triazole and tetrazine derivatives might be obtained from the bisdiazo-acetic acid which is formed by the action of alkali on diazo-acetic ester.

TETRAZOLES, in organic chemistry, a group of heterocyclic compounds, capable of existing in two isomeric series (formulae 1 and 2), although the methods of preparation do not always permit discrimination between the possible isomers. They are prepared by the action of nitric acid on cyanamidrazide (dieryanophenylhydrazine) and hydrolysis of the resulting nitrile, from which J. A. Bladin by elimination of the phenyl group (by nitration, reduction, &c.) and of carbon dioxide obtained free tetrazole, CH₄N₂; from amidines by the action of nitrous acid, followed by the reduction of the intermediated formed dioxytetrazoc acids with sodium amalgam; from amidoguanidine by diazotization, the diazonium nitrate on treatment with acetates or carbonates yielding aminotetrazole (J. Thiele, Ann., 1892, 270, p. 1); from the action of nitric acid on phenylthiosemicarbazide; and by the action of arylazomides on the hydrazones (O. Dimroth, Ber., 1897, 40, p. 2402). The tetrazoles behave as strong monobasic acids, but are exceedingly stable. A series of tetrazolium bases (formula 3) have been obtained by H. V. Peckham (Ber., 1894, 27, p. 2920) starting from formyazol compounds (formula 4), which are oxidized by means of amyl nitrite and hydrochrolic acid. They are strong bases, which in aqueous solution absorb carbon dioxide readily. The free bases have not been isolated, but their salts are well-crystallized solids.

TETRASTOÖN (Gr. τετράς, four, and στόιχων, a portico), the term in architecture given to a rectangular court round which on all four sides is carried a covered portico or colonnade; the same as peristyle (q.v.).

TETRASTYLE (Gr. τετράς, four, and στυλός, a column), the term in architecture given to a portico of four columns which forms the main front of a temple (q.v.).
TETUAN (TETTAWAN), the only open port of Morocco on the Mediterranean, a few miles S. of the Strait of Gibraltar, and about 40 m. E.S.E. of Tangier. Population about 25,000, of whom a fifth are Jews. It is picturesquely situated on the northern slope of a fertile valley, which flows from the Védiat, with the harbour of Tetuan, Martil, at its mouth. Behind rise rugged masses of rock, the southern wall of the Anjera country, practically closed to Europeans, and across the valley are the hills which form the northern limit of the still more impenetrable Rif. In point of cleanliness Tetuan compares favourably with most Moorish towns. The streets are fairly wide and straight, and several of the houses belonging to aristocratic Moors, descendants of those expelled from Spain, have fine courts surrounded by arcades, some with marble fountains and planted with orange trees. Within the houses the ceilings are often elaborately carved and painted in Mannerist style, such as are found in the Albambra, and the tile-work for which Tetuan is known may be seen on floors, pillars and dados. The principal industries are tilework, inlaying with silver wire, and the manufacture of thick-soled yellow slippers, much esteemed by flintlocks, and artistic "towels" used as cape and skirt by Moorish country girls. The Jews live in a mellah, separated from the rest of the town by gates which are closed at night. The harbour of Tetuan is obstructed by a bar, over which only small vessels can pass, and the roadstead, sheltered to the N., N.W. and S., is exposed to the E., and is at times in danger of being transformed into a lagoon.

The present town of Tetuan dates from 1492, when the Andalusian Moors first reared the walls and then filled the enclosure with houses. It had a reputation for piracy at various times in history, and was taken on the 4th of May 1860 by the Spaniards under Don Antomill, and almost transformed by them into a European city before its evacuation on the 2nd of May 1862, but so hateful were the changes to the Moors that they completely destroyed all vestiges of alteration and reduced the city to its former state. (K. A. M. *)

TETZEL, JOHANN (c. 1460-1519), preacher and, on 1499, son of Hans Tetzel, a goldsmith of Leipzig, was born there about 1460. He matriculated at the university in 1482, graduated B.A. in 1487, and in 1489 entered the Dominican convent at Leipzig. He early discovered his vocation as a preacher of indulgences; he combined the eloquentatory gifts of a revivalist orator with the shrewdness of an auctioneer. He painted in lurid colours the terrors of purgatory, while he dwelt on the cheapness of the indulgence which would purchase remission and his prices were lowered as each sale approached its end. He began in 1501 in the service of the Cardinal-legate Raymond Perandri; and in the next few years he visited Freiberg (where he extracted 2000 gulden in two days), Dresden, Pirna, Leipzig, Zwickau and Görlitz. Later on he was at Nuremberg, Ulm and Innsbruck, where he is said to have been condemned to imprisonment for adultery, but released at the instance of the elector of Saxony. This charge is denied by his apologists; and though his methods were attacked by good Catholics like Johann Hass, he was elected prior of the Dominicans in Giana in 1505. He published his momentous ninety-five theses on the subject of indulgences on October 31, 1517 (see Luther).

Even Albrecht was shamed by Luther's attack, but he could not afford to relinquish his profits already pledged for the repayment of his debts; and Tetzel was encouraged to defend himself and indulgences. Through the influence of Conrad Wimpina, rector of Frankfurt, Tetzel was created D.D. of that university, and with Wimpina's assistance he drew up, in January 1518, a hundred and six theses in answer to Luther's. But the storm overwhelmed him; some Catholics felt that his teaching was contrary to Catholic doctrine, and Miltitz, who was sent from Rome to deal with the situation, administered to him a severe castigation. He hid himself in the Dominican convent at Leipzig in fear of popular violence, and died there on the 4th of July 1519, just as Luther was beginning his famous dispute with Eck.

Many lives of Tetzel have been published on the Protestant and on the Catholic side, the most recent being Körner's (1880), K. W. Hermann's (2nd ed. 1884), and N. Paulin's Geschichte der deutschen Biographie; Gесs's Geheim und Briefe zu der Kirchenpolitik Horszov Georg von Sachsen, vol. i. (1903), Intro. pp. 76-8, &c.; H. Barge's Andere Bodenstein von Carlstadt (2 vols. 1905), J. Janz's Leben der German People, and An meine Kritiker (M. Creighton's Hist. of the Papacy, vol. vi.; and H. C. Lea's Hist. of Ancilla Confession and Indulgences (3 vols. 1866). All the histories of the Reformation in Germany and all the lives of Luther deal at greater or shorter length with Tetzel; in the index to vol. ii. of the Cambridge Mod. History he is confused with a later Tetzel of Nuremberg. (A. F. P.)

TEUFFEL, WILHELM SIGMUND (1820-1878), German classical scholar, was born at Ludwigswburg in the kingdom of Württemberg on the 27th of September 1820. In 1849 he was appointed extraordinary, in 1857 ordinary professor in the university of Tübingen, which post he held till his death on the 8th of March 1878. His most important work was his Geschichte der römischen Literatur (1870; 5th ed. by L. Schwabe, 1890; Eng. tr. by G. C. Warr, 1900), which, although written in an unattractive style, is indispensable to the student, the bibliographical information being especially valuable. After the death of A. Pauly, the editor of the well-known Real-Encyclopädie der classischen Altertumswissenschaft, Teuffel, at first assisted by E. C. Walz, undertook the completion of the work, to which he also contributed numerous articles.

He was also the author of "Prologomena zur Chronologie der homerischen Gedichte" (in Zeitschrift für die Altertumswissenschaft, 1842); Charakteristik des Horaz (Leipzig, 1842); Horan, the literaristorische Uberlieferung in Giugul in 1849; The History of the Clouds of Aristophanes (1856) and the Persae of Aeschylus (1866). His Studien und Charakteristik (1871; 2nd ed., 1889).
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possess only to give a brief summary of the chief characteristics of these languages as a group, and of the chief divergences noticeable in early times between the various members of the group. It should be noted at the outset that the written records of the various languages date from very different periods. Gothic is known to us almost entirely from Úlfríðs' translation of the Bible; which dates from the 4th century. English written literature starts with the beorhtþryht Ælfric; Latin, from the 1st century, though earlier matter may be preserved in certain poems. The earliest

The Teutonic languages form a distinct and well-defined group of the Indo-European family. Their nearest affinities are on the one side with the Celtic and Italic (Latin, &c.) languages, and on the other with the Slavonic and Baltic languages. In regard to the fundamental distinction, however, by which the Indo-European languages as a whole fall into two main divisions, namely according to the treatment of certain guttural and palatal consonants, the Teutonic group belongs definitely, together with Celtic, Italian and Greek, to the western of these divisions.

The chief characteristic of the Teutonic languages as a whole lies in their divergence from the Indo-European sounds. This characteristic, generally known as Grimm's Law, is due to sound-changes peculiar to Teutonic, though somewhat similar changes may be traced both in Armenian and Celtic. The most noteworthy phenomena are as follows: —

(1) The Indo-European voiced aspirates, bh, dh, gh (Lat. f, f h; Gk. φ, ϑ, χ) became voiceless spirants, b, d, g. After nasals these spirants became explosive (b, d, g); and in the first two cases the voiceless sound took place palato-alveolar, though hardly during the early centuries of our era, e.g. A.S. berere; O.C. berere; Lat. berere, Gk. βερερε; A.S. stigan; Gk. στιγε; O.N. mérðr (A.S. medr); Gk. μύδρ.

(2) The I.-Eur. voiceless explosives, p, t, k, were preserved only after s (also in the I.-Eur. groups pt and kt); e.g. A.S. stede; Goth. stás; Gk. στάσ; Goth. nátus; Lat. vocem. In all other cases they became voiceless sps, f, p, k, e.g. Gk. stikis, O.H.G. sehs; Lat. sex; Goth. nátum; (ii) immediately after the (original) accent, e.g. Goth. bropar; A.S. brore; O.H.G. bro; Goth. tahan; O.H.G. sehan; Lat. decem, Gk. δέκα. In all other cases they became voiceless sd ("Verner's Law"), identical with those arising from L.-A. in ðh, dh, gh (see above); e.g. A.S. fæder; Lat. pater, Gk. πάτερ; A.S. ægware, O.H.G. sw这个游戏(mother-in-law); Gk. ἐγώ.

(3) The I.-Eur. voiced (un spirated) explosives, b, d, g, became voiceless sps, f, p, k; e.g. A.S. etan; Lat. edere; A.S. æcær, Goth. æhru; Lat. ager, Gk. ἀγρός.

Among other consonantal changes we may note especially the following: —

(4) 3w arising from 1.-Eur. ghw ow cw (see above) was reduced (except after nasals) before υ (perhaps also before 1.-Eur. ο) to ι, and in all other cases to ν; e.g. A.S. gub (war); O.H.G. de-saros (cf. θυσία); A.S. smihet (snows); Lat. nīvem, Gk. νείβαι.

(5) The I.-Eur. cons. group arising from combination of dental sound ðt became ðz, as in Celtic and Latin, e.g. A.S. sess (seat); sittan, Lat. sedere (cf. Sanskr. pp. satyas, Lat. obesity).
(6) The treatment of 1.-Eur. i was precisely parallel to that of the voiceless spirants ʃ, χ (arising from I.-Eur. ʃ, χ; see above). It was therefore, probably, the original spirantization which is not well preserved; e.g. A.S. cozen, pp. coren (gēnus-gēnus); Gk. γεώμαι (cf. Lat. gustus); A.S. snarh, O.H.G. snarh (daughter-in-law); Sanscr. snad, Gk. xeoid. Most of the other consonantal changes are in the nature of assimilation.

(7) bn, da, 3n before the accent became bb, dd, gg (probably through the intermediate voiced bb, dd, gg); e.g. A.S. liecan, I.-Eur. liekan (from liecan); Gk. ἀγείαω (cf. Goth. bi-laigon). In became ii; e.g. A.S. full, Goth. fullis: Lith. pilnas.

(8) Final consonants also underwent change; e.g. A.S. byne, O.N. banno; Lat. tenenis.

(9) At ii, ii became ii; e.g. A.S. stei(i)l, O.N. steilr, Lat. stabulum (from stabulum).

(11) In some combinations consonants are lost or new consonants developed; e.g. Goth. (scar). O.H.G. kunnno (centurion) from hundrn, cf. Goth. hund: Lat. centum; A.S. stream, O.N. strum from strum-, cf. Gk. παῦν, Old Irish straim.

The following changes are found in all Teutonic languages, but took place apparently later than those enumerated above—

(i) n was lost before (h), with compensatory lengthening of the vowel; e.g. A.S. pēhā, Goth. pāha beside A.S. pencan, Goth. pahai.

(ii) Final explosives and nasals were lost; e.g. A.S. vele, Goth. willi: Lat. velīt; A.S. ea, Goth. ahwau: Lat. aquam; Goth. kustuam: Lat. custumam.

In the vowel-system the earliest known form of Teutonic did not differ greatly from the other 1.-Eur. languages. Its chief peculiarities seem to have been as follows—

(1) (h) corresponded in the two vowel systems a, o found in the other 1.-Eur. languages; e.g. Goth. ahrs, O.N. áhr: Ager, Gk. ἀγχαρχα: Goth. ahtau, O.H.G. ahko: Lat. octo, Gk. ὀκτώ.

(2) It had also one vowel (e) corresponding to the two vowels ą, ę found in the other 1.-Eur. languages, e.g. A.S. brōdr, Goth. brōpar: Lat. frater, Gk. φίλαπα; A.S. rōw (rest), O.H.G. rōwau: Gk. ῥωπον (rūpion).

The 4th and 5th Teuton. vowels, ę, ą, ę, were preserved in the earliest Teutonic. Soon after the beginning of our era, e began to change to i before a nasal followed by a consonant; e.g. PtoL. Φιάλα, A.S. Fén, O.N. Fān; against Tac. Φέλα, A.S. fela. The dipthong ei became i; e.g. A.S., O.H.G. stigan, O.N. stiga: Gk. στίγμα (the ei of Goth. stiegn is merely graphic).

The reduced nasal sounds generally written u, m, arising from er, er, er, etc., in unaccented syllables, became un, um (rarely unu, unus), e.g. A.S., Goth., Æ.- un- (negative prefixes); Lat. iv-, Gk. ἵ-; A.S. hund: Lat. centum: Gk. ἱ-κτόρ. Similarly the reduced liquid sounds ù, ù, û, became ur, ur, û, e.g. A.S. wurh: Lat. fūrca; Goth. fuls: Lat. tellus, Gk. τῆλη.

Accent.—In the I.-Eur. languages the position of the accent was originally free—i.e., any syllable in the word could bear the chief accent—variation occurring very frequently, e.g. between different cases of the same noun. The liberty of the free accent must have been retained in Teuton and 1.-Eur. at the time when voiceless spirants (ʃ, χ, s) became voiced (see above). Eventually, however, as in Gaelic (Irish) and at one time also in the Italic languages, the first syllable of every word came to bear the chief accent, the only noteworthy exceptions being certain compound words, more especially verbs compounded with prepositions, which were probably long regarded as more or less independent words. This system of accentuation was intimately connected with the principle of alliteration, the essential characteristic of early Teutonic poetry and the dominant factor in family nomenclature. Alliteration in family names certainly dates from the very beginning of the Christian era, e.g. the S-names in one of the princely families of the Cheruici frequently mentioned by Tacitus, and there is also some evidence that Teutonic poetry was alliterative by this time. It is probable, therefore, that the change in the system of accentuation took place not later than the 1st century B.C.

The description of the phonetic characteristics given above applies in general to the Teutonic group of languages as a whole. So far as one can judge from the proper names, etc., which occur in Latin works, the description would probably be true for the time about the beginning of the Christian era. Dialectical differences no doubt already existed, but few of them were so clearly marked that they can now be traced with anything like certainty. The language of the earliest Runic inscriptions does not differ very markedly from this type. The principal changes which we can now detect are as follows:

(1) e became ę, i (in the unaccented syllable of dissyllabic and in the nasals (n), preserved in the Italic languages and nasals (n) of the vowel ę, and we n; e.g. A.S. eñoher, O.N. enner (stem wen-); A.S. eoloher, O.N. eoher (stem eol-.)

(2) u became o when the following syllable contained a, ę, ę; e.g. (i) sing. pret. (2s.); A.S. wero(h)er, O.H.G. wer(a)hia: A.S. wuro, O.H.G. wurchen.

(3) e became ä always; e.g. *märīs (inscr.): Gt. mērs.

(4) final a, e, were lost; e.g. (1, 3 sing. pret.) waz (inscr.); cf. Gk. ἔπεσε, L. desper.

(5) final long vowels were (in general) shortened (i-ä, ò-ö) e.g. liuhtu (inscr.).

(6) final nasals and explosives were lost; e.g. varothā, i sing. pret. (cf. Gk. ἱππέτη).

These changes appear to have operated in all the northern and western Teutonic languages during the first four centuries of our era, except the change ę-ä, which in the extreme west (Frankish) seems not to have taken place until the latter part of the 6th century. Several of them can be traced more or less clearly in Latin writings of the 1st century. The Gothic language, however, seems to have developed on quite different lines. The more important of its changes are as follows:

(1) e became i always; e.g. wegs (road): A.S. weg. But, i later became e (written as in Ulfilas' orthography) before r, h; e.g. hairdeis (hardman): O.H.G. herdei.

(2) u became o (written au) before r, h; e.g. baurges: A.S. burg. (In Ulfilas' orthography the letters transcribed e, o are used for long vowels only.)

(3) i, au became ę, ę but the digraphs were still written.

(4) Short vowels (except u) in final syllables were lost; e.g. dags, gastu: (N. inscr.) daga, -taske.

(5) final nasals and explosives were lost; e.g. sumu (Acc. sing.): Sanscr. samanam.

(6) Final long vowels (including those which had become final through the last change) were (in general) shortened (i-ä, ò-ö, ù-ö); e.g. warbote (1 sing. pret.): (N. inscr.) whoradā: liuhtu (N. sing. fem.): (N. inscr.) liubu.

(7) voiceless spirants when final (also before s) became voiceless; e.g. ðap (3 sing. pret. of bidjan).

All these changes appear to have taken place before or during the 4th century. The effect of them must have been to render the Gothic language hardly intelligible to a person who spoke a northern or western Teutonic language. Nevertheless there is little differences among the latter languages themselves. At a later date Gothic underwent further changes which do not appear in Ulfilas' version, or only to a slight extent.

(i) i became a closed e-sound; e.g. Venethae (Jordanae), for Winia-

(2) u became a closed o-sound; e.g. Fyrow (Procopius): Rugii; later o became a in unaccented syllables; e.g. āros (for -sos).

(3) e became i; e.g. leiskes for leikes (not unfrequently in the MSS.).

(4) ò became ą; e.g. sunjas for sunjas.

The chief sound-changes in the northern and western languages seem to have taken place in the 6th and 7th centuries. Some of these changes were common to all the languages in question, some to English and Scandinavian, some to English and German, while others again occurred in only one of these languages or a portion of it.

I. Among the chief changes common to English, Scandinavian and German we may reckon (1) the loss of final a (in Scandin. also for nasal consonants); e.g. A.S., O.N., O.H.G. korn (N. inscr. korn); (2) the loss of unaccented i, u after long syllables, e.g. A.S. hund, O.N. hond, O.H.G. hant: Goth. handus; (5) the change s-w (in the above relations); e.g. A.S. dier, O.N. dier, O.H.G. tier: Goth. (plur.) disra.

II. Among the most important of the changes common to English and Scandinavian must be classed (1) the affection (unattested) of the vowels (generally i, u) of following syllables; e.g. A.S. cyn(n), O.N. kyn: O.H.G. kunni; A.S. geofu, O.N. gof: O.H.G. geba.

In early German the only case of this kind was the affection of a by a following i and even this seems to have taken place much later. To the same category we must reckon (2) the early loss of h
between sonants, e.g. A.S. *sien, sian, O.N. *síð: O.H.G. *sehan;
(3) the loss of n before s, e.g. A.S. *sís, O.N. *sí: O.H.G. *As-
nei.

Many of the vowel-changes are indistinguishable forms. The Swedes who were the following: (1) The loss of final s; e.g. A.S. *dæg, O.H.G. *tag: O.N. *dag (N. inscr. *dæs). In short monosyllables, however, *s became r in High German, as in Scandinavian; e.g. mir (Datt.): A.S. *mita, O.N. *miða, O.H.G. *mor. Such change did not take place before d (whereas assimilation took place in Scand.), e.g. A.S. hord, O.H.G. hort: O.N. hodd, Goth. hund. (3) The change d-s=d in all positions, e.g. A.S. dêd, O.N. dêð, O.H.G. *ddieh, O.Fr. dèd, O.Fr. *sant (O.H.G. *fiter): O.Fr. *sant. (4) The lengthening of all consonants (except r) before j (in Scand. only gutturals), e.g. A.S. biddan, O.H.G. *bilen: O.N. *blita.

The treatment of the English, Scandinavian and German are treated in the articles dealing with these languages. It should be noted that the Frisian dialects agree with English not only in the phenomena enumerated above, but also in a number of changes peculiar to that language. Thus the change of nasal syllables, e.g. A.S. *mêna, O.Fr. *môna; O.H.G. *mân; (2) the change d-s=d (later e) in other positions, e.g. A.S. rôd, O.Fr. réd; (3) the presence of *s in Frisian, e.g. A.S. sêda, A.S. *sêdê (O.H.G. *kneht); (4) the lengthening of r in Frisian, e.g. A.S. *bairif, the plur. *-a (2) a general feature in the Teutonic languages. In the earliest Anglo-Saxon there is no trace of the diphthongisation of vowels before e, e.g. A.S. *steaf, O.Fr. stef: O.H.G. *steip; (5) the labialisation of Frisian words in -er; e.g. A.S. *ger, O.Fr. *gère: O.H.G. *erator; (6) the palatalization of Frisian syllables, e.g. A.S. *gêldan, gêldan (Engl. yield), O.Fr. Baldwin: O.H.G. gelan. The actual records of the Frisian changes in the earliest Anglo-Saxon seem to have been very few: (1) a, e, i, o, u are diphthongised after r followed by a consonant in English, but not in Frisian, e.g. A.S. ear, A.S. oer, A.S. eor: O.Fr. ore, O.H.G. eor; (2) the change of e in English everywhere, but in Frisian only in open syllables (e in close syllables); e.g. A.S. eft: O.Fr. eth (Alto sax., Goth. eht), but A.S., O.Fr. āþun (Goth. āþan); (3) the diphthongisation of words like bairift, the plur. *-a has taken place in English everywhere, but in Frisian only in open syllables (e in close syllables); e.g. A.S. *sêda, A.S. *sêdê (Alto sax., O.H.G. *kneht); (4) it was labialized in Frisian, but not in English, before (original) w in the following syllable: e.g. O.Fr. sîngan: A.S. *sîgan (cf. Goth. *singan). Frisian texts of the 13th and 14th centuries show many characteristic changes which must have rendered the language almost, if not wholly, unintelligible to an Englishman of the same period; but it is hardly probable that these changes were for the benefit of any great antiquity.

Dative. — The I.-Eur. languages seem originally to have had three numbers and eight cases, though it is by no means certain that each of the latter had a distinct form in every class of stems. In Teutonic there is scarcely any trace of the dative case in nouns. Of the cases all the early Teutonic languages preserved four, viz. the Nominative, Accusative, Genitive and Dative. The Vocative also was kept in Gothic and the Instrumental to a considerable extent early in German, while the earliest Anglo-Saxon preserved many traces of the locative.

The case endings are best preserved in the earliest Northern inscriptions and Gothic. As an illustration we may take those of the I.-Eur. -dedened verbal formations:

As examples of the forms found in the inscriptions may be given N. erlaz, A. staina, G. A(n)-arztaslaz, D. Wodaridaz. In the other cases of stems the dative-declension conforms to the general I.-Eur. types. Whatever changes have taken place have usually tended towards simplification; thus there are but few traces of stem-variation (ablaut) between different cases of the same noun.

The treatment of adjectives was somewhat more peculiar. In addition to the old type of declension which conformed to that of the demonstrative pronoun and not, as in Greek and Latin, to that of substantives, almost every adjective was derived from a verb. The characteristic of the type of inflection occurs chiefly in conjunction with the demonstrative pronoun (definite article) and it is thought that its origin is to be found in substantival (positional) sage.

The comparative of adjectives is formed partly by a suffix -eiun (e.g. Goth. suilzan, A.S. lengae), which is apparently extended from the suffix -is, -is found in the other I.-Eur. languages and probably in Old Norse, which is the root of the -is-a (e.g. Goth. suivispo) which is peculiar to Teutonic. Similarly the superlative is formed partly by a suffix -is (e.g. Goth. huzilisz, A.S. lenghæ), corresponding to -iis in other I.-Eur. languages (Gk. ighro), as partly by a new formation -iis (e.g. Goth. armast). Most of the I.-Eur. demonstrative pronouns are found in Teutonic, and the peculiarities of the inflection are in general typical of A.S. noun, O.H.G. *tawn (related to Gk. *au), and probably identical with the Pret. A.S. sing, dode (dyde), plur. dodezen; O.H.G. sing, tet, plur. tütan. The short reduplication-suffix, however, is lost in the singular, while the long reduplication-suffix is preserved only in Gothic. The inflection of the dative is as follows:—

Goth. 1 sing. basi, 2 -basí, 3 -bási, 1 dual -budás, 2 -bidás, 3 -budán; cf. Gk. 1 sing. obá, yegómov, 2 eó, 3 eó, 2nd, 1 pl. tézor, ýeýamov. Except in Gothic and Scandinavian the 2 sing. has generally a form (originally Aorist) similar to the plural, e.g. A.S. bude. The stem of the Conjunctive also agrees with that of the present.

The "weak" Preterite seems originally to have arisen out of a periphrastic formation of which the second part consisted of imperfect or Aorist forms of the verb seen in A.S. dón, O.H.G. tawn (related to Gk. *au), and probably identical with the Pret. A.S. sing, dode (dyde), plur. dodezen; O.H.G. sing, tet, plur. tütan. The short reduplication-suffix, however, is lost in the singular, while the long reduplication-suffix is preserved only in Gothic. The inflection of the dative is as follows:—

Goth. 1 sing. nasida, 2 -des, 3 -das; A.S. nerede, -des(1), -de, O.H.G. nerila, -des, -des; O.N. nátla (early inscr. 3), 4. -d.

It is to be observed that the stem of the weak Preterite almost always conforms to the formations of the singular. The forms of A.S. *wasreda, -erhsa (stem wasrhoht-) on the analogy of pret. nasida beside past part. natis (stem nasidos), where the resemblance between the two formations is due to the regular operation of the sound laws.
The inflection of the Conjunctive agrees with that of the strong Preterite, e.g. Goth. nasidafulan. 

This is derived from the present stem with an ending -an (A.S. beran), and probably was originally a case-form of a verbal noun. In the western languages we find also the Dative of a stem -ranga- used after a preposition; e.g. A.S. to besciéen, O.H.G. sihmen.

The Present Participle has a stem -ond- (I.-Eur. -ont-) identical with the ending of the 3 plur. Indic., as in the other I.-Eur. languages; but the Participles in -ai- (Teut. -aia, -ai-) are formed as -on- or -ja- stems, e.g. G. bartandra, A.S. berende. The unextended stem survives only in substantives, e.g. A.S. wigend, "warriors."

The stem of the Past Participle (Passive) is formed by the suffixes -lo- and -ling- (Teut. -aia, -aia), as in the other I.-Eur. languages. The first stem occurs as a living formation only in connexion with the verbs whose present stem ends in -ja, -ja, -ja (in Gothic also -ja); e.g. Goth. nand, sound, nadj, G. nagen. The Past Participle in usage is formed with the class of verbs has a stem -aun- or -aun- and was replaced in English and Scandinavian, the latter in Gothic and German; e.g. A.S. borne, O.N. bornin, Goth. bournan, O.H.G. (gi)beran. 

Remains of old Participles in -ja, -ja formed otherwise than in living use may be found in adjectives; e.g. A.S. (e)ald: alan (cf. Lat. alius), full: Lat. pleo (cf. Lith. pilnas).

The above sketch will suffice to show that in regard to morphology the Teutonic group of languages has many characteristic features which distinguish it from other languages of the same stock. On the other hand the morphological differences which exist among the Teutonic languages themselves are on the whole comparatively slight and due mainly to the operation of syncretism and other simplifying processes. In more recent times these processes have been carried still further, so that e.g. the Danish verb has lost all inflection and the German has practically disappeared in English. In the earlier stages of the Teutonic languages differences of phonology are more marked than those of morphology, and afford surer criteria for determining the relations of these languages to one another. It is customary among scholars to classify the whole group in three main divisions, an eastern or Gothic, a northern or Scandinavian, and a western which includes English, Frisian and German.

We have noticed above that Gothic began at an early date to show marked divergences from the other languages. The Scandinavian languages also certainly underwent a considerable number of peculiar changes before the beginning of their literatures. But it is to be remembered that from the 6th century to the 9th the Scandinavian peoples were practically cut off from communication with other Teutonic nations by the Slavonic occupation of Mecklenburg and eastern Holstein.

The earliest of the more striking sound-changes peculiar to Scandinavian, viz. the loss of initial j-, is not thought to have taken place before the 7th century, while the most characteristic features in its morphology, i.e. the development of the post-positive article and the new, more numerous, forms of the participle, are practically of a later period. If we confine our attention to changes which probably took place before the middle of the 7th century it will be seen that the English and Frisian languages may fairly be described as lying about midway between Scandinavian and German, though they had already developed well-marked characteristics of their own. They are doubtless to be regarded as the representatives of the old language of the maritime districts, and it is probable that languages of this type were at one time spoken along the whole of the coast between the present frontiers of Belgium and Denmark. On the other hand the special characteristics of German in all probability developed in the interior and those of Scandinavian round the Baltic and the Cattegat. From the 8th century onwards the High German (southern) dialects of German differed greatly from those spoken further north owing to the operation of the changes generally known as the "second sound-shifting."

The northern dialects, however (Old Saxon and Low Frankish), were essentially German, though both were more or less affected by Frisian influence.

The Gothic and Scandinavian languages have one or two characteristics in common, the most important of which is the treatment of intervocalic j and w in a number of words. In the former case we find Goth. jidd- and O.N. -ggi-, whereas in German a diphthong developed; e.g. Goth. twaddje (Gen. of twad, "twow"), O.N. tvegg: O.H.G. zweiio. In the latter case both Gothic and Scand. had g(w) (O.N. ggr), while a diphthong appears both in English and German, e.g. Goth. iriggus ("true"), O.N. trygger: A.S. ge-tr Vue, ge-true, O.H.G. gilruniu. It may also be noted that Gothic and Scandinavian preserved the ending -am in the first plural, while in the singular that of the strong Preterite, whereas in English and German there was a different form, having in each of the plur. (see above). On the ground of these common characteristics some scholars hold that Gothic and Scandinavian are more closely related to one another than to the other Teutonic languages. But, whatever may have been the case originally—and the evidence is far from conclusive—it is clear that by the 4th or 5th century the Scandinavian languages had far more resemblance to English and German than to Gothic.

The languages of the Vandals, Gepidae and other eastern tribes seem to have been practically identical with Gothic. That of the Burgundians, so far as we can judge from the slight evidence at our disposal, had at least as much in common with southern German as with Gothic, which may be due to the fact that this tribe, though originally located in the basin of the Oder, had moved westwards by the 4th century. The early divergence of the eastern languages in general from those of the north and west is perhaps to be ascribed in part to the great extension southwards of the territories of the eastern tribes in the 3rd and 4th centuries. Yet it is not to be overlooked that the geographical and ethnic divisions which today are the subject of discussion were of relatively recent origin, as compared, e.g., with the special characteristics of some of the Greek dialects. Indeed there is scarcely one of them of which we can say with certainty that it dates from before the beginning of our era.

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TEUTONIC ORDER, THE, or Teutonic Knights of St Mary's, Hospital at Jerusalem (Der deutsche Orden, Deutsche Ritter) was one of the three great military and religious orders, i.e. the Knights of the Hospital of St John of Jerusalem, the Hospitalers (see above), and the Teutonic Order, which dominated by 1240 the last Crusade and the latter century. Its original numbers remained large, and the knights of the Order retained their lands in the Holy Land even after the fall of Acre in 1291. Its order continued to exist, however, under the control of the Portuguese, and the Teutonic Knights of St Mary's, Hospital at Jerusalem (Deutsche Ritter), and the Hospital of St John in Jerusalem. The Teutonic Order was founded by the Teutonic Knights, who took the name of the Order of St John and St Mary. The Teutonic Order traces its origins to the 3rd Crusade. The Teutonic Order was founded in 1190 by the Emperor Frederick II. The order was formed in the Rhineland in the 13th century. It was composed of knights who had joined in the last Crusade and who had taken the name of the Teutonic Knights of St Mary's, Hospital at Jerusalem. The Teutonic Order was founded on the foundations of a hospital in a

1 Rübricht, Geschichte des Königreichs Jerusalem, p. 242.
vessel which they had drawn ashore. Within a few years the foundation apparently became attached to the German Church of St Mary the Virgin at Jerusalem; and in March 1198 (thoc being present in the Holy Land a number of Germans, the relics of Henry VI.'s projected crusade), the great men of the army and the kingdom raised the brethren of the German Hospital of St Mary to the rank of an order of knights. The original members were thus ennobled; and henceforth it was the rule that only Germans of noble birth could join the Order. The Order was chosen the first, therefore, by those who joined in the west of the Order the privileges of Crusaders; and the knights, supported by numerous donations and large accessions to their ranks, rapidly increased their territories. By 1260 they ruled the eastern bank of the Vistula from Kulm to its mouth, and the northern shore of the Baltic from the mouth of the Vistula to Königsberg. Livonia they held after 1237; and during the 14th century they gained the Lithuanian territory of Samogitia, which lay between Livonia and their Prussian dominions, while they also added, to the west of the Vistula, Pomerellen and the Neumark (see under PRUSIA). Already by the beginning of the 14th century these conquests had fundamentally changed the character of the Order. It lost any connexion with the East: after the fall of Acre in 1291, the grand master (whose seat had been at Acre, while the German master (Deutschmeister) had controlled the Order in Germany) moved first to Venice, and then in 1308, to Marienburg on the Vistula. Again, with the accession of large territories, the Order became a governing aristocracy; the original care for the sick, and even the later crusading zeal of the period of conquest, gave way, when conquests were gained and administration was needed, to the problem, half military, half political, of governing a frontier state. The statutes of the Order were altered to suit the new conditions, and a whole system of administration arose. At Marienburg the grand master maintained a magnificent court; round him were the five great dignitaries of the Order, the Grand Commander, the Marshal, the Hospitaler, the Treasurer (Tressler) and the Keeper of the Wardrobe (Trapier) to see to the clothing of the Order. There was a Landmeister for Livonia, and another (the Deutschmeister) for the German province, with his seat at Mergentheim in Swabia. Over each of the twenty districts of the Order was set a commander (Kontor), with the brethren of his own district as his subordinates, and the help of the advice of his brethren; and in the same way the general chapter of the Order, consisting of the landmeisters and the great dignitaries, formed an advisory board to the grand master in matters such as treaties and internal legislation. It was government by an aristocracy almost Venetian in character. The individual was merged in the Order: each brother must pray four times in the day, and four times at night, and he must at all times pay an unquestioning obedience to his superiors. The Order was at once supreme ecclesiastical and political authority. There were no struggles of Church and State in its dominions: the state was also the church: the bishops and the canons of the four bishoprics (with the exception of Ermland) were priests of the Order. The lay subjects of the Order consisted of two classes; on the one hand there were the conquered Prussians, in a position of servitude, bound in time of war to serve with the brethren in foreign expeditions; on the other hand there were the German immigrants, both urban and rural, along with the free Prussians who had voluntarily submitted and remained faithful. The towns were large and flourishing; as many as sixty arose in the period between 1233 and 1416, including Thorn and Elbing, Danzig and Königsberg (named after Ottokar of Bohemia, who took part in the Order during which it was founded). The towns possessed the rights of Magdeburg, or (like Elbing) those of Lübeck; the most important of them soon came to join the Hanseatic League. The Order only imposed customs duties: it levied no tolls within the land; and though its consent was necessary to any change in municipal ordinances, it allowed the towns a large amount of self-government. The Concord of the Order with the towns and the Hanse was one great cause of its prosperity.

In 1229 the Order began the conquest of Prussia, founding fortresses at each step to rivet its conquests (for instance, at Thorn, named after Toron in Palestine), much as the Anglo-Normans had done in their conquest of Wales. Frederic II. gave the Order the rights of a prince of the Empire in its territories: Conrad of Masovia gave it the whole of Kulmerland in 1230; while in 1234 the Order established its independence of all authorities except the Papacy, by surrendering its territories to the Holy See and receiving them back again as a fief. The Order gave to those who joined in the work of the Order the privileges of Crusaders; and the knights, supported by numerous donations and large accessions to their ranks, rapidly increased their territories. By 1260 they ruled the eastern bank of the Vistula from Kulm to its mouth, and the northern shore of the Baltic from the mouth of the Vistula to Königsberg. Livonia they held after 1237; and during the 14th century they gained the Lithuanian territory of Samogitia, which lay between Livonia and their Prussian dominions, while they also added, to the west of the Vistula, Pomerellen and the Neumark (see under PRUSIA). Already by the beginning of the 14th century these conquests had fundamentally changed the character of the Order. It lost any connexion with the East: after the fall of Acre in 1291, the grand master (whose seat had been at Acre, while the German master (Deutschmeister) had controlled the Order in Germany) moved first to Venice, and then in 1308, to Marienburg on the Vistula. Again, with the accession of large territories, the Order became a governing aristocracy; the original care for the sick, and even the later crusading zeal of the period of conquest, gave way, when conquests were gained and administration was needed, to the problem, half military, half political, of governing a frontier state. The statutes of the Order were altered to suit the new conditions, and a whole system of administration arose. At Marienburg the grand master maintained a magnificent court; round him were the five great dignitaries of the Order, the Grand Commander, the Marshal, the Hospitaler, the Treasurer (Tressler) and the Keeper of the Wardrobe (Trapier) to see to the clothing of the Order. There was a Landmeister for Livonia, and another (the Deutschmeister) for the German province, with his seat at Mergentheim in Swabia. Over each of the twenty districts of the Order was set a commander (Kontor), with the brethren of his own district as his subordinates, and the help of the advice of his brethren; and in the same way the general chapter of the Order, consisting of the landmeisters and the great dignitaries, formed an advisory board to the grand master in matters such as treaties and internal legislation. It was government by an aristocracy almost Venetian in character. The individual was merged in the Order: each brother must pray four times in the day, and four times at night, and he must at all times pay an unquestioning obedience to his superiors. The Order was at once supreme ecclesiastical and political authority. There were no struggles of Church and State in its dominions: the state was also the church: the bishops and the canons of the four bishoprics (with the exception of Ermland) were priests of the Order. The lay subjects of the Order consisted of two classes; on the one hand there were the conquered Prussians, in a position of servitude, bound in time of war to serve with the brethren in foreign expeditions; on the other hand there were the German immigrants, both urban and rural, along with the free Prussians who had voluntarily submitted and remained faithful. The towns were large and flourishing; as many as sixty arose in the period between 1233 and 1416, including Thorn and Elbing, Danzig and Königsberg (named after Ottokar of Bohemia, who took part in the Order during which it was founded). The towns possessed the rights of Magdeburg, or (like Elbing) those of Lübeck; the most important of them soon came to join the Hanseatic League. The Order only imposed customs duties: it levied no tolls within the land; and though its consent was necessary to any change in municipal ordinances, it allowed the towns a large amount of self-government. The Concord of the Order with the towns and the Hanse was one great cause of its prosperity.
in Livonia; the towns, such as Danzig; the native aristocracy, organized in a league (the Eidechsenbund, or League of the Lizard), all sought to use their opportunity. It was in vain that the heroic grand master, Henry of Plauen (1440-1453) sought to stem the tide of disaster; he was deposed by the chapter of the Order for his pains. The success of the Hussite raids in Germany gave fresh confidence to the Slavs of Poland. The Order was at variance within itself; some of the houses of the brethren refused to obey the marshal, and the grand master quarrelled with the German master. Above all, there arose in 1440 the Prussian League (Preussischer Bund), in which the towns of Germany and Prussia united together, nominally for common protection of their rights, but really against the Order. The League naturally sympathized with Poland, not only because Poland was the enemy of the knights, but also because under Poland it hoped to enjoy the practical liberty which Polish anarchy already seemed to offer. The ultimate result was that in 1454 an embassy of the League offered Prussia to the Polish king, and that, after many years of war, the Peace of Thorn (1466) gave to Poland West Prussia, with Marienburg, Thorn, Danzig and other towns, in full possession, and, while leaving East Prussia to the Order, made the Order the vassal of Poland for the territory which it retained. Henceforth the grand master was to sit in the Polish diet on the left of the king, and half of the knights of the Order were to be Polish.

From 1466 to 1526 grand masters of the Order ruled in East Prussia as vassals of Poland. But the master of the Livonian province and the German master would not obey a Polish vassal, and went their own way; the German master took the grand master's place as a prince of the Empire. The brethren of East Prussia, however, still sighed for independence; and they pursued the policy of choosing German princes to be grand masters of the Order, in the hope of regaining liberty by their aid. Frederick of Saxony held the office from 1468 to 1511; and he was succeeded by the Hohenzollern Albert of Brandenburg-Anspach. When Lutheranism arose, it spread rapidly in Prussia; Albert himself came into contact with Luther, and turning Protestant he secularized his territories, and (1526) made them into an hereditary duchy, still held as a fief of the king of Poland. Few of the brethren resisted; and the Order quietly ceased from the land where for three hundred years it had had its being.

Henceforth the Teutonic Order lived in Germany and in Livonia. The master of the latter province had beaten off an attack of the Russians in 1502, and secured a fifty years' peace. But in 1561 another master followed the example of Albert, and received Courland as an hereditary fief from Poland. Henceforth the Order was confined to Germany alone. The German master—now grand master and German master in one—had his headquarters at Mengenthal in Swabia; the revenues of the states scattered throughout the twelve bailiwicks of Germany sustained him and his Order. The Order, clinging to its rights with the conservatism of an ecclesiastical corporation, still maintained its claims to East Prussia, and pressed them tenaciously even against the electors of Brandenburg themselves, when they inherited the land on the failure of Albert's descendants in 1618. The French Revolution finally deprived the Order of all its estates, and for a while of its existence. In 1801 the bailiwicks to the west of the Rhine were absorbed by France; in 1809 the Order was entirely suppressed, and its lands went to the secular principalities in which they lay. But in 1840 the Order was resuscitated in Austria, where it now exists as a semi-religious knighthood, closely connected with the Habsburgs.

It has remembered its earliest objects, and has of late years engaged during war in the ambulance service. "At the foot of sunny vineyards," says Treitschke, "the house of the Teutonic Order now stands at Botzen; on its door is still emblazoned the black cross—in the middle of the shield of the Habsburg-Lorrainers." Whatever its connexion with the Habsburgs, the Order has its real heirs in the Hohenzollerns of Prussia. When Frederic the Great gained West Prussia by

1 Every house of the Order had two learned brethren, one learned in the law, one in theology. There were also elementary schools, and municipal foundations in which Latin was taught, in the dominions of the Order.
The first partition of Poland (1772), he was uniting together once more the dominions of the Order, sanded since 1466; and it is the kings of Prussia who have inherited the Order’s task of maintaining German influence on the banks of the Vistula.

Literature.—The article is chiefly based on H. von Treitschke’s Das deutsche Ordensland Preussen, in Historische und politische Aufsätze, vol. ii. (Leipzig, 1870–71), and on J. Loserth, Geschichtedes spätern Mittelalters (Munich and Berlin, 1903). Loserth gives a bibliography of authorities dealing with the history of the Order on pp. 331, 365 to 368. The original evidence is to be found in E. Scholz, Tabulae Ordinis Teutonicorum (Berlin, 1869), and in Scriptores rerum Prussicarum (Leipzig, 1861–1870). J. Voigt has traced the history of the Order previous to 1526 in his Geschichte Preussen (Berlin, 1877–78); J. Loserth, Geschichte des Teutonic Order, and with its history in Germany from 1525 to 1858, in his Geschichtedes deutschen Ritterorden in seinen zwölf Büchern in Deutschland (Berlin, 1857–1859). More recent writers are Loserth, Geschichtedes Ost- und Westpreussen (Gotla, 1880), and Prutz, Geschichte Preussen (Stuttgart, 1900). For monographs on the grand masters, the various territories, and the different epochs in the history of the Order see the references in Loserth’s work (E. Br.)

**TEUTONIC PEOPLES,** a comprehensive term for those populations of Europe which speak one or other of the various Teutonic languages, viz., the English-speaking inhabitants of the British Isles, the German-speaking inhabitants of Germany, Austria-Hungary and Switzerland, the Flemish-speaking inhabitants of Belgium, the Scandinavian-speaking inhabitants of Sweden and Norway and practically all the inhabitants of Holland and Denmark. To these we have to add small German and Flemish-speaking communities in Italy and France and some in Switzerland and Silesia.Outside Europe we have to include also the very numerous populations in America, Africa, Australasia, &c., which have emigrated from the same countries. The statement that the Teutonic peoples are those which speak Teutonic languages requires a certain amount of qualification on one side. In the British Isles, especially Ireland, there is (in addition to the Celtic-speaking elements) a considerable population which claims Celtic nationality though it uses no language but English; and further all Teutonic communities contain to a greater or less degree certain immigrant (especially Semitic) elements which have adopted the languages of their neighbours. On the other hand there does not appear to be any considerable population anywhere which claims Teutonic nationality without using a Teutonic language. We know indeed that France, Spain, Italy, &c., contained within historical times large populations which were Teutonic both by origin and by language, but these have now been completely absorbed. Similarly, there is no doubt that the inhabitants of England and of the German-speaking regions of the Continent are descended largely from peoples which two thousand years ago spoke non-Teutonic languages. Yet on the whole the definition given above may be accepted as generally true for the present time.

It is to be observed that the term “Teutonic” is of scholastic and not of popular origin, and this is true also of the other terms (“Germanic,” “Gothic,” &c.) which are or have been used in the same sense. There is no generic term now in popular use either for the languages or for the peoples, for the reason that their common origin has been forgotten. In Tacitus’s time, however, when the area occupied by the Teutonic peoples was, of course, considerably less than now, a consciousness of their relationship to one another was fully retained. He cites native poetry which showed that the language elements, Herminic and Istaæones—the three main branches of the Germani (see below)—were sprung from three sons of a certain Mannus (perhaps “Man”), who was himself the son of the god Tuisto; the son of Earth; and in a Frankish document at least four centuries later we hear again of three brothers named Erminius, Ingus and Istio, from whom many nations were descended. In English documents also we find eponymous national ancestors grouped together in genealogical trees, and there is reason to believe that the common origin of the various Teutonic peoples was remembered to a certain extent until comparatively late in the middle ages.

The linguistic characteristics of the various Teutonic peoples have been dealt with under TEUTONIC LANGUAGES. In regard to physical features they present at the present time very many varieties both of stature and of pigmentation, though on the whole they are probably the tallest and fairest of European peoples. These characteristics are noted by a number of ancient writers in language which seems to show that they must at that time have been at least as pronounced as at any of the present time. The Teutonic peoples, however, the tallest and dolichocephalic which now specially mark the more northern peoples of the group appear very prominently in cemeteries of the migration period in Switzerland and other neighbouring countries. On the whole, however, the skeletons found in German and Scandinavian tombs dating even from the earliest period do not show any very remarkable differences from those of the present day. But whether we are justified in speaking of a Teutonic race in the anthropological sense is at least doubtful, for the most striking characteristics of these peoples occur also to a considerable extent in the eastern and western neighbours, where they can hardly be ascribed altogether to Teutonic admixture. The only result of anthropological investigation which so far can be regarded as definitely established is that the old Teutonic lands in northern Germany, Denmark and southern Sweden have been inhabited by people of the same type since the neolithic age, if not earlier.

The results of investigations in prehistoric archaeology are treated in the articles GERMANY and SCANDINAVIAN CIVILIZATION. As no Teutonic inscriptions are extant from before the third century B.C., the Teutonic peoples became important only after this time. What types of objects are characteristic of Teutonic civilization in the bronze and earliest iron ages. Yet throughout the bronze age it is possible to trace a fairly well-defined group of antiquities covering the basin of the Elbe, Mecklenburg, Holstein, Jutland, southern Sweden and the islands of the Belt, and archaeologists have conjectured with much probability that these antiquities represent the early civilization of the Teutonic peoples. The civilization was, of course, not wholly of native growth. Strong foreign influence, first Aegean and later Etruscan, can be distinguished; but the types introduced from the south have generally undergone considerable modification and expansion. The somewhat surprising degree of wealth and artistic skill of which many of the earliest antiquities give evidence is probably to be explained by the importance of the amber trade. Both in eastern and in western Germany the objects found are of somewhat different types and seem to point to a lower standard of civilization. What peoples inhabited these regions can only be conjectured, but there is a certain amount of evidence from place-names—not altogether satisfactory—that the Celtic peoples at one time extended eastwards throughout the basin of the Weser. With the beginning of the iron age (perhaps c. 500–500 B.C.) Celtic influence becomes apparent everywhere. By this time, however, the great Celtic movement towards the south-east had probably begun, so that the Teutonic peoples were now cut off from direct communication with the centres of southern civilization.

1. History.—The first recognition that the inhabitants of Germany, Holland, &c., were a people distinct from their Celtic neighbours dates from about the middle of the 1st century B.C., when Caesar’s conquest of Gaul rendered a knowledge of northern Europe more generally accessible to the Romans. Certain notices relating to individual Teutonic tribes come down from still earlier times. Thus there can be little doubt that the Cimbri (g.v.) and their allies, who invaded Illyricum, Gaul and Italy in the last years of the preceding century, were for the most part of Teutonic nationality. The Bastarnae also, who in the 3rd century B.C. invaded and settled in the regions between the Carpathians and the Black Sea, are said by several ancient writers to have been Teutonic by origin, though they had largely intermarried with the native inhabitants. Again, individual travellers from the time of Pytheas onwards had visited Teutonic countries in the north. In none of the early records, however, do we get any clear indication that the
Teutonic peoples were distinguished from the Celts. From the time of Caesar onwards the former were known to the Romans as “Germani,” a name of uncertain, but probably Gaulish origin. It is said to have been first applied to certain Belgic tribes in the basin of the Meuse, who may formerly have come from beyond the Rhine.

At the beginning of our era the Teutonic peoples stretched from the Rhine to the Vistula. Before Caesar’s arrival in Gaul they had advanced beyond the former river, but their further progress in this direction was checked by his campaigns, and, throughout the first half of the century, they were checked by Teutonic tribes throughout the greater part of its course, most of these tribes remaining in definite subjection to the Romans. The easternmost Teutonic tribe was probably that of the Goths, in the basin of the Vistula; while the farthest to the south were the Marcomanni and Quadi, in Bohemia and Moravia. These latter districts, however, had been conquered from the Boii, a Celtic people, shortly before the beginning of our era. Towards both the south and west the Teutonic peoples seem to have been pressing the Celts for some considerable time, since we are told that the Helveti had formed a common arrangement as far as the Main, while, according to our Celtic tribe, the Vorni Teutones, occupied a still more remote position, which it is impossible now to identify. How far the Teutonic peoples extended northwards at this time cannot be determined with certainty, but it is clear that they occupied at least a considerable part of the Scandinavian peninsula.

It has already been mentioned that the Teutonic peoples of this period seem to have been fully conscious of their common origin. What exactly the grouping into Inguaeaeus, Herminos and Istaeques was based upon can only be conjectured, though probably its original basis was to be sought rather in religion than in political union. The name of the Herminos, who are defined as “central” or “interior” peoples, is probably connected with that of the Irmisus, the sacred pillar of the Old Saxons. The Inguaeaeus again are defined as being “next to the ocean,” but the name can be traced only in Denmark and Sweden, where we find the eponymous hero Ing and the god Yngvi (Frey) respectively. It is likely that the name really belonged only to the peoples of the southern Baltic. Very probably there were many tribes which did not regard themselves as belonging to any of these groups, Tacitus himself records a variant form of the genealogy (see above), according to which Mannus had a larger number of sons, who were regarded as the ancestors of the Suebi, Vandili, Marsi and others (see Suebi, Vandals). In two at least of these cases we hear of sanctuaries which were resorted to by a number of tribes. It is not to be doubted that such religious confederations were favourable to the existence of political unions. Generally speaking, however, each tribe formed a political unit in itself, and the combinations brought together from time to time in the hands of powerful kings were liable to fall to pieces after the first disaster. For a few years at the beginning of the Christian era the part of Germany which lies west of the Elbe was under Roman government; but after the defeat of Varus (A.D. 9) the Rhine and the Danube formed in general the frontiers of the empire. Roman influence, however, made itself felt both by way of trade and especially by the employment of German soldiers in the auxiliary forces. In the age of national migrations—from the 4th to the 6th century—the territories of the Teutonic peoples were vastly extended, partly by conquest and partly by arrangement with the Romans. These movements began in the east, where we find the Goths ravaging Dacia, Moesia and the coast regions as early as the 3rd century. In the following century the Vandals settled in Pannonia (western Hungary), while the Goths occupied Dacia, which had now been given up by the Romans, and subsequently took possession also of large territories to the south of the lower Danube.

The 5th century was the time of the greatest national movements. In 406–9 the Vandals and other tribes invaded Gaul from the east and subsequently took possession of Spain and north-western Africa. Immediately afterwards the Visigoths invaded Italy and captured Rome; then turning westwards they occupied southern Gaul and Spain. The southern Suebic peoples, the Alamanni and Bavarians, extended their frontiers as far as the Alps probably about the same time. Not much later a considerable portion of northern Gaul fell into the hands of the Franks, and before the middle of the century the eastern part was occupied by the Burgundians. Several of these movements were due, without doubt, to pressure from the Huns, an eastern people who had conquered many Teutonic tribes and established the centre of their power in Hungary. Their empire, however, speedily fell to the share of their king Attila in 453. The chief events of the latter part of the century were the conquest of the eastern part of Britain by the Angli, the invasion of Italy by the Ostrogoths and the complete subjugation of northern Gaul by the Franks. By this time, with the exception of Brittany and the southern part of the Balkan peninsula, practically the whole of southern and western Europe was under Teutonic government.

It is customary to attribute this great expansion partly to the increasing weakness of the Romans and partly to pressure of population in the regions of their expansion. It may contain a residue of truth; but there is also doubt whether the military strength of the Teutonic nations was far more formidable now than it had been in the time of the early empire. Not only is it clear, both from literary and archaeological evidence, that they were better armed (see below), but also their power was much more concentrated. Thus during the 1st century we hear of about a dozen different tribes in and around the lower part of the basin of the Rhine. In later times, with one or two possible exceptions, these were all included under the general term Franks, and by the end of the 5th century all had become subject to one king. Similar processes can be traced elsewhere, e.g. among the Alamanni and in the northern kingdoms. Their effect, of course, must have been to provide the kings with greater wealth and with larger permanent bodies of armed men. The motive force towards expansion of territories was supplied by military ambition; especially we have to take account of the growth of a warlike spirit in the North, which was constantly driving young warriors to seek their fortunes in the service of continental princes. Where the movement was really of a migratory character it may generally be ascribed to external pressure in particular from the Huns and the Avars.

The first half of the 6th century saw the subjugation of the Burgundian and Visigothic portions of Gaul by the Franks and the recovery of Africa by the Romans. This latter event was soon followed by the overthrow of the Ostrogothic kingdom; but not many years later Italy was again invaded by the Langobardi (Lombards), the last of the great Teutonic migrations. By this time the extension of Teutonic dominion towards the south and west had brought about its natural sequel in the occupation of the old Teutonic lands in eastern Germany, including even the basin of the Elbe, by Slavonic peoples. Before the end of the century Bohemia also and Lower Austria, together with the whole of the basins of the Drave and the Save, had become Slavonic countries.

The story of the succeeding centuries may briefly be described as in general a process of return to the ethnographical conditions which prevailed before the migration period. The Franks and the Langobardi remained in Gaul and Italy, but they gradually became denationalized and absorbed in the native populations, while in Spain Teutonic nationality came to an end with the overthrow of the Visigothic kingdom by the Moors, if not before. Yet throughout the west and south-west the Teutonic frontier remained from fifty to two hundred miles in advance of its position in Roman times. In south-eastern Europe also the Teutonic elements were swallowed up by the native and Slavonic populations, though a small remnant lingered in the Crimea until probably the 17th century. On the other hand the political consolidation of the various continental Teutonic peoples (apart from the Danes) in the 8th century led to the gradual recovery of eastern Germany together with Lower Austria and the greater part of Styria and Carinthia, though
Bohemia, Moravia and the basins of the Vistula and the Warthe have always remained mainly Slavonic. In the British Isles the Teutonic element, in spite of temporary checks, eventually became dominant everywhere. Lastly, from the very beginning of the 9th century bodies of Scandinavian warriors began to found kingdoms and principalities in all parts of Europe. The settlers, however, were not sufficiently numerous to preserve their nationality, and in almost all cases they were soon absorbed by the populations (Teutonic, Celtic, Latin or Slavonic) which they had conquered. Their settlements in Greenland and Canada likewise came to an end, but Iceland, which was formerly uninhabited, remained a Scandinavian colony. The permanent expansion of the Teutonic peoples outside Europe did not begin till the 16th century.

2. Form of Government.—From the evidence at our disposal it is difficult to determine how far the Teutonic peoples were under kingly government in early times. Tacitus speaks of tribes which had kings and tribes which had not, the latter apparently being under a number of princes. On nearer examination, however, it appears that kingship was intermittent in some tribes, while in others, which had no kings, we find mention of royal families. All such cases were perhaps peculiar to the western peoples; in the east, north and centre we have no evidence for kingless government. Further, while Tacitus represents the power of Teutonic kings in general, with reference no doubt primarily to the western tribes, as being of the slightest, he states that among the Goths, an eastern people, they had somewhat more authority, while for the Swedes he gives a picture of absolutism. It is quite in harmony with these statements that many Northern and probably all the Anglo-Saxon kingly families traced their origin to the gods. The Swedes, indeed, and some of the eastern peoples seem to have regarded their kings themselves as at least semi-divine (see below, § Religion). As the west was the side most open to foreign influence during the Roman period, it is likely that the form of government which prevailed there was less primitive than the other, especially as we know that kingship had by this time died out among the Goths. In later times we very frequently find a number of "kings," generally belonging to one family, within the same tribe; and it is not improbable that the early princes were persons of similar position. The kingless state may therefore have arisen out of kingship through divisions of the royal power or through failure on the part of the leading men to agree on a head acceptable to all. On the other hand the conditions of the migration period were doubtless favourable to monarchical government, and from this time onwards kingship appears to have been universal, except among the Old Saxons and Franks.

The comitum or tribal assembly figures largely in Tacitus's account of the Germani, and he represents it as the final authority on all matters of first-rate importance. Further, it was here that the princes were chosen, serious charges brought against members of the tribe and youths admitted to the rights of warriors. The duties of opening the proceedings and maintaining order belonged not to the king but to the priests, from which we may probably infer that the gathering itself was primarily of a religious character and that it met, as among the Swedes in later times, in the chief's dwelling (Gaulh of the Latins, sanctuary). Such religious gatherings were no doubt common to all Teutonic peoples in early times, but it may be questioned whether among the eastern and northern tribes they were invested with all the powers ascribed to them by Tacitus. After his time tribal assemblies are seldom mentioned, and though we hear occasionally, both in England and elsewhere, of a concourse of people being present when a king holds court on high days or religious festivals, there is no evidence that such concourses took part in the discussion of state affairs. Indeed, considering the greatly increased size of the kingdoms in later times, it is improbable that they were drawn from outside the immediately adjacent districts. When we hear of deliberations now they are those of the king's council or court, a body consisting partly of members of the royal family and partly of warriors old and young in the personal service of the king. Such bodies of course had always existed (see below) and exercised at all times a powerful influence upon the kings, frequently even forcing them into war against their own wishes. That they were more prominently now than in earlier times is due to the fact that owing to the increased size of the kingdoms, they had become both more numerous and more wealthy. The principle of representation for the unofficial classes, i.e. for those not under the immediate lordship of the king, scarcely begins before the 13th century.

Of all the institutions of the Teutonic peoples probably none exercised a greater influence on their history than the comitatus. From Caesar we learn that it was customary at tribal assemblies for one or other of the chiefs to propose an expedition. He the exact position of the god who embraced his service were held bound to accompany him to the end, any who drew back being regarded as traitors. Incidents illustrative of this custom are of frequent occurrence in early history and tradition. Moreover, kings and other distinguished persons kept standing bodies of young warriors, an honour to them in time of peace, as Tacitus says, as well as a protection in war. Chiefs of known prowess and liberality attracted large retinues, and their influence within the tribe, and even beyond, increased proportionately. The followers (called by Tacitus comites, in England anlrusites, 8 c.) were expected to remain faithful to their lord even to death; but 40 close was the relationship between the two that it seems to have reckoned as equivalent to that of father and son. According to Tacitus it was regarded as a disgrace for a comites to survive his lord, and we know that in later times they frequently shared his exile. Perhaps the most striking instance of such devotion was that displayed at the battle of Strassburg in 357, when the Alamannic king Chonodomarius was taken prisoner by the Romans, and his two hundred comites gave themselves up voluntarily to share his captivity. In return for his services the chief was expected to reward his followers with treasure, arms and horses. If he were a king the reward might take the form of a grant of land, or of jurisdiction over a section of the population subject to him—in early times a village, in later, perhaps, a considerable district. Further, since the grantees as a rule naturally sent their sons into the service of their own lords, such grants tended to become hereditary, and in them we have the origin of the baronage of the middle ages. The origin of the earls or counts, on the other hand, is to be found in the governors of large districts (Tacitus's principes), who seem at first generally to have been the sons of the royal family, though later they were drawn from the highest barony.

3. Social Organization.—As far back as the time of Tacitus we hear of three social classes, viz. nobles, freemen and freedmen. The same classes are met with in later times, though occasionally one of them disappears, e.g. the nobility among the Franks and the freedmen (as a distinct class) in the Anglo-Saxon kingdoms, except Kent. Each of these classes was, to a large extent at least, hereditary and had separate rights and privileges of its own. Among the chief of these must be reckoned the wergeld or "man-price." When homicide took place vengeance was regarded as a sacred duty incumbent on the relatives, and sometimes at least the lord also, of the slain man; but, as in the case of any other injury, compensation could be made by a fixed payment. From the evidence of later custom it is probable that the normal payment for a freeman was a hundred head of cattle. The sums paid for members of the other classes were more variable; for the freedman, however, they were always lower, and for the noble higher, sometimes apparently three or four times as high. Similar gradations occur in the compensations paid for various injuries and insults, in fines and, among some tribes, in the value attached to a man's oath. There is a good deal of uncertainty in regard to the exact position in society of the husbandman of Tacitus's age. It is probable, however, that the latter, like
the liti or lati of later times, consisted not only of manumitted slaves but also of whole communities which had forfeited their liberty through unsuccessful warfare or other causes. In addition to these classes there was also a considerable population of slaves, who had no legal status or wergeld and were regarded as the property of their masters. In general, however, their lot seems to have struck the Romans as favourable, since they were not attached to their masters' households but lived in homes of their own, subject to fixed payments in corn, live stock, and cash.

Groups of family and kindred occupy a prominent position in the accounts of Teutonic society given by Caesar and Tacitus. It was regarded as a universal duty to afford protection to one's kinsmen, to assist them in the redress of wrongs and to exact vengeance or compensation in case of death. Hence to have a numerous kindred was a guarantee of security and influence. The large amounts fixed for the wergelds of nobles and even of freemen were paid no doubt, as in later times, not only by the slayer himself, but by every member of his kindred in proportion to his wealth or remoteness of his relationship like manner they were distributed among the kindred of the slain. The importance of the kindred, however, was not limited to purposes of mutual protection. It appears also in the tenure of land, and according to Tacitus the tribal armies were drawn up by kindreds. As to the nature of these organizations the evidence is not altogether consistent. It is clear that agnatic succession prevailed among the princely families of the Cherusci, and the general account given in the Germania seems to imply that this type of organization was normal. On the other hand there are distinct traces of cognation not only in Teutonic works but also in Nordic tradition, and the kindred was more especially in the Salic law. On the whole it seems not unlikely that at the beginning of the Christian era the Teutonic peoples of the continent were in a state of transition from cognatic to agnatic organization.

All the usual forms of marriage were known, including marriage by capture and marriage by purchase. The latter appears most prominently in Kent and among the Old Saxons, Langobardi and Burgundians. In other nations, e.g. the Franks, we find the payment of a very small sum or of no sum at all. Frequently the only price required was a sum of gold or purchase. Yet this explanation is open to question owing to the very early date at which the regulation appears, and to the fact that in the case of widows the sum specified had to be paid to relatives of the widow herself on the female side, and by preference to those of a younger generation. Again, Tacitus states that the presents of arms and oxen given by the bridegroom at marriage were made to the bride herself and not her guardian, and such appears to have been the case in the North also from early times. It is not certain, therefore, that marriage by purchase was a universal and primitive Teutonic custom. Of the actual ceremonies practised at marriage not very much is known. It was preceded, however, by a formal betrothal and accompanied by a feast. Moreover, even among those peoples with whom purchase prevailed it was customary for the bridegroom to present the bride with a "morning-gift," which in the case of queens and princesses often took the form of considerable estates. There is no doubt that the marriages of heathen times were often of a kind which could not be permitted after the adoption of Christianity. Among these may be mentioned marriages with brothers' widows and stepmothers, the latter especially in England. Polymy was known, but limited, both in early and late times, to persons of exceptionally high position, while of polyandry there is hardly any trace. Indeed, the sanctity attached to marriage seems to have struck the Romans as remarkable. On the other hand strife between persons connected by marriage appears to have been of extremely frequent occurrence, and no motive plays a more prominent part in Teutonic traditions.

4. State of Civilization.—It is a much disputed question whether the Teutonic peoples were really settled agricultural communities at the time when they first came into contact with the Romans, shortly before the beginning of our era. That agriculture of some kind was practised is clear enough from Caesar's account, and Strabo's statement to the contrary must be attributed to ignorance or exaggeration. But Caesar himself seems to have regarded the Germani as essentially pastoral peoples and their agriculture as of quite secondary importance, while from Tacitus we gather that even in his time it was of a somewhat primitive character. For not only were the husbandmen in North Germany expressly told that late in the spring apparently the ploughlands were changed from year to year without any recognition of a two-course or three-course system. Caesar, moreover, says that the clans or kindreds to whom the lands were allotted changed their abodes also from year to year—a statement which gives a certain amount of colour to Strabo's description of the Germani as quasi-nomadic. Yet there is good reason for believing that this representation of early Teutonic life was by no means universally true. We have evidence, both archaeological and linguistic, that the cultivation of cereals in Teutonic lands goes back to a very remote period, and that even the earliest of the ox-ploughs is attested by the rock-carvings at Tegneyb in Bohuslän (Sweden), which are believed to date from early in the bronze age. Further, that the tribes were not normally of a migratory character, as Strabo seems to imply, is shown by the existence of sanctuaries of immemorial age and by frontier ramparts such as that raised by the Angariumi against the Cherusci. It would seem that Julius Caesar encountered the Germani under somewhat abnormal conditions. Several of the tribes with which he came into collision had been expelled from their own territories by other tribes and in North Germany expressly told that late in the spring they had not entered a house for fourteen years. Further, there is satisfactory evidence that the basin of the Rhine, perhaps also a considerable area beyond, had been conquered from Celtic peoples not very long before—from which it is probable that western Germany was still in a more or less unsettled condition. Indeed Caesar himself seems to have regarded the prevalence of the military spirit as the chief hindrance to the development of agriculture. From this time onwards it was from the west mainly that Roman civilization made its way into Germany; but in earlier ages, as we have already noticed, there are more abundant traces of civilization in the basin of the Elbe than in the districts farther to the west. Hence it is not so surprising as might at first sight appear that at the remote Aestii, a non-Teutonic people settled about the mouth of the Vistula, are represented by Tacitus as keener agriculturists than any of the other inhabitants of Germany.

All ancient writers emphasize the essentially warlike character of the Germani. Yet Tacitus seems to represent their military equipment as being of a somewhat primitive type. Swords, helmets and coats of mail, be says, were seldom to be seen; in general they, were armed only with huge shields, unwieldy spears and darts. Here again he appears to be thinking of the western tribes; for elsewhere he states that some of the eastern peoples were armed with short swords and round shields—which probably were of comparatively small size, like those used in later times. This latter type of equipment prevailed also in the North, as may be seen, e.g. from the figures of warriors on the inscribed golden horn found at Galliche (Jutland) in 1734. The favourite method of attack was by a wedge formation (known later in the North as stenvykling), the point being formed by a chosen band of young warriors. Certain tribes, such as the Tencteri, not only for their horses but for the Germani in general preferred to fight on foot. Sometimes also we hear of specially trained forces in which the two arms were combined. Naval warfare is seldom mentioned. The art of sailing seems to have been unknown, and it is probable that down to the 3rd century the only peoples which could truly be described as seafaring were those of the Baltic and the Cattegat.

There is no doubt that Roman influence brought about a considerable advance in civilization during the early centuries of our era. The cultivation of vegetables and fruit trees seems to have been practically unknown before this period, and almost
all their names testify to the source from which they were derived. We may notice also the introduction of the mill in place of the quern which hitherto had been in universal use. In all such cases the tribes subject to the Romans, in the neighbourhood of the Rhine, probably the chief channel by which Roman influence made its way, though account must also be taken of the fact that considerable numbers of warriors from remoter districts were attracted to serve in the Roman armies. Great improvements took place likewise in armour and weapons; the equipment of the warriors whose relics have been found in the Schleswig bog-deposits, dating from the 4th and 5th centuries, appears to have been vastly superior to that which Tacitus represents as normal among the Germans of his day. Yet the types, both in armour and dress, remained essentially from Teutonic or rather Chetic-Teutonic. Indeed, when in the course of time uniformity came to prevail over the greater part of Europe, it was the Teutonic rather than the Roman fashions which were generalized.

The antiquity of the art of writing among the Teutonic peoples is a question which has been much debated. Tacitus says that certain marks were inscribed on the divining chips, but it cannot be determined with certainty whether these were really letters or not. The national type of writing, generally known as Runic, must have been fully developed by the 4th century, when some of its letters were borrowed by Ulfilas (Wulfila) for his new alphabet (see Gotius: § C.). Indeed, by this time it was probably known to most of the Teutonic peoples, for several of the inscriptions found in Jutland and the islands of the Belt can hardly be of later date. As to the source from which it was derived opinions still differ, some thinking that it was borrowed from the Romans a century or two before this time, while others place its origin much farther back and trace it to one of the ancient Greek alphabets. Many of the earliest inscriptions read from right to left, and the βουκραφος' type is also met with occasionally. It is clear from the time of their use that the character was chiefly used for writing on wood, but the inscriptions which have survived are naturally for the most part on metal objects—in Sweden, Norway and England also on monumental stones. In Germany very few Runic inscriptions have been found, and there is nothing to show that the alphabet was used after the 8th century. In England also it seems not to have lasted much longer, but inscriptions are far more numerous. On the other hand, in Scandinavian countries it continued in use through the greater part of the middle ages—in Gotland till the 16th century; indeed, the knowledge of it seems never to have wholly died out. In the course of time it underwent many changes, and the earliest inscriptions must have been unintelligible for over a thousand years until they were deciphered by scholars within the last half century. The Roman alphabet first came into use among the western and northern Teutonic peoples after their adoption of Christianity.

5. Funeral Customs.—Icelandic writers of the 12th and 13th centuries distinguished between an earlier "age of burning" and a later "age of barrows," and the investigations of modern archaeologists have tended in general to confirm the distinction, though they failed to establish any evidence that the character of the ceremony was antecedent to the age of burning. Throughout the stone age inhumation appears to have been universal, many of the neolithic tombs being chambers of considerable size and constructed with massive blocks of stone. Cremation makes its appearance first in the earlier part of the bronze age, and in the latter part of that age practically displaces the older rite. In the early iron age there is less uniformity, some districts apparently favouring cremation and others inhumation. The former practice is the one recognized by Tacitus. In the national migration period, however, it fell into disuse among most of the continental Teutonic peoples, even before their conversion, though it seems to have been still practised by the Heruli in the 5th century and by the Old Saxons probably till a much later period. It came into Britain with the Anglo-Saxon invaders and continued in use in certain districts perhaps until nearly the close of the 6th century. In Scandinavian lands the change noted by Icelandic writers may be dated about the 5th and 6th centuries, though inhumation was certainly not altogether unknown before that time. After the 6th century cremation seems not to have been common, if we may trust the sagas, but isolated instances occur as late as the 10th century. It is to be observed that cremation and the use of the barrow are not mutually exclusive, for cremated remains, generally in urns, are often found in barrows. On the other hand inhumation below the surface of the ground, without perceptible trace of a barrow, seems to have been the most usual practice during the national migration period, both in England and on the continent. A special form of funeral rite peculiar to the North was that of cremation on a ship. Generally the ship was drawn up on land; but occasionally we hear, in legendary sagas, of the burning ship being sent out to sea. Large ships containing human remains have sometimes been found in barrows of the viking age. Arms and ornaments are frequently met with, sometimes also horses and human remains which may be those of slaves, the belief being that the dead would have all that was buried with him at his service in the life beyond.

6. Religion.—The conversion of the Teutonic peoples to Christianity was a gradual process, covering some seven centuries. The first to accept the new religion seem to have been the Goths, beginning about the middle of the 4th century, and the Vandals must have followed their example very quickly. In the course of the 5th century it spread to several other nations, including the Gepidae, Burgundians, Rugii and Langobardi. In all these cases the Arian form of Christianity was the one first adopted. The first conversion to the Catholic form was that of the Franks at the end of the 5th century. The extension of Frankish supremacy over the neighbouring Teutonic peoples brought about the adoption of Christianity by them all, partly under compulsion, and these and these are generally in no way comparable to the detailed accounts given in Icelandic writings. Hence it is often difficult to decide whether a given rite or legend which is mentioned only in Icelandic literature was really peculiar to that country alone or to the North generally, or whether it was once the common property of all Teutonic peoples.

A number of gods were certainly known both in England and among many, if not all, the Teutonic peoples of the continent, as well as in the North. Among these were Odin (Woden), Thor (Thunor) and Tyr (Ti); so also Frigg (Frig), the wife of Odin (see Frigg, Odin, Woden, Thor, Tyr). Some scholars have thought that Baldur, the son of Odin, was once known in Germany, but the evidence is at least doubtful. Heimdalr, the watchman of the gods and Ullr, the stepson of Thor, as well as Hoenir, Bragi and most of the other less prominent gods,
were also probably peculiar to the North, though Ullr at least was known in Denmark. Some of these deities may originally have been quite local. Indeed, such may very well have been the case with Frey, the chief god of the North after Thor and Odin. Tradition at all events uniformly points to Upsala as the original home of his cult. But it is probable that both he and his sister Freyja were really specialized forms of a divinity which had once been more widely known. Their father, Njörðr, the god of wealth, who is a somewhat less important figure, corresponds in name to the goddess Nerthus (Hertha), who in ancient times was worshipped by a number of tribes, including the Angli, round the coasts of the southern Baltic. Tactus describes her as "Mother Earth," and the account which he gives of her cult bears a somewhat remarkable resemblance to the ceremonies associated in later times with Frey. This family of deities were collectively known as Vanir, and are said to have once been hostile to the Asir, to whom Odin belonged. Their worship was generally connected with peace and plenty, just as that of Odin was chiefly bound up with war. Gefjon was another goddess who may represent a later form of Nerthus. In her case tradition points distinctly to a connexion with Denmark (Sjælland). On the other hand, the portrayal of Skáddi, the wife of Njörðr, seems to point to a Finnish or Lappish origin. The rest of the northern goddesses are comparatively unimportant, and only one of them, Fulla, the handmaid of Frigg, seems to have been known on the continent.

Some of the deities known to us from German and English sources seem always to have been of a blended character. Such a god was Fúit, to whom Helgaland was sacred. Saxnot (Seaxneat), from whom the kings of Essex claimed descent, was probably a god of the Saxons. Holda, who is known only from the folklore of later times, appears to have been a German counterpart of Nerthus. Ing, who is connected with Denmark in Anglo-Saxon tradition, was in all probability the eponymous ancestor of the Ingueanos (see above). His name connects him, too, with the god Frey, who was also called Yngvifreyr and Ingunnarfreyr, and he must at one time have been closely associated with Nerthus. The relationship of Ing to the Ingueanos is paralleled by that of Ieuan in the Harp (see above). He may be the deity whom Tacitus called "Heracles."

Some of these eponymous ancestors may be regarded as heroes rather than gods, and classed with such persons, as Skíöldr, the eponymous ancestor of the Danish royal family, who is not generally included in the Northern pantheon. But the line of division between the human and the divine is not very definite. The royal family of Norway claimed descent from Frey, and many royal families, both English and Northern, from Woden (Odín). Indeed, several legendary kings are described as sons of the latter. Sometimes, again, the relationship is of a conjugal character. Skíöldr, though hardly a god himself, is the husband of the goddess Gefjon. So we find Freyja's priest described as her husband and Frey's priestess as his wife, and there is no reason for regarding such cases as exceptional.

If it is not always easy to distinguish between gods and heroes, there is still greater difficulty in drawing a line between the former and other classes of supernatural beings, such as the "giants." (O.N. jötnar, A.S. ēotenās). Here again we have intermarriage. Skáddi, the wife of Njörðr, and Gerðr, the wife of Frey, were the daughters of the giants Thialzi and Gymir respectively, though Skáddi is always reckoned as a goddess. Loki also was of giant birth; but he is always reckoned among the gods, and we find him constantly in their company, in spite of his malevolent disposition. In general it may be said that the giants were regarded as hostile to both gods and men. Often they are represented as living a primitive life in caves and desolate places, and their character is usually ferocious. But there are exceptions even among the male giants, such as Aegir, whom we find on friendly terms with the gods. It is worth noting also that some of the leading families of Norway are said to have claimed descent from giants, especially from Thrymr, the chief opponent of Thor. In such cases there may be some connexion between the giants and the semi-civilized (Finnish or Lappish) communities of the mountainous districts. This connexion is more clear in the case of Thórgárður Hólgabráður, who is known chiefly from the extreme veneration paid to him by Haakon, earl of Lade (+993). According to one story she was the daughter of Hólgi, the eponymous king of Halogaland (northern Norway); according to another she was the wife of Hólgi and daughter of Gusi, king of the Fins. She ought perhaps to be regarded rather as a goddess than as a giantess, but she is never associated with the other deities.

Another class of supernatural beings was that of the dwarfs. They were distinguished chiefly for their cunning and for skill in working metals. More important than these from a religious point of view were the elves (O.N. alf, A.S. yfel), who certainly received worship, at all events in the North. They are almost always spoken of collectively and generally represented as beneficent. In some respects, e.g. in the fact that they are often said to inhabit barrows, they seem to be connected with the souls of the dead. In other cases, however, they are hardly to be distinguished from spirits (the Icel. landvættir, &c.), which may be regarded as genii locorum.

In addition to the above there were yet other classes of supernatural beings (see Norns and Valkyries). Mention, however, must be made here of the fylgur and hammering of Northern belief. These are of two kinds, though the names seem not always to be clearly distinguished. Sometimes the fylgia is represented as a kind of attendant spirit, belonging to each person, who may be seen, generally in animal form, in visions or by persons of second sight. In another case the fylgia is a sign of impending death. In other cases the fylgur (or perhaps more correctly the hamingur) apparently belongs to the whole family. These generally appear in the form of maidens.

Human beings, especially kings and other distinguished persons, were not infrequently honoured with worship after death. In Sweden during the 9th century we have trustworthy record of the formal deification of a dead king and of the erection of a temple in his honour. In general the dead were believed to retain their faculties to a certain extent, and in the place where they were buried, and stories are told of the resistance offered by them to tomb-robbers. It would seem, moreover, that they were credited with the power of helping their friends (and likewise of injuring other people) very much in the same way as they had done in life. Hence the possession of the remains of a chief who had been both popular and prosperous was regarded as highly desirable.

The blessings which kings were expected to bestow upon their subjects, in life as well as after death, were partly of a supernatural character. Chief among them was that of securing the fertility of the crops. The prevalence of paling among the Swedes was attributed to the king's remissness in performing sacrificial functions; and on more than one occasion kings are said to have been put to death for this reason. Under similar circumstances Burgundian kings were deposed. In connexion with this attribution of superhuman powers, we may mention also the widespread belief that certain persons had the faculty of "changing shape," and especially of assuming the forms of animals.

Besides the various classes of beings to the worship of which we have already referred, we hear occasionally also of sacred animals. Tacitus tells of how he consecrated to the service of the gods, and of omens drawn from them, and we meet again with such horses in Norway nearly a thousand years later. In the same country we find the legend of a king who worshipped a cow. Besides the anthropomorphic "giants," mentioned above, Northern mythology speaks also of theriomorphic demons, the chief of which were Midgarðsormr, the "world-serpent," and Fenrisulfr, a monster wolf, the enemies of Thor and Odin respectively. These beings are doubtless in part to poetic imagination, but underlying this there may be a substratum of primitive religious belief. In contrast with later Scandinavian usage Tacitus states that the ancient Germans
had no images of the gods. But he does speak of certain sacred symbols which he defines elsewhere as figures of wild beasts. One of the chief objects of veneration among the Cimbri is said to have been a brazen bull.

Figures of human, however, were not the only inanimate things regarded in this way. The Quadi are said to have considered their swords divine. More important than this was the worship paid, especially in the North, to rocks and stone cairns, while springs and pools also were frequently regarded as sacred in all Teutonic lands. But, on the whole, there is perhaps no characteristic of Teutonic religion, both in early and later times, more prominent than the sanctity attached to certain trees and groves, though it is true that in such cases there is often a doubt as to whether the tree or a perpetual sacrifice or whether it was regarded as the abode of a god or spirit. The sanctuaries mentioned by Tacitus seem always to have been groves, and in later times we have references to such places in all Teutonic lands. One of the most famous was that in or beside which stood the great temple of Upsala. Here also must be mentioned the Swedish Vårdrträd or "guardian tree," which down to our own time is supposed to grant protection and prosperity to the household to which it belongs. One of the most striking conceptions of Northern mythology is that of the "world-tree," Yggrnasl's Ash, which sheltered all living beings (see Yggdrasil). The description given of it reveals in many respects that of a particularly holy tree which stood beside the temple at Upsala. For the idea we may compare the Iermnsol, a great wooden pillar which appears to have been the chief object of worship among the Old Saxons, and which is described as "universalis columna quasi sustinens omnia."

The Northern sanctuaries of later times were generally buildings constructed of wood or other materials. A space apparently partitioned off contained figures of Thor or Frey and perhaps other gods, together with an altar on which burned a perpetual fire. This is believed to have held the sacrificial feasts. The presiding priest seems always to have been the chief to whom the temple belonged, for there is no evidence for the existence of a special priestly class in the North. In England, however, the case was otherwise; we are told that the priests were never allowed to bear arms. There is record also of priests among the Burgundians and Goths, while in Tacitus's time they appear to have held a very prominent position in German society. Among all Teutonic peoples from the time of the Cimbrini onwards we frequently hear also of holy women whose duties were connected with the worship and divination. Some of these, as in the case of Veleda, a prophetess of the Bructeri, during Vespasian's reign, they were regarded practically as deities. After the adoption of Christianity, and possibly to a certain extent even before, such persons came to be regarded with disfavour—whence the persecutions for witchcraft—but it is clear from Tacitus's works and other sources that their influence in early times must have been very great. In the North the sanctuaries called hørgar seem to have been usually under the charge of the wives and daughters of the household. But there is some evidence also for the existence of special priestesses among the Germanic peoples.

Of religious ceremonials the most important was sacrifice. The victims were of various kinds. Those offered to Odin (Woden) were generally, if not always, men, from the time of Tacitus onwards. Human sacrifices to Thor and the other gods are not often mentioned. Of animals, which were consumed at the sacrificial banquets, we hear chiefly of horses, but also of oxen and boars. At human sacrifices, however, dogs and hawks were often offered with the men. At all sacrifices it seems to have been customary to practise divination; in conjunction with human sacrifice we have record of this rite from the time of the Cimbri. One barbarous custom which was regarded as a sacrifice was the dedication of an enemy's army to the gods, especially Odin. This custom, which is likewise known to have prevailed from the earliest times, involved the total destruction of the defeated army, together with everything belonging to them. In general the chief sacrificial festivals seem to have taken place at fixed times in the year, one in early or mid-autumn, another at mid-winter and a third during the spring. The sacrifices on an exceptionally large scale were held at Upsala and Leire every nine years, at the former place about the time of the spring equinox, at the latter in the early part of January. Besides these fixed festivals sacrifices could of course be offered in all time of public or private need. In the latter case resort was very frequently had also to sorcery and necromancy.

Mention has been made above of the belief that the dead retained a conscious existence in or near the place where they were buried, and that they were able to confer blessings upon their families. It is also possible, however, that this belief seems hardly to be compatible with it, viz., that the souls of the dead passed to the realm of Hel, who in Northern mythology is represented as the daughter of Loki. Again, those who had fallen in battle were supposed to go to Valhalla, where they became warriors in Odin's service. This last belief seems to have been connected at one time with the practice of cremation. In conclusion it must be mentioned that even the life of the gods was not to be for ever. A day was to come when Odin and Thor would fall in conflict with the wolf and the world-serpent, when the abode of the gods would be destroyed by fire and the earth would be swallowed up by the sea. Hence it is said that in the future the gods of a younger generation would govern a better world. How far these beliefs were common to the Teutonic peoples as a whole cannot be determined with certainty. Some scholars hold that they were peculiar to the mythology of Norway and Iceland and that they arose at a late period, largely through Christian influence. But a serious objection to this view is presented by the fact that very similar ideas in some respects were current among the ancient Gauls.

AUTHORITIES.—I. Ancient. The most important of the early authorities is Tacitus (A.D. 55-118). He wrote Germania (II. 31-54, iv. 1-19; vi. 21-24), Strabo (esp. p. 290 ff.), Pliny, Hist. Nat. (esp. iv. 96 ff., xvi. 1 ff., xxxvii. 42 ff.), Tacitus (esp. Germania, Breviarium, Marmor, and Polyhistor, Geogr. ii. 11). Among later writers whose valuable information is given by Ammianus Marcellinus, Jordanes, Procopius, Gregory of Tours, Bede, Paulus Diaconus, Widukind, Thietmar, Adam of Bremen and Saxo Grammaticus, as well as by the early laws and charters. To these must be added a large number of Old Norse writings including the elder Edda and the prose Edda (the chief authorities for Northern mythology), Islanda Landnámabók and many sagas dealing with the history of the Teutonic peoples in Iceland (such as Ærbyggja Saga) or with the lives of Norwegian and other kings, both historical and legendary (in Heaeringskringla, Foramanna Sogur and Rafa's Forntafsar Sogur Norfa). For further references see BRITAIN (Anglo-Saxon), Germany (Ethnography and Early History), and ScANDINAVIAN CIVILIZATION.

TEVIOT—TEWFIK PASHA

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H. C. M.)

TEVIOT, ANDREW RUTHERFORD, EARL OF (d. 1664), was the son of William Rutherford of Quarrelhoses, Roxburghshire. His education was received in Edinburgh, and he took up the career of soldier of fortune. His services were given to the French government, which maintained regiments of Scottish mercenaries. On the restoration of Charles II., Rutherford was taken into employment by his own king on the recommendation of Lord Lovat of Lovat, a colonel of cavalry, and soon became a lieutenant-general in France and had a high reputation for personal courage. Charles II. gave him the Scottish title of Lord Rutherford and the government of Dunkirk, which had been acquired by the Protector Oliver Cromwell. When Charles II. sold the town to France in 1662 Rutherford was consoled by the command of the 2nd or Tangier regiment, was made earl of Teviot in the peerage of Scotland, and was sent in 1663 as governor to Tangier. His tenure of office was very short, for on the 4th of May 1664 he allowed himself to be entrapped into an ambush by the Moors, who carried off incessant irregular warfare against the English garrison and was killed, together with nineteen officers and nearly five hundred men of his garrison.


TEVIOTDALE, the valley of the Teviot, Roxburghshire, Scotland. In a limited sense the word usually describes the stretch above Hawick, (9 ft.), in a wider sense the whole valley extending in a north-easterly direction from Teviethed near to the confines of the parish of Roxburgh, a distance of 23 m. It is sometimes incorrectly used as an alternative name for the shire, much of the area of which, in point of fact, lies outside the Teviot drainage basin. There are numerous points of interest in the vale. Henry Scott Riddell (1798-1870), the poet, was buried at Teviethed. Almost side by side in the churchyard are the obelisk near his grave and the memorial stone erected in the cemetery wall to John Armstrong of Gilnockie, the soldier, and whose son up to his death was treacherously seized in 1530 and hanged at Caerlarnigan, in the immediate vicinity, by order of James V. Riddell is further commemorated by a monument on Dryden hill. Branthom tower, the peak of Goldielands, and Harden castle (on Harden burn, a tributary of Northwick) water are spots familiar through the writings of Sir Walter Scott and many Border ballads. Five m. to the east of Hawick stands the hill of Ruberslaw (1392 ft.). Among the crags on its summit is the rock, still called, "Peden's chair," from which Alexander Peden preached to congregations of Covenanters. Below Hawick in the principal villages and centres around the Teviot, on the De Hazeldean of Sir Walter Scott's song, "Jock o' Hazeldean," and Ancrum.

TEWFIK PASHA (1852-1892), khevide of Egypt, son of the Khevide Ismail, was born on the 15th of November 1852. His mother was a fellah woman. Although the eldest son, he was not sent to Europe to be educated, like his younger brothers, but was left to grow up in his native country. In 1866 Ismail succeeded in his endeavour to alter the order of succession to the khedivate. The title, instead of passing to the eldest living male descendant of Mehemet Ali, was now to descend from father to son. Ismail sought this alteration mainly because he disliked his uncle, Halim Pasha, who was his heir-presumptive, and he is supposed to have imagined that he would be able to select whichever of his sons he pleased for his successor. But he found, after the change had been made, that the powers interpreted the new arrangement as applying strictly to the eldest son. Tewfik therefore became heir-apparent. He was given a palace near Cairo to live in, and for twelve years he passed an uneventful life, farming and establishing a reputation for good sense and fair dealing with his fellah tenants. In 1878 he was appointed president of the council after the dismissal of Nubar Pasha. He held this office only for a few months; but this was long enough to show that, if he was unambitious and not particularly intelligent or energetic, he had the wisdom to refrain from taking part in the intrigues which then formed the chief part of political life in Egypt. He went back to his estate, and settled down once more to a quiet country life. He was not left undisturbed for long. On the 26th of June 1881, at the instance of Great Britain and France, was deposed by the sultan, who sent orders at the same time that Tewfik should be proclaimed khedive. The new viceroy was so little pleased by the news of his accession that he soundly boxed the ears of the servant who first brought the tidings to him. Egypt at that time was involved in financial and political troubles brought about by the policy of Ismail (q.v.), and the situation was made worse by the inaction of England and France for some months following Tewfik's accession. Tewfik's people were dissatisfied, his army deserted; his advisers were nearly all of the adventurer class, with their selfish object; and he himself had neither the strength nor the experience that would have enabled him to secure an orderly administration of affairs. Disorder prevailed until November 1879, when the dual control was re-established by the governments of Great Britain and France. For over two years Major Baring (afterwards Lord Cromer), Mr. (afterwards Sir) Auckland Colvin, and M. de Bignières practically governed the country, endeavouring to institute reforms while possessing no means of coercion. During all this time the disaffection in the Egyptian army was increasing. Tewfik has been blamed for his failure to take a firm line with the men of the army, but his position was difficult. The Great Powers had been concerned by the relations of Great Britain and France, and he was unable to control events. The dissatisfaction culminated in the anti-foreign movement headed by Arabi Pasha (q.v.), who gained complete command of the army. In July 1882 the attitude of Arabi, who was carrying out defensive works on a large scale, made it necessary for the British admiral (Sir Beauchamp Seymour, afterwards Lord Alcester) to declare that he would bomb hard the forts of Alexandria unless they were handed over to him. Before the bombardment began it was suggested to Tewfik that he should at once strike for Egypt, and if he failed to reach Alexandria he was to throw himself on the mercy of the Great Powers. When it was found that Arabi had reached Cairo after the battle of Tel-el-Kebir, had consented to the reforms insisted upon by Great Britain, and had assumed the position of a constitutional ruler under the guidance of Lord Dufferin, the British special commissioner. When
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the cholera broke out, he insisted upon going to Alexandria. His wife accompanied him, and he went round the hospitals, setting an excellent example to the authorities of the city, and encouraging the patients by kind and hopeful words. In 1864 Sir Evelyn Baring went back to Egypt as diplomatic agent and consul-general of Great Britain. His first task was to demand that Tewfik should abandon the Sudan. Tewfik gave his consent with natural reluctance, but, having consented, he did everything he could to ensure the success of the policy which Baring had been sent to carry out. He behaved with equal propriety during the negotiations between Sir H. Drummond Wolfe in the Turkish Empire, Montefiore (1859) and Evelyn Baring, by Tewfik's knowledge of the divergence of views between Nubar and the British agent. Baring encouraged Tewfik to show his activity in matters of administration, and he took a great interest in all matters connected with irrigation, education and justice. He was not a particularly strong man either in mind or in character, but he showed a genuine desire to govern his country for its own benefit. He understood the importance to Egypt of British assistance and support; his natural shrewdness made him accept the British conditions; his natural good feeling kept him from any inclination to intrigue. In private life he was courteous and amiable. He had no desire to keep up the unapproachable state of an oriental ruler. Indeed, in many ways his manners and habits were less oriental than European. He married in 1873 his kinswoman, Amina Hanem, with whom he lived very happily. She was his only wife and Tewfik was a strong advocate of monogamy. He died on the 7th to January 1892, at the Heliouan palace near Cairo, and was succeeded by his eldest son, Abbas II. (q.v.)

A warm tribute to Tewfik's many admirable qualities was paid by Baring (Lord Cromer) in his report on the administration of Egypt for 1891 (see Egypt, No. 3. 1892, pp. 1 and 2).

Tewkesbury, a market town and municipal borough in the Tewkesbury parliamentary division of Gloucestershire, England, 15½ m. N.E. of Gloucester by the Midland railway. Pop. (1901) 5419. It lies in a flat pastoral district, with low hills to the south, on the Warwickshire Avon, close to its junction with the Severn. The Severn is crossed by an iron bridge with a flattened arch of 170 ft. span, erected by Telford in 1824. Of the great Benedictine abbey, one of the richest foundations in England, refounded and enlarged by Sir Robert Fitz-Hamon in the 12th century on the site of an ancient hermitage and Saxon monastery, there only remain the gate and a few other fragments. The only portion of the abbey church that was discovered in 1125, is a magnificent specimen of early Norman. This elaborate cruciform building consists of nave and side aisles, with transepts united by a great central tower richly arcaded. The choir terminates in an apse and is surrounded by an ambulatory. One of the most remarkable features of the building is the unique western front, the central part of which is occupied by one vast arch extending from the ground to the roof. Originally it was filled in with Norman windows, but a Perpendicular window now occupies the space. The whole building underwent restoration in the Decorated period, and of this style it is one of the finest existing examples. The Norman windows in the nave were replaced, and stone groining was substituted for the carved wooden ceiling, a like transformation taking place in the transepts. The Norman columns in the choir still exist; but above them rises a grand superstructure of Decorated work. The elegant clerestory windows are of the 14th century, with stained glass of the same date. The ambulatory was rebuilt some distance farther out, and from it projected a beautiful series of chapels. The elaborate tombs include those of Sir Robert Fitz-Hamon, the De Spencers, Alan Prior of Canterbury, Sir Guy de Brien, and the vault of George Duke of Clarence (murdered in the Tower) and his wife Isabella. Edward, prince of Wales, slain after the battle of Tewkesbury (1471) by the Yorkists, is also buried in the church. Of the two organs, one, dating from the early 17th century, is of singularly beautiful tone. In the High Street there are several ancient timbered and gabled houses. Remains of an ancient wall have been discovered adjoining the town. There are a free grammar school (1541) and a number of charities and almshouses. Tewkesbury is chiefly dependent on its agricultural trade. Below the junction of the rivers there is a great lock and weir on the Severn, up to which the stream is sometimes reversed by the tidal bore. The borough is under a mayor, 4 aldermen and 12 councillors. Area, 5232 acres.

Remains of Roman encampments and roads prove that the earliest settlement near Tewkesbury (Theotestub, Theochebus, Thoocksbury) of which we have evidence was a military encampment against the British. It was the site of a Saxon church, however, which in the 10th century was refounded by Odo, the Norman lord, and became a minster. The church, which was the site of a battle in 1087 when it was part of the royal domain. It was subsequently granted by Earl Robert of Gloucester, who granted a charter before 1107, which exempted the borough from certain tolls and from suit at the hundred court. Edward III confirmed this charter in 1337, and made Tewkesbury free from tolls throughout England. The borough was incorporated by Elizabeth by a charter of 1574, which was confirmed in 1604, 1605, 1609 (when the manor and borough were sold to the corporation) and 1685, when the town was governed under the charter granted by William III. In 1688 until the corporation was remodelled in 1835, the modern government consisting of a mayor, 4 aldermen and 12 councillors. Tewkesbury returned two members from 1604 to 1867, when it lost one member, and in 1885 the representation was merged in that of the county. A fair on July 20 was granted in 1323, and fairs on September 21 and August 24 in 1440, and on April 25 in 1574. For the last May 3 was substituted in 1605, and two more fairs on June 11 and September 29 were granted in 1609. All these grants were confirmed by the charter of 1685. One fair only is now held, on October 10. It is a pleasure fair and a fair for hiring servants, and has lost the commercial importance of the early wool fairs. The long-existing provision trade along the four rivers declined through railway competition. Cloth-making lasted from the 11th century until the beginning of the 18th; gloving in the 17th century was followed by worsted-combing in the 18th. Cotton-thread lace-making, introduced in 1825, collapsed about 1862. Tewkesbury was once celebrated for the manufacture of mustard, which ceased to be important at the end of the 18th century. Stocking-frame knitting was the chief trade in 1830, but has been replaced by the boot and shoe trade. Tewkesbury was strategically important in the Wars of the Roses, and was the site of a battle in 1471, and in the Civil War was four times besieged.

See Victoria County History, Gloucestershire; James Bennet, History of Tewkesbury (1850); William Wyde, History of Tewkesbury (1797).

Texarkana, two adjoining cities forming one community, situated on either side of the boundary line between Arkansas and Texas, U.S.A., about 165 m. E. by N. of Dallas, Texas; Texarkana, county-seat of Miller county, Arkansas, pop. (1900) 4914, of whom 130 were foreign-born and 3978 were negroes; (1910) 5655; Texarkana, Bowie county, Texas, pop. (1900) 5236, of whom 192 were foreign-born and 1964 were negroes; (1910) 9700. Texarkana is served by the Kansas City Southern (Port Arthur Route), the Texas & Pacific (of which it is the eastern terminus), the St Louis, Iron Mountain & Southern (Iron Mountain Route, the southern terminus), and the St Louis South-Western (Cotton Belt Route) railways. The public buildings are two city halls, a well-designed Post Office, which stands on the
state line and serves both cities, a county court house (on the Arkansas side), and a Federal court building (on the Texas side). The chief trade is in lumber (especially hard woods, such as white pine and ash), and cotton. The oil and gas is piped here from the Caddo gas-fields, about 48 miles, in Louisiana. The first permanent settlement here was made in 1874; Texarkana, Texas, was incorporated in 1875, and Texarkana, Arkansas, in 1881.

**Texas.** A south central state of the United States of America, extending from lat. 26° 51' N. to lat. 36° 39' N. and from long. 93° 30' W. to long. 106° 30' W. A western projection is bounded N. by New Mexico, but the main portion of the state is bounded N. by Oklahoma, from which it is separated in part by the Red river; and the E. by Louisiana, from which it is bounded E. by Oklahoma, but the main portion is bounded E. by Texas and Louisiana, and the Sabine river separating it in part from Louisiana; on the S.E. the state is bounded by the Gulf of Mexico; on the S.W. by Mexico, from which it is separated by the Rio Grande; on the W. by New Mexico. Texas is much the largest state in the Union. Its length and breadth are nearly equal—about 750 m. and its area is 262,398 sq. m., of which 3,498 sq. m. are water surface.

**Physical Features.** Texas is crossed by four physiographic provinces: the Prairies and Coast Plains, the Rocky Mountains, the Gulf Lowlands, and the Trans-Pecos Province. The Prairies and Coast Plains form the western half of the state and extend from the Panhandle in the N.W. to the Gulf of Mexico in the S.E. The Rocky Mountains are in the S.W., and the Gulf Lowlands, which form much of East Texas, extend from the Gulf of Mexico in the S. to the Panhandle in the N.W. The Trans-Pecos Province is located in the S.W. The prairie and Coast Plains are characterized by their flatness, with some rolling hills, and by the absence of forests. The Rocky Mountains have a rugged topography with numerous peaks and valleys. The Gulf Lowlands are characterized by swamps and marshes.

**Climate.** The climate of Texas is classified as humid subtropical with mild winters and hot summers. The state experiences a wide range of temperatures throughout the year, with an average of 66°F (19°C) in January and 79°F (26°C) in July. The state has a well-defined growing season, with most of the state having at least 280 frost-free days.

**Vegetation.** The vegetation of Texas is diverse, with a mixture of grasslands, forests, and desert habitats. The plains are dominated by grasses, while the mountains have a mix of grasses and coniferous forests. Texas is home to several species of cacti, as well as various grasses, shrubs, and wildflowers. The state is also home to a variety of birds, including raptors, shorebirds, and waterfowl.

**Fauna.** Texas is home to a wide variety of wildlife, including mammals, birds, reptiles, and amphibians. Some of the most notable species include the white-tailed deer, the armadillo, the bobcat, the alligator, and the kingfisher. The state is also home to several species of fish, including catfish, bass, and trout. Texas is a popular destination for bird watchers, with over 450 species recorded in the state.

**Geology.** The geology of Texas is characterized by the presence of sedimentary rocks, with the Permian basin being the largest in the state. The state is also home to several major oil and gas fields, including the Caddo gas-fields.

**History.** Texas has a rich history, with the state gaining its independence from Mexico in 1836 and becoming a state of the United States in 1845. The state has played a significant role in the history of the United States, including its role in the Civil War and its role in the development of the oil and gas industry.

**Economy.** Texas is one of the largest and most economically diverse states in the United States. The state is home to several major industries, including agriculture, oil and gas, and manufacturing. Texas is also a major center for high-tech and biotechnology companies.

**Transportation.** Texas has a well-developed transportation network, with major highways, interstates, and railways connecting the state. The state is also home to several major airports, including Dallas/Fort Worth International Airport, Houston International Airport, and San Antonio International Airport.

**Education.** Texas has a robust education system, with both public and private schools. The state is home to several major universities, including the University of Texas, Rice University, and Texas A&M University.

**Sports.** Texas is known for its sports, particularly football and basketball. The state is also home to several professional sports teams, including the Dallas Cowboys and the Houston Rockets.
is the most common of Texas lizards, except in the western counties where the Texas rock lizards (Sceloporus torquatus; S. clarkii; S. spitiosus; S. consobrinus; S. dispur) are numerous. The tree swift, or scaly lizard, is also an inhabitant of western and Texas. The greater grasshopper whip-tailed lizard (Chromisaurus gularis; C. sexlineatus; C. tessellatus, &c.) are widely distributed. The Gila Monster (Heloderma suspectum), a poisonous species, is also widely distributed the west and south-west, and the middle man, also occurs in the desert regions. The blow snake, or spreading adder (Heterodon platyrhinos), black snake (Bacascunon constrictor), coach whip (Bacascunon flagidum), and prairie bull snake (Pituophis) are common; the greater green water snake (Natrix fasciata) is found along creeks; the king snake (Lampropeltis getula), in central and southern Texas; and the pilot snake (Callopelis obsotulus), mostly in the woods of the McLennan county. Among venomous reptiles of the Trans-Pecos region are the harlequin, or coral snake (Claviceps), copperhead along the coast; the copperhead (Agris istron constrictor) along the wooded banks of creeks and rivers; the cottonmouth (Agris istron piscatorius), the latter which is the Trans-Pecos with a tendency to garter snake, and the "sidewinder," or massasauga (Sistrurus cassinus constrictor), some called Crotalephporus ligerius) and the ground rattlesnake (Sis-

1The average annual rainfall decreases quite regularly westward and south-westward from 47-6 in. at Galveston to 9-3 in. along the coast. The autumn months are the driest; for example, at Galveston the rainfall amounts to 5-7 in. in September and only 2-9 in. in August. The western and south-western sections of the state are the driest; thus, at El Paso the rainfall amounts to 2-2 in. in July and only 0-2 in. in April. The average annual snowfall for the state is about 5 in., ranging from 19 in. in the highlands to 0 in. in the coastal region. The first snows usually appear in November along the Trans-Pecos and in the lower Rio Grande Valley. A very thin soil covers the Edwards Plateau, but on the Llano Estacado is brown and red clay soils derived from Carboniferous rocks. A very thin soils covers the Edwards Plateau, but on the Llano Estacado is brown and red clay soils derived from Carboniferous rocks. 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there were 1,909,000 sheep in the state. The wool product of the state in 1907, 303,972 lb., was washed and unwashed and 3,040,875 lb. scoured. In this number of chickens (13,562,302 in 1900) the state ranked fifth, and in the number of ducks, geese and turkeys (1,399,044 in 1900), ranked first.

The cereals grow generally throughout the state, excepting in the arid western lands. The crop of Indian corn is especially large in a belt of counties beginning near the north-eastern corner of the state and extending as far westward as Austin. Sparsc scrub timber, of little value except for posts, poles and rough beams and for fuel, occupies the region westward to approximately the longitude of the Pease river. Outside of these general areas, the hardest products are of relatively little value, the exceptions being the dense growths, in certain restricted areas, of live-oak, which is in demand for ship timbers; and scattering patches of hickory, which is valuable for manufacturing. In fine-wood lumbering, the forests are of great economic value because of the density of their growth, and there are at hand the means of profitable development of this industry in the numerous watercourses which make logging cheap. The rivers—the Brazos, the Rio Grande, the Trinity, the Neches, the Sabine, the Sabine Neches, the Trinity—feed gum, sycamore, hickory and poplar, found on the southern slope of the Osage highlands, on the uplands about the source of the Neches river, and to a much less extent, in the pine-timbered area south of those points not reached by the railways. Another important undertaking is the deepening of the Trinity river to Dallas, a distance of 51 m., thereby affording a navigable waterway almost to the northern boundary of the state. Congressional appropriations for the survey, improvement and maintenance of waterways began in 1852; amounted to $15,055,688 between 1891 and 1896 inclusive, and $6,813,829 between 1897 and 1907; the total appropriated being $32,540,410. The ports of entry of Texas are Galveston, Corpus Christi, Eagle Pass, El Paso and Brownsville.

Population.—The population in 1880 was 1,591,749; in 1890, 2,235,523; in 1900, 3,045,710; and in 1910, 3,869,542, 1907, 3,869,542. 2 Of the population in 1900, 94.1 per cent. was native born, 70.6 per cent. was white and 20.4 per cent. (or 620,722) was negro, or of negro descent. There were in 1900, 2,249,688 native whites, 179,357 persons of foreign birth, 836 Chinese, 470 Indians and 133 Japanese. Of the inhabitants of the United States 132,389 were natives of Tennessee; 129,945 of Alabama, 90,863 of Mississippi, 77,950 of Georgia and 75,033 of Arkansas; and of the foreign-born,71,626 were Mexicans, 48,295 Germans, 9,204 Bohemians, 8,313 English, 6,870 Austrians and 6,173 natives of Ireland. Of the total population 471,572 were of foreign parentage—i.e. either one or both parents were foreign-born, and of those both of whose parents were foreign-born 70,736 were of German, 10,967 of Bohemian, 7,759 of Irish and 6,536 of Austrian parentage. In 1906 1,226,906 inhabitants of the state were members of religious societies. Of these 401,720 were Baptists; 102,935 Methodists; 98,136 Roman Catholics; 62,009 Presby- terians; 39,550 Disciples of Christ; 34,006 members of the Churches of Christ; 27,437 Lutherans; 14,245 Protestant Episcopalians; 7745 members of the German Evangelical Synod of North America, and 186 Congregationalists. The principal cities are San Antonio, Houston, Dallas, Galveston, Fort Worth, Austin, the capital, Waco, El Paso, Laredo, Denison and Sherman.

Manufactures.—The value of the manufactures of Texas in 1905 was $190,257,383, the capital invested in manufacture in 1907 being $226,805,185. In 1907 the value of the products of the cotton-seed oil and cake product Texas surpassed all other southern states. Four and one-half million bushels of cottonseed oil were produced in 1906, valued at $11,945,556 in 1900 to $22,683,136 in 1905. The values of other products in 1905 were as follows: slaughtering and meat packing (wholesale), $15,620,931; lumber and timber products (wholesale), $4,153,938; brick and clay products, $2,653,415; cement, $1,293,415; mill lumber, $4,153,938; saddlery and harness, $1,293,415; cotton, $3,251,255. The highest average quantity of rough milled rice per establishment in the United States in 1905 was for Texas, where 54.8 bushels were produced. Cottonseed meal was valued at $148,040, valued, together with that of other rice products, at $4,638,867.

Transportation.—Until the middle of the 19th century transportation facilities remained practically undeveloped in Texas. In 1840 there were 2,746 miles of railroad in the state. In 1880, 3,244 m.; in 1890, 8,709 m.; in 1905, 11,949 m.; in 1907, 12,877 m.; and in 1908, 13,066 m. Most of this mileage is in the eastern part of the state, the western and southern portions having slight railway facilities. The principal railway systems are the Southern Pacific, the Santa Fe, the Texas & Pacific and the Colono & Southern. The inland waterways include the 25 ft. ship canal from the Gulf to Port Arthur (the Port Arthur Canal), opened in 1869, and transferred to the United States government in 1906; the Galveston and Brazos River canal, 29.5 m. long and of a ruling depth of 3 ft., also acquired by the government in 1902, but of which the cost of construction was $250,400. Another important waterways which have been authorized by the United States government and on which work was proceeding in 1910 are commercial canals, 15 ft. in depth, extending from Corpus Christi to Aransas Bay. Other important waterways which have been authorized by the United States government and on which work was proceeding in 1910 are commercial canals, 15 ft. in depth, extending from Corpus Christi to Aransas Bay. Other important waterways which have been authorized by the United States government and on which work was proceeding in 1910 are commercial canals, 15 ft. in depth, extending from Corpus Christi to Aransas Bay. Another important undertaking is the deepening of the Trinity river to Dallas, a distance of 51 m., thereby affording a navigable waterway almost to the northern boundary of the state. Congressional appropriations for the survey, improvement and maintenance of waterways began in 1852; amounted to $15,055,688 between 1891 and 1896 inclusive, and $6,813,829 between 1897 and 1907; the total appropriated being $32,540,410. The ports of entry of Texas are Galveston, Corpus Christi, Eagle Pass, El Paso and Brownsville.

2 The statistics given in the text for 1900 from this point are for factory products and are thus comparable with those given for the same years. The census of 1890 for the last year was limited to the manufactures under the factory system.
3 In other census years the populations were: 1850 (first under the United States), 212,592; 1860, 604,215; 1870, 818,579.
governed under the constitution of 1876, with amendments of 1879, 1883, 1890, 1891, 1897, 1904 and 1906. All male citizens not twenty-one years of age and resident in the state for one year are eligible for the general electorate, which includes the courts immediately preceding election (except paupers, idiots, lunatics, felons, United States soldiers, marines and seamen, and persons who have taken part, either as principal or second, in fighting a duel or in sending a challenge) have the right of suffrage. The constitution originally forbade the registration of voters, but an amendment of 1891 permits it in cities having a population of ten thousand or more, and the Australian ballot system was adopted in such cities by an act of the twenty-second legislature in 1892. An amendment to the constitution in 1892 required a two-thirds vote of the members elected to each house of the legislature, and is adopted if it is approved by a majority of the popular vote on the amendment.

The executive department consists of a governor, lieutenant-governor, secretary of state, comptroller of public accounts, treasurer, commissioner of the general land office, and attorney-general. Contrary to the usual custom in other states, the secretary of state is appointed by the governor. The other officialists, elected by popular vote for two years' terms. The governor and lieutenant-governor must be, at the time of election, at least thirty years of age, and the United States must have been a citizen of the United States for the preceding five years. The governor receives an annual salary of $4000 and the use of the governor's mansion. His functions are rather more extensive than those of the average American executive. He exercises the government of the state, proclaims public meetings and reprieves, he controls considerable patronage, and possesses a power of veto which extends to separate items in appropriation bills. At least two-thirds majority in each house is necessary to override a veto.

The legislature of the state is composed of a Senate and a House of Representatives. The Senate consists of thirty-one members, chosen at-large for four years, one-half retiring every two years. Representatives are elected biennially. Their number, originally ninety-three, is determined by apportionment bills passed after the publication of each Federal census, but under the constitution it can never exceed two-thirds of the members elected in the preceding five years. The governor receives an annual salary of $4000 and the use of the governor's mansion. His functions are rather more extensive than those of the average American executive. He exercises the government of the state, proclaims public meetings and reprieves, he controls considerable patronage, and possesses a power of veto which extends to separate items in appropriation bills. At least two-thirds majority in each house is necessary to override a veto.

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colleges; the Sam Houston Normal Institute (1879) at Huntsville, the North Texas State Normal (1901) at Denton, the South-west Texas Normal (1903) at San Marcos, the School of Industrial Arts for Colored (1887) at Austin, the Prin- cipal National Training School (1876) for negroes near Hempstead. The system is not unified or organized: the university's department of education, the school for girls at Denton and the negro normal school all issue together and are not controlled by the Department of Education or the State Board of Education. The state library and museum are a part of the Department of Banking, State and Commerce, an organization under the unified university Department of Statis- tical and Educational Statistics.

The state in 1824, the school for girls at Belton; the medical department at Waco; St Edward's College (Roman Catholic, under the Congrega- tion of the Holy Cross; 1885), at Austin; St Mary's University (1854; since 1884 under the Society of Jesus), at Galveston; St Basil's College (under the Basilians Fathers; 1890), at Waco; for girls, the Institute for Domestic Science (1845), at Belton; the Antonio Female College (Methodist Episcopal, South; 1894), at San Antonio; North Texas Female College (Methodist Episcopal, South; 1877), at Sherman; and the Academy of Our Lady of the Lake, at Austin (1866). The first public school for negroes Paul Quinn College (African Methodist Episcopal; 1881), at Waco; Tillotson College (Congregational; 1881), at Austin; the Polytechnic College (Baptist; 1885), at Marshall; Wiley University (Methodist Episcopal; 1873), at Marshall; and Texas College (Coloured Methodist Episcopal; 1895), at Tyler.

The state, therefore, has done more than any other Southern state for the humane and scientific treatment of its dependent and defective classes. There are insane asylums at Austin (the State Lomatnic Asylum), San Antonio (the Southwest Insane Hospital); at Tyler, the Texas Insane Institution (Baptist; 1845) at Belton; the Antonio Female College (Methodist Episcopal, South; 1894), at San Antonio; North Texas Female College (Methodist Episcopal, South; 1877), at Sherman; and the Academy of Our Lady of the Lake, at Austin (1866). The first public school for negroes Paul Quinn College (African Methodist Episcopal; 1881), at Waco; Tillotson College (Congregational; 1881), at Austin; the Polytechnic College (Baptist; 1885), at Marshall; Wiley University (Methodist Episcopal; 1873), at Marshall; and Texas College (Coloured Methodist Episcopal; 1895), at Tyler.

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History.—The history of Texas may be regarded as a step in the great struggle between England, France and Spain for the possession of America. The earliest explorations were made by the Spaniards, Cabeza de Vaca, 1528-36, and Francisco Vasquez de Coronado, 1540-47, but the first colony was that planted on Matagorda Bay in 1685 by the French under the Sieur de la Salle. This was, however, soon abandoned, and the field left to the Spanish. Beginning in 1690 they established several ecclesiastical, military and civil settlements known respectively as missions (Franciscan), presidios, and pueblos. In or near the city of San Antonio are the ruins of five missions built of stone; and missions were more numerous in east Texas, but they were built of wood and nothing remains to mark their location. In 1777 the territory, with vaguely defined limits, was formed into a province and named Tejas, or Texas, a corruption of the tribe or by private contract sold them for less than 200 years old. The first campaign under the French control was a successful revolt against Spain in 1762, when the French captured San Antonio and defeated several Mexican armies, but was finally overpowered; the third, under James Long, an ex-officer of the United States army, 1819-21, was less formidable. The year 1821 marks a significant turning-point in the history. By the Florida treaty, finally ratified at that time, the claims of the United States to Texas, based on the Louisiana purchase, were given up, and the eastern and northern boundaries of the province were determined. They were to be, in general terms, the Sabine river, the 49th meridian (approximate), the Red river, the 100th meridian, the Arkansas river, and the 122nd parallel. So far as Spain was concerned this was only a formality, inasmuch as Mexico, of which Texas formed a part, was just completing its long struggle for independence (1810-21).

In that year also (December 1821) Stephen F. Austin established the first permanent Anglo-American settlement at San Felipe de Austin on the Brazos river. This was followed by an extensive immigration from the United States during the period of Mexican rule (1821-36). It is estimated that the population, exclusive of Indians, increased from four thousand in 1821 to ten thousand in 1827, and nearly twenty thousand in 1830. Settlements and communities extended in the southern section of the Union and of course brought their slaves with them, but there is no evidence to show that their object was the territorial extension of slavery, or that the revolt against Mexico was the result of dissatisfaction with that country's anti-slavery policy. Texas was joined to Coahuila in 1827 to form a state of the Mexican federation. Although the attempt to force the Roman Catholic religion upon the people, the federal decree of 1830 forbidding further immigration from the states, and the reckless grants of land to Mexican favourites aroused some ill-feeling, the government on the whole was fairly liberal. The peace party, led by Stephen F. Austin, was able to restrain the more warlike followers of William H. Wharton and Henry Smith (1794-1851) until 1835, when Santa Anna overthrew the federal constitution of 1824 and established a dictatorship. A consultation of representatives from the various settlements met at San Felipe de Austin, October to November 1835. Under Austin's influence the delegates rejected an independence resolution and recommended a constitution with the Mexican Liberals for the restoration of the constitution of 1824. A provisional government was organized with Henry Smith as governor and James W. Robinson (d. 1853) as lieutenant-governor. Sam Houston as mayor-general, and the armies of Texas; and Austin, Wharton and Branch T. Archer (1790-1858) were elected commissioners to seek aid in the United States. Hostilities had already begun. The Texans routed the Mexicans near Gonzales on the 2d of October. About a hundred men under Colonel James Bowie and Captain J. W. Fannin defeated a Mexican force near Mission Conception on the 28th of October; and after a campaign of nearly two months Béjar was surrendered to them on the 11th of December.
In the Matamoros expedition the Texas forces were severely crippled on account of a quarrel between Governor Smith, who desired independence, and the majority of his council, who favoured union with the Mexican Liberals. The command was divided between Houston, who was supported by the governor, and two leaders, Frank W. Johnson and J. W. Fannin, who were appointed by the council. The Mexicans under Santa Anna captured the Alamo on the 6th of March 1836 and slaughtered its garrison of 183 men; on the 20th of the same month they captured Fannin and his force of 371 men, and a week later slaughtered all except twenty who escaped. Houston now assumed active command and retreated before Santa Anna until he reached the San Jacinto, where he dealt the enemy a crushing blow and brought the war to an end; nearly all of Santa Anna’s army were killed, wounded or taken prisoners, and even Santa Anna himself was captured the next day, while the Texans lost only two killed and twenty-three wounded.

The weakness of the Mexican Liberals and the necessity of securing aid in the States led the Austin party to abandon their opposition to independence. A convention, assembled in the town of Washington on the 1st of March, adopted a declaration of independence on the 2nd and a republican constitution on the 17th. Houston was elected president in September 1836, and the independence of the republic was recognized in 1837 by the United States, Great Britain, France and Belgium. After a long conflict over the slavery question, the state was admitted into the Union under a joint resolution of Congress adopted on the 1st of March 1845, on condition that the United States should settle all questions of boundary with foreign governments, that Texas should retain all of its vacant and unappropriated public lands, and that new states, not exceeding four in number, might be formed within its limits. The western boundary claimed by the republic was the Rio Grande to its source and the meridian of longitude from that point to the forty-second parallel, although as a political division Mexico its limits never extended farther west than the Nueces and the Medina. The United States government asserted the Rio Grande claim and prepared to enforce it at the cost of war; at the same time the Mexican government considered annexation, regardless of the boundary question, a declaration of war by the United States. An army of 2000 men under Zachary Taylor (g.v.) arrived on the north bank of the Rio Grande, opposite Matamoras, on the 28th of March 1846. The Mexican commander, Pedro de Ampudia, demanded Taylor’s withdrawal beyond the Nueces within twenty-four hours. He did not obey, and Mariana Arista, Ampudia’s successor, opened hostilities. The Americans, outnumbered three to one, made a successful stand at Palo Alto (May 8th) and Resaca de la Palma (May 9th). The war terminated in the treaty of Guadalupe Hidalgo (February 7, 1848) by which Mexico accepted the Rio Grande boundary. By the Compromise of 1850 Texas received $10,000,000 for its territory lying north and west of a line drawn from the 100th meridian to the Rio Grande, following 36° 30’ N., 103° W. and 32° N. The final step in the determination of the present boundaries of the state was taken in 1896, when the Supreme Court of the United States decided the Greer case (g.v.). Under the terms of the treaty of 1819 the boundaries of the Red river were to be the northern boundary of Texas east of the 100th meridian, but as there are two branches of the river meeting east of the meridian the enclosed territory (Greer county) was in dispute. The decision of 1896 selected the southern branch and thus deprived Texas of a large tract of fertile land over which it had previously exercised jurisdiction.

In the crisis of 1860–61 Texas sided with the other Southern States in spite of the strong Unionist influence exerted by the German settlers and by Governor Sam Houston. An ordinance of secession was adopted February 1, 1861, and Governor Houston was deposed from office on March 16th. The state was one of the four seceding states during the Civil War (1861–65), although it is interesting to note that the last battle of the conflict was fought on its soil, at Palmito, near Palo Alto, on the 13th of May 1865, more than a month after the surrender at Appomattox. In conformity with President Johnson’s plan of reconstruction, a constitution recognizing the abolition of slavery, renouncing the right of secession, and repudiating the war debt was adopted in 1869, and J. W. Throckmorton, Unionist Democrat, was elected governor. When, in 1873, the Congressional plan of reconstruction was substituted, Texas was joined to Louisiana to constitute the fifth military district, and the first commander, General P. H. Sheridan, removed Throckmorton from office as “an impediment to reconstruction ” and appointed E. M. Pease in his place. Delegates to a new constitutional convention were elected in 1868, the constitution framed by this body was ratified in November 1869, state officers and congressmen were elected the same day, the new legislature ratified the Thirteenth and Fourteenth Amendments, and on the 30th of March 1870 Texas was readmitted to the Union. But the state remained under the rule of negroes and carpet-baggers, supported by United States troops until the inauguration of Governor Richard Coke in 1874. It has since been consistently Democratic. The supremacy of the party was threatened for a time by the growth of Populism, but the danger was avoided by the acceptance of free silver, and the partial adoption of the Populist local programme. This surrender aroused strong opposition among the conservative or Cleveland Democrats, which culminated in the Hogg-Clark gubernatorial campaign of 1893.

The victory of the Radicals resulted in the establishment of a railway rate commission, based upon a constitutional amendment of 1890 and a statute of 1891, the passage of an alien land law in 1891, which was declared unconstitutional and amended in 1892, the adoption of the Australian ballot system for cities and towns of more than 10,000 inhabitants (1892), the retirement of Roger Q. Mills from the United States Senate (1899) and the sending of free silver delegations to the national conventions of 1896 and 1900.

GOVERNORS

Spanish Period (1690–1821)

Domingo Terán de los Ríos.
Don Gasparo de Anaya.
Don Martín de Alartón.
Marquis San Miguel de Aguayo.
Fernando de Alamanz.
Melchor de Medialvilla y Arcona.
Juan Antonio Bustillos y Cevallos.
Manuel de Sandoval.
Carlos de Franquis.
Pradencio de Oribio de Basterra.
Juez Bonito.
Jacinto de Barrios y Jaurequi.
Antonio de Martos y Navarrete.
Juan María Barón de Ripperda.
Domínguez Caballero.
Rafael Pacheco.
Manuel Muñoz.
Juan Bautista Elizegaray.
Antonio Cordero.
Manuel de Salcedo.
Manuel de Salcedo.
Christoval Domínguez.
Antonio Martínez.

Mexican Period (1821–36)

Trespalacios.
Don Luciana García, provisional.
Rafael Gonzales, provisional.
Vctor Blanco.
José María Viesca.
José María Letona.
Francisco Vidaury y Villaseñor, provisional.
José María Goríbar.
José María Elizagibar.
Augustín Viesca.
Henry Smith, provisional.

Period of the Republic (1836–46)

David G. Burnet, provisional.
Sam Houston.
Mirabeau B. Lamar.
San Houston.
Anson Jones.

2 Coahuila and Texas, 1690–1725, Texas alone 1725–1824.
3 Coahuila and Texas, 1824–35.
4 The state was annexed to the Union in 1845, but the government of the Republic continued in existence until early in 1846.
is used by students as the standard book on the subject which they may be studying.

**TEXTILE-PRINTING.** "Textile" (see Weaving) is a general name for all woven fabrics (Lat. *textere*, to weave), and the art of ornamenting such fabrics by printing on designs or patterns in colour is very ancient, probably originating in the East. It has been practised in some form, with considerable success, in China and India from time immemorial, and the Chinese, at least, are known to have made use of engraved wood-blocks many centuries before any kind of printing was known in Europe. That the early Egyptians, too, were acquainted with the art is proved not merely by the writings of Pliny but by the discovery, in the Pyramids and other Egyptian tombs, of fragments of cloth which were undoubtedly decorated by some method of printing.

The Incas of Peru, Chile and Mexico also practised textile-printing previous to the Spanish Invasion in 1519; but, owing to the imperfect character of their records before that date, it is difficult to say whether they discovered the art for themselves, or, in some way, learnt its principles from the Asiatics.

There is no doubt that India was the source from which, by two different channels, Europeans derived their knowledge of block-printing. By land its practice spread slowly westwards through Persia, Asia Minor and the Levant, until it was taken up in Europe—during the latter half of the 17th century. Almost at the same time the French brought directly by sea, from their colonies on the east coast of India, samples of Indian blue and white "resist" prints, and along with them, particulars of the processes by which they had been produced.

I. Technology

Textile-printing was introduced into England in 1676 by a French refugee who opened works, in that year, on the banks of the Thames near Richmond. Curiously enough this is the first print-works on record; but the nationality and political status of its founder are sufficient to prove that printing was previously carried on in France. In Germany, too, textile printing was in all probability well established before it spread to England, for, towards the end of the 17th century, the district of Augsburg was whether they discovered the art for themselves, or, in some way, learnt its principles from the Asiatics.

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decorative work, viz., appropriateness of pattern and excellency of workmanship. If, occasionally, the earlier designers permitted themselves to indulge in somewhat bizarre fancies, they at least carefully refrained from any attempt to produce those pseudo-realistic effects the undue straining after which in later times ultimate failure and even disaster was due in part to their desire to avoid or injure it during the cutting of the coarser parts. When large masses of colour or the corresponding parts on the block are usually cut in outline, the object being filled in between the outlines with felt, which not only absorbs the colour but also tends to fill in parts of the design. From this it is not possible to obtain with a large surface of wood. When finished, the block presents the appearance of flat relief carving, the design standing out like letterpress type.

Frequently, too, the process of "coppering" is used for the purpose of making a mould, from which an entire block can be made and used as often as desired, by casting. In this case the metal strips are driven to a predetermined depth into the face of a piece of lime-wood cut across the grain, and, when the whole design is completed in this way, the block is placed, metal face downwards. The outer edges of the metal plates are then heated to a temperature sufficient to enable them to carbonize the wood immediately in contact with them, and, at the same time, firmly attaches itself to the outstanding portions. When the strip is removed slightly the outline of the design becomes detached from the block, the wood being left behind. The block is then heated, and the metal plate is removed and cast into a mould of the design, which may consist of any sort of metal, brass being the most commonly used. A block of malleable iron or iron and copper is made, on the surface of which is drawn a line of dimensions to be cut, and then the surface is covered with soft black ink. This is allowed to dry, and a fine object is covered with iron dust, which is then filled between the edges of the iron plate and the block, and the surface is cleansed with a brush. When the line is of the design is repeated, the work is again continued, and the process is repeated until the whole design is completed.

The blocks are then transferred to the printing press, and the paper is drawn over the design. The process of printing is then repeated until the desired effect is obtained. The paper is then removed, and the block is cleaned with a brush, and the process is repeated until the desired effect is obtained.

In addition to the above method of printing, there are several other methods which are used. One of these is the use of a lithographic stone, which is used to produce prints of very high quality. The stone is used in the same way as a wood block, and the design is transferred to it in the same manner. The stone is then treated with a varnish, and the design is printed on to the paper in the usual way.

Another method of printing is the use of a photolithographic process, in which the design is transferred to a plate of metal, and the paper is then printed on to the plate. This method is used in the production of engravings, and is very useful for producing prints of high quality.

The printing process is then repeated until the desired effect is obtained, and the paper is then removed, and the block is cleaned with a brush, and the process is repeated until the desired effect is obtained.

Having thus received a tracing of the pattern the block is produced, and the design is transferred to the plate. The plate is then struck with a hammer, and the design is transferred to the paper by the process of "printing." The design is then printed on to the paper in the usual way.

The process of "printing" is then repeated until the desired effect is obtained, and the paper is then removed, and the block is cleaned with a brush, and the process is repeated until the desired effect is obtained.

The above methods are all used in the production of prints of high quality, and are very useful for producing prints of high quality. The process of "printing" is then repeated until the desired effect is obtained, and the paper is then removed, and the block is cleaned with a brush, and the process is repeated until the desired effect is obtained.

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TEXTILE-PRINTING is textiles should the three too is, Machine-Printing. surface, the advantages in the original mode for speaking the proper faces of the three faces of a specially constructed printing table over which the cloth passes (together with its backing of printer's blanket) after each impression. The faces of the table are arranged at right angles to each other, and may be moved in any desired direction, so that the machine is in motion. The first effect of starting the machine is to cause the colour sieves, which have a reciprocating motion, to pass over, and receive a charge of colour from the rollers, fixed to revolve, in the colour troughs. They then return to their original position between the tables and the printing blocks, coming in contact with the way with the distributing brushes, which spread the colour evenly over their entire surface. Meanwhile, the blocks advance and are gently pressed twice against the colour pads (or sieves) which then retreat once more towards the colour troughs. During this last movement the cloth to be printed is drawn from the printing table by a series of wooden or iron levers, and the colour is transferred to the cloth. The printed cloth is then carried through a series of rollers which press the colour firmly into the fabric. The design is repeated for each colour, and the process is repeated for each colour, until the entire pattern is complete.

(2) PERROTTE PRINTING. The "perrotte" is a block-printing machine invented by Messrs. Levesque in 1834, and practically similar to the block-printing machine employed for this purpose. For some reason or other it has rarely been used in England, but its value was almost immediately recognized on the Continent, where it has been employed in a variety of forms. It is similar to such an enormous extent by roller-printing, the "perrotte" is still largely employed in French, German and Italian works. The construction of this ingenious machine is too complex to describe here without the aid of several detailed drawings, but its mode of action is roughly as follows:—Three large blocks (3 ft. long by 3 to 5 in. wide), with the pattern cut or cast on them in relief, are brought to bear successively on the three faces of a block-printing machine invented by Messrs. Levesque in 1834, and practically similar to the block-printing machine employed for this purpose. For some reason or other it has rarely been used in England, but its value was almost immediately recognized on the Continent, where it has been employed in a variety of forms. It is similar to such an enormous extent by roller-printing, the "perrotte" is still largely employed in French, German and Italian works. The construction of this ingenious machine is too complex to describe here without the aid of several detailed drawings, but its mode of action is roughly as follows:—Three large blocks (3 ft. long by 3 to 5 in. wide), with the pattern cut or cast on them in relief, are brought to bear successively on the three faces of a specially constructed printing table over which the cloth passes (together with its backing of printer's blanket) after each impression. The faces of the table are arranged at right angles to each other, and may be moved in any desired direction, so that the machine is in motion. The first effect of starting the machine is to cause the colour sieves, which have a reciprocating motion, to pass over, and receive a charge of colour from the rollers, fixed to revolve, in the colour troughs. They then return to their original position between the tables and the printing blocks, coming in contact with the way with the distributing brushes, which spread the colour evenly over their entire surface. Meanwhile, the blocks advance and are gently pressed twice against the colour pads (or sieves) which then retreat once more towards the colour troughs. During this last movement the cloth to be printed is drawn from the printing table by a series of wooden or iron levers, and the colour is transferred to the cloth. The printed cloth is then carried through a series of rollers which press the colour firmly into the fabric. The design is repeated for each colour, and the process is repeated for each colour, until the entire pattern is complete.

(4) ROLLER-PRINTING, CYLINDER-PRINTING, OR MACHINE-PRINTING. This elegant and efficient process was patented and worked by Bell in 1785 on fifteen years after his application of the engraved plate to textiles. It will probably remain a moot question as to whether he was the originator of the idea, but it is beyond doubt that he was the first man to put into practice the continuous printing of cloth from engraved copper rollers. Bell's first patent was for a machine to print six colours at once, but, owing probably to its incomplete development, this was not immediately successful, although a second improvement, introduced in 1786, was shown to be practical by the printing of one colour with perfectly satisfactory results. The difficulty was to keep the six rollers, each carrying a portion of the pattern, in perfect register with each other. This defect was overcome by Mr. Parkinson of Manchester, and in 1785, the year of its invention, Bell's machine with Parkinson's improvement was successfully employed by Messrs. Livesey, Harrows, Hall & Co., of Bamber Bridge, Preston, for the printing of calicoes from two to six colours in its operation.

What Parkinson's contribution to the development of the modern roller-printing machine really was is not known with certainty, but it was probably the invention of the delicate arrangement known as "the box wheel," whereby the rollers can be turned, whilst the machine is in motion, either in or against the direction of their rotation.

The simplest form of the roller-printing machine consists of a strong cast iron cylinder mounted in adjustable bearings capable of sliding up and down slots in the sides of the rigid iron framework. Beneath this cylinder the engraved copper roller rests in stationary bearings and is supplied with colour from a wooden roller which revolves in a colour-box below it. The copper roller is mounted on a stout steel axle, at one end of which a cog-wheel is fixed to gear with the driving wheel of the machine, and at the other end a smaller cog-wheel to drive the colour-furnishing roller. The cast iron pressure cylinder is wrapped with several thicknesses of a special material made of wool and cotton—lapping—the object of which is to ensure a constant and uniform pressure is brought to bear on the face of the cylinder. As the rollers revolve, handkerchiefs, or the like, are placed between them to prevent the cloth from being printed the lines of engraving. A further and most important appliance is the "doctor"—a thin sharp blade of steel which rests on the engraved roller and serves to remove any surplus of ink on the engraved roller and to prevent the ink fromimpinging on the cloth. Instead of "doctoring" the engraved roller, the "lint doctor" from its purpose of cleaning off loose filaments or "lint" which the roller picks off the cloth during the printing process. A steel or "cleaning doctor" is pressed against the roller by means of weighted plates which is "lifted" by the "lint doctor" when the plates are not required and the roller is "doctoring". The machine is so constructed that it is just allowed to rest upon it by its own weight and as its function is merely to intercept the nap which becomes detached from the cloth and would, if not cleaned from the roller, mix with the colour and give a bad effect in the future.

The working of the machine will be best understood by referring to the accompanying diagrammatic sketch of a single colour (fig. 1).
TEXTILE-PRINTING

A is the cast iron pressure cylinder; B the lapping with which it is connected; C, the steam chest, and D the sex of the "doctor"; E the brass "lent doctor"; F the colour-furnishing roller; G the colour-trouch or "box" in which the latter (F) works partly immersed in colour; X an engraving machine; Y a "box" or bevelled contact to the force spur all of the machines for the purpose of adjusting the cylinders in vertical direction. Connecting the only part of the machine directly connected with the motor or main drive of the works through the cog-wheel on its axle—

(1) the mandril—all the other parts deriving their motion from it, either directly or indirectly. In the case of the cylinder or by a spur wheel as in that of the colour-furnishing roller. The mode of printing is almost self-evident; the roller C revolving in the direction of the arrow takes colour from the furnisher F, the excess is scraped off by the "doctor" G and, in continuing its course, it comes in contact with the cloth K, which being pressed by the cylinder A into the engraving abstracts the colour therefrom and forms the exact impression of the engraved part.

Larger machines printing from two to sixteen colours are precisely similar in principle to the above, but differ somewhat in detail and are naturally more complex and difficult to operate. In these cases the "box" (Y) is in two or more sections each carrying one portion of the design, are arranged round a central pressure cylinder, or bowl, common to all, and each roller is driven by the corresponding weight when the bellows are actuated, in most cases, by its own steam-engine or motor. Another difference is that the adjustment of pressure is transferred from the cylinder to the rollers which work in specially constructed bellows, instead of the old fashioning windings which, of course, are not so accurately actuated, in most cases, by its own steam-engine or motor. Notwithstanding the great latitude of movement thus provided each roller is furnished with a "box-wheel," which serves the double purpose of transferring the printing work to the "doctor" and affording a fine adjustment. Each roller is further furnished with its own colour-box and doctor.

With all these delicate apparatus at his command a machine-printer may set to work to fill all the various parts of the most complicated patterns with ease, dispatch and precision which are remarkable considering the complexity and size of the machine.

In recent years many improvements have been made in printing machines. A most important of these is the introduction of the "intermittent" and the "Duplex" machines. In the former any or all of the rollers may be stopped to permit of the pattern being passed, and at certain intervals. Such machines are used in the printing of shawls and "saris" for the Indian market. Such goods require a wide border right across their width at varying distances—sometimes even requiring a different one for each part of the design. To meet this, with rollers of ordinary dimensions, that "interruption" machines are used. The body of the "sari" will be printed, say for six yards with eight rollers; these then drop away from the bed, and each roller having been given an impression, immediately fall into contact and print a border or crossbar, say one yard wide, across the piece; they then recede from the cloth and the first eight again return and print another six yards, and so on continually.

The "Duplex" or "Reversible" machine derives its name from the fact that it prints both sides of the cloth. It consists really of two ordinary machines so combined that when the cloth passes, fully printed on one side from the first, its plain side is exposed to the rollers of the second, which print an exact duplicate of the first impression upon it in such a way that both printings coincide. A piece of cloth 36 inches wide in its face will pass, through the corresponding part of the design printed on the back if the two patterns are in good "fit." The advantages possessed by letter-printing over all other processes first its high productivity—10,000 to 12,000 yds. being commonly printed in one day of ten hours by a single-colour machine; secondly, by its capacity of being applied to small and medium sized goods. From the nature of the design, delicate lines of copperplate engraving and the small "repeats" and limited colours of the "perrotine" to the broadest effects of block-printing and to patterns varying in "repeat" from 1 to 800; in addition to which these machines are capable of printing any portion of an elaborate multicolour pattern can be fitted into its proper place, and the entire absence of faulty joints at its points of "repeat" or repetition—a consideration of the utmost importance for delicate work, where such a blur would utterly destroy the effect.

(5) Stencilling.—The art of stencilling is very old. It has been applied to the decoration of textile fabrics from time immemorial. The process is really very simple, and is being used in Europe for certain classes of decorative work on woven goods for furnishing purposes.

The pattern is cut out of a sheet of stout paper or thin metal, with the exception of certain points—"tie" points, that is to say, the part that is to be "reserved" or left uncoloured. The sheet is now laid on the material to be decorated and colour brushed through the open spaces to give the required design.

It is obvious that with suitable planning an "all over" pattern may be as easily produced by this process as by hand or machine printing, and that moreover, if several plates are used, as many different patterns may be produced as there are plates, each plate being used to print a different part of the design. What stencilled patterns is that they have to be held together by "ties," that is to say, certain parts of them have to be left open, so as to connect them with each other, and prevent them from falling apart, and this is done by a number of "ties." These may be cut without its centre dropping out, and, consequently, its outline has to be interrupted at convenient points by "ties" or uncut portions. Similarly with other objects. The necessity for "ties" exercises great influence on the design, and in the hands of a designer of indifferent ability they may be very unsightly.

On the other hand, a capable man utilizes them to supply the drawing, which works in contact with colour-furnishing rollers and the other part with the cylindrical block. This block is known as a "surface" or "pey" roller. Many attempts have been made to print multicolour patterns with "surface" rollers alone, but little success, owing to their irregularity in action and to the difficulty of preventing them from warping. These defects are not present in the printing of linoleum in which opaque oil colours are used—colours which neither sink into the body of the printing roller nor tend to warp the roller. The printing of yarns and warps is extensively practised. It is usually carried on by a simple sort of "surface" printing machine and it may be the same as that for textiles.

Lithographic printing, too, has been applied to textile fabrics with somewhat qualified success. Its irregularity and the difficulty of printing "all over" patterns to "repeat" properly, have retarded its use in contact with colour-furnishing rollers and its application to the different parts of the pattern in such a way as to complete themselves.

ENGRAVING OF COPPER ROLLERS

The engraving of copper rollers is one of the most important branches of textile-printing and on its perfection of execution depends, in great measure, the ultimate success of the design. Roughly speaking, the operation of engraving is performed by three different methods, viz.: (1) By hand with a graver which cuts the metal away; (2) by etching, in which the pattern is dissolved out in nitric acid; and (3) by machine, in which the pattern is simply indented.

Engraving by hand is the oldest and most obvious method of engraving, but is the least used at the present time on account of its slowness. The design is transferred to the roller from an oil-paper block, or by cutting out, with a steel graver, precisely in section, and sharpened to a bevelled point. It requires great steadiness of hand and eye, and although capable of yielding the finest results it is only now employed for very special work and in the production of patterns which are too large in scale to be engraved by mechanical means.

(2) In the etching process an enlarged image of the design is cast upon a zinc plate by means of an enlarging camera and transferred by means of a transfer paper to the zinc plate. This is roughly approximating to those in the original, and the outlines of each colour are carefully engraved in duplicate by hand. The necessity of this is, however, of which will be greatly reduced, as is generally reduced to its original size and, if the outlines on the zinc plate were too small at first, they would be impracticable either to etch or print. The reduction of the design and its transfer to a varying number of copper or zinc plates is an operation in the pantograph machine. This machine is capable of reducing a pattern on the zinc plate from one-half to one-tenth
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of its size, and is so arranged that when its pointer or "stylus" is moved along the engraved lines of the plate a series of diamond points are raised or depressed and rubbed against the paper, upon which the roller is covered. These diamond points vary in number according to the number of times the pattern is required to repeat along the length of the roller. Each colour of a design is transferred in this way to a separate roller. The roller has then been placed in a shallow trough containing nitric acid, which acts only on those parts of it from which the varnish has been scraped. To ensure evenly the acid is distributed during the process, the roller is rolled in the acid. When the etching is sufficiently deep the roller is washed, the varnish dissolved off, any parts not quite perfect being retouched by hand.

The machine engraving the pattern is impressed on the roller by a small cylindrical "mill" on which the pattern is in relief. It is an indirect process and requires the utmost care at every stage. The machine is arranged so that it is never allowed to repeat exactly round the roller. One repeat of this pattern is then engraved by a small highly polished soft steel roller, usually about 3 in. long and 1 in. to 3 in. in diameter; the size varies according to the size of the "mill," repeat with which it must be identical. It is then repolished, painted with a chalky mixture to prevent its surface oxidizing and exposed to a red heat in a box filled with chalk and charcoal; then it is plunged in cold water to harden it and finally tempered to the proper degree of toughness. In this state it forms the "die" from which the "mill" is made. To produce the actual "mill" with the design in relief a softened steel cylinder is screwed tightly on to the "moe" of the "mill," so that the pattern is transferred to the "mill" by screwing it in the roller, with several replicas of what was cut on the original "die." When the full circumference of the roller is engraved, the "mill" is moved sideways along the length of the roller, the process is repeated and the whole roller is fully engraved.

PREPARATION OF CLOTH FOR PRINTING

Goods intended for calico-printing ought to be exceptionally white, the size and other impurities, are certain to arise during subsequent operations. Particles of bleaching will be found in the article BLEACHING (q.v.).

The chemical preparations used for special styles will be mentioned. For general purposes a "preparation," or "preparation," for most colours that are developed and fixed by steaming only, consists in passing the bleached calico through a weak solution of "sulphate" or "torrey red oil containing from 2 to 3 per cent. to 5 per cent. of the dyestuff. "Preparation" gives the bleached cloth, but all patterns containing allamine, red, rose and salmon shades, are considerably brightened by the presence of oil, and indeed very few, if any, colours are detrimentally affected by it.

Apart from wet preparations the cloth has always to be brushed, to free it from loose nap, flocks and dust which it picks up whilst being handled. Frequently, too, it has to be "screwed" by being passed over rapidly revolving knives arranged spirally round an axle, which rapidly and effectually cuts off all filaments and knots, leaving the cloth perfectly smooth and clean and in a condition fit to receive the "preparation." The preparation, in oiling or steaming, makes the fabric, especially those woven in checks, stripes and "cross-overs," require very careful stretching and straightening on a special machine, known as a "stenter," before they can be printed. It is usual, certain formal styles of pattern which are intended in one way or another to correspond with the cloth pattern. Finally, all descriptions of cloth are wound round hollow wooden or iron centres in rolls of convenient size for mounting on the printing machines.

PREPARATION OF COLOURS

The art of making colours for textile-printing demands both chemical knowledge and extensive technical experience, for their ingredients must not only be properly proportioned to each other, but they must be combined in such a way as to give the particular style of work in hand. For a pattern containing only one colour any mixture whatever may be used so long as it fulfils all conditions as to shade, quality and fastness; but where two or more colours are associated in the same design each must be capable of undergoing without injury the various operations necessary for the development and fixation of the others.

There are four main styles of colouring matter or not are known technically as "colours," and are referred to as such in the sequence.

Colours vary considerably in composition. The greater number of them is made up of all the elements necessary for the development and fixation of the colour-lake. Some few contain the colouring matter alone and require various after-treatments for its fixation; the latter are called "dyes." In addition to the essential dye, which is the metallic salt or other substance which combines with the colouring principle to form an insoluble colour-lake, either directly by steaming, or indirectly by dyeing.

It should always be remembered that two folds of cloth may be printed, for the twofold object of enabling them to be transferred from colour-box to cloth without loss and to prevent them from "running" or spreading beyond the limits allowed by the rollers.

Dyeing Agents.—The thickening agents in most general use as colouring matter in printing, are starch, flour, gum arabic, gum senegal and gum tragacanth, British gum or dextrine and albumen.

Starch Paste.—This is made by mixing 15 lb. of wheat starch with a little cold water to a smooth creamy paste; a little olive oil is then added and sufficient water to bring the whole up to 10 gallons. When ready for use, it is being boiled for about an hour, and, after cooking, is ready for use.

Starch is the most extensively used of all the thickenings. It is applicable to all but strongly alkaline or strongly acid colours. When it is not thickened up to a stiff unworkable jelly, it is usually mixed with mineral acids or acid salts convert it into dextrine, thus diminishing its thickening power. Acetic and formic acids have no action on it even at the boiling point.

FLOUR Paste is made in a similar way to starch paste. At the present time it is rarely used for anything but the thickening of aluminium and iron mordants, for which it is eminently adapted.

"Gum arabic and gum senegal" are both very old thickenings, but they have been superseded by certain preparations of tragacanth, which are far more delicate and effective. They are especially useful thickenings for the light ground colours of soft muslins and satins on account of the property of being able to absorb completely out of the fibres of the cloth in the washing process after printing. Starch and artificial gums always leave the cloth somewhat harsh in "feel" unless they are treated specially, and are moreover incapable of yielding the pleasantly clear and perfectly even tints resulting from the use of natural gums. Very dark colours cannot well be obtained with gum senegal or gum arabic thickenings; they come away too much in washing, the gum apparently preventing them from coming out of the cloth together, and at other times being highly torrefied, and almost completely soluble in cold water and very dark in colour. Its thickening power decreases and its "gummy" nature increases as the temperature at which it is roasted is raised. The lighter coloured gums or dextrines will make a good thickening with from 2 to 3 lb. of gum to one gallon of water; the darkest and most highly calcined require from 4 to 10 lb. per gallon to give a substantial paste. Between these limits all qualities are obtainable. The darkest qualities are very useful for strongly acid solutions, and with the exception of gum senegal, and gum tragacanth, for starch paste.

Like the natural gums, neither light nor dark British gums penetrate into the fibre of the cloth so deeply as pure starch or flour, and are therefore unsuitable for very dark strong colours.

"Gum tragacanth," or "Dragontree gum," is one of the most inexpensive thickening agents possessed by the textile printer. It may be mixed in any proportion with starch or flour and is equally useful for pigment colours and mordant colours. When added to starch pastes it renders them "gummy," and, if a certain amount of gum be added, diminishes its thickness, makes it easier to wash out of the fabric and produces much more level colours than starch paste alone. It is better to use it with other gums rather than to add it to goods which are required to retain their soft cloth feel. A tragacanth mucilage may be made either by allowing it to stand a day or two in contact with cold water or by soaking it for twenty-four hours in water. After being dried and powdered it becomes smooth and homogeneous. If boiled under pressure it gives a very fine smooth mucilage (not a solution proper), much thinner than if made in the cold.

Albumen.—Albumen is both a thickening and a fixing agent for
insoluble pigments such as chrome yellow, the ochres, vermilion and ultramarine. Alum is always dissolved in the cold, a process which takes several days when large quantities are required. The usual strength of the solution is 4 lb per gallon of water for both alum and logwood extract. The latter is expensive and only used for the lightest shades. For most purposes one part of alum solution is mixed with one part of tragacanth mucilage, this proportion of alum being found amply strong. After that, for the ordinary pigment colours and special instances the blood alum solution is made as strong as 50 per cent., but this is only in cases where very dark colours are required to be absolutely fast to washing. After printing, alum-bent toner and mordant colours are exposed to hot steam, which coagulates the alum and effectively fixes the colours.

Formerly colours were always prepared for printing by boiling the requisite dye or mordant for several hours in water. In the ordinary pigment colours, as well as in the blood solution, the fibres of the fabric are treated with a solution of the acid and alkali, and then waiting, and cooling and adding the various fixing agents. At the present time, however, concentrated solutions of the colouring matters and other adjuncts are often simply added to the cold toner, and the whole left in a large vessel to cool.

Colours are reduced in shade by simply adding more starch or other paste. For example, a dark blue containing 4 oz. of methylene blue per gallon may readily be made into a pale shade by adding to it thirty times its bulk of starch paste or gum, as the case may be. Similarly with other colours.

Before printing it is very essential to strain or sieve all colours in a fine manner. The fabric is placed on a straining frame and the solution is forced through, the coloured filaments, fine sand, &c., which would inevitably damage the highly polished surface of the engraved rollers and result in bad printing. Every scratch on the surface of a roller prints a fine line in the cloth, and too much care, therefore, cannot be taken to remove, as far as possible, all grit and other hard particles from every colour.

The straining is usually done by squeezing the colour through fine cotton or silk cloths. Mechanical means are also employed for colours that are used hot or are very strongly alkaline or acid.

**Styles of Printing**

The widely differing properties of the hundreds of colouring matters now on the market give rise to many different styles of textile-printing. Generally speaking, these fall into the following four great divisions:—

1. Direct printing.
2. The printing of a mordant upon which the colour is afterwards dyed.
3. The discharge style.
4. The resist or reserve style.

The fact that each of these divisions is further sub-divided into many smaller divisions renders it out of the question to give more than a few typical examples of the various styles they include.

**Application of Mordant Dye-Stuffs.**—Mordant colours include both artificial and natural dye-stuffs (see also DYEING), the most important of all being alizarine, an artificial preparation of the colouring-principle of the madder root. With different metallic oxides alizarine forms different colour-lakes all exceedingly fast to light and soap. Alum mordant gives red and pink lakes; iron mordant, purples and lavenders; chromium yields maroon; and uranium gives grey shades. Mixtures of iron and alum produce various tones of chocolate and brown.

In addition to alizarine the following are a few of the more important mordants employed in textile-printing:

- Alizarine orange with aluminium and chrome mordants for orange and warm brown shades respectively; alizarine bordeaux, with alumina, for violets; alizarine blue with chrome and zinc for quiet blue shades; coeruleine and alizarine viridite for greens and olives with chromium mordants; gallochine, chrome violet blue, alizarine cyanines, &c., with chromium for various shades of blue and violet; alizarine yellows and anthracene brown for yellos and fawn shades especially with aluminium or chrome mordants. The natural dye-stuffs belonging to this series are chiefly: logwood, with chromium and iron mordants; logwood extract, with chromium and alum mordants; catechu, with chromium, for very fast dark browns; and, occasionally, in mixture with logwood extract, with alum and chromium mordants; and divi-divi extracts with any of the above-mentioned mordants.

The mordants are mostly in the form of acetates which are stable in the cold but decompose during the steaming process, and combine as hydrides with the colours, forming and fixing on the fabric the insoluble lake.

Alizarine reds and pinks are the most complicated of the mordant colours, requiring for their proper production the addition of brightening agents, such as oxalate of tin, oils, tartric acid, and also acetate of lime. This also applies to alizarine orange, but all the other colours are very simple to prepare and are stable for a long time after making. Reds, pinks and oranges are best prepared freshly each day; their constituents are liable to combine if the colour stands twenty-four hours before printing. The following types of recipes will give some idea of the way in which colours are mixed:

**Red.**
- 64 gallons thick starch and tragacanth paste.
- 14 " alizarine (20 per cent. commercial paste).
- 1 nitrate of alumina, 18° Tew.
- 10 " oxalate of lime, 28° Tew.
- 10 per cent. solution of tartaric acid.

**Pink.**
- 64 gallons starch-tragacanth paste.
- 1 blue shade alizarine (20 per cent. paste).
- 1 " red shade chrome, 18° Tew.
- 1 " acetate of lime, 28° Tew.
- 10 " oxalate of tin.
- 10 " citrate of alumina, 40° Tew.

For reds and pinks the nitrate, sulphoanide and citrate of alumina are generally preferred in practice to the acetate though the latter is also largely used. Oranges from alizarine orange are made similarly.

**Purple.**
- 64 gallons starch paste.
- 1 " blue shade alizarine, 20 per cent.
- 1 " acetic acid.
- 1 " acetate of lime, 28° Tew.
- 1 " acetate of iron, 24° Tew.

**Maroon.**
- 64 gallons paste.
- 1 " alizarine, 20 per cent.
- 1 " acetate of chrome, 32° Tew.
- 1 " acetate of lime, 28° Tew.

Blues and the other colours are made by leaving out the lime in the last recipe and replacing the alizarine with another colour.

**Alizarine Blue.**
- 64 lb alizarine blue shade (powd.).
- 1 gallon water.
- 13 " thick paste.
- 5 " citrate of chrome, 40° Tew.

**Light Shade.**
- 1 gallon water.
- 13 " thick paste.
- 5 " acetate of chrome, 40° Tew.

**Logwood Black.**
- 15 lb starch.
- 10 " British gum.
- 4 " gallons water.
- 4 " alum.
- 4 " logwood extract, 48° Tew.
- 4 " quercitrin extract, 48° Tew.
- 1 " salt.
- 2 " water.
- 11 " starch.
- 2 " salt.
- 11 " water.

Boil, cool and add:
- 1 lb red prussiate of potash.
- 1 lb alizarine.
- 2 " acetic acid.
- 2 " acetate of chrome, 40° Tew.
- 2 oz. chloride of potash.

**Quercitrin Yellow.**
- 64 lb quercitrin extract, 48° Tew.
- 6 " water.
- 11 " starch.

Boil, cool and add:
- 1 gallon solution of chrome, 30° Tew.

The proportions here given are liable to variations according to circumstances. Indeed, no two works employ quite the same recipes, although the proportion of mordant to dye-stuff is pretty generally known and observed.

After printing, these goods are dried, steamed for one hour, and then washed and finished.

**Application of Basic Amtine Dye-Stuffs.—**These colours all form insoluble lakes with tannic acid; hence tannic acid is the common fixing agent of the group. Arsenic in combination with alumina also gives basic-colour lakes, but their poisonous character and their inferior fastness to most reagents considerably limit their application.

The more important basic dye-stuffs are: methylene blue, methyl violet, rhodamine, auramine yellow, safranine, emerald green and indigo blue. Most of them are fairly fast to soaping, but towards the action of light they vary a good deal, methylene blue being perhaps as good as any, and the malachite green the least stable.

Their application is simple. A solution of the colouring matter is added to the required quantity of starch paste or gum, and, when well mixed in, the tannin is added in the form of a solution also. If desired they may be boiled up like the extract dye-stuffs (logwood, &c.), but this is not necessary unless large quantities of the common fixing agent of the group are added.

Boil the whole at once to three small batches by hand.
Methylene blue will serve as a type of the method by which all basic colours are compounded.

Blue. 2 gallons water, 5 oz. Methylene blue, 10 per cent. solution in water and acetic acid.

6 oz. thick starch paste.
1 oz. tragacanth mucilage.
3 oz. tannic acid solution, 50 per cent.

10 gallons.

All other basic colours are made up for printing in a similar way by replacing the blue with the required dye-stuff.

After printing, goods containing basic dyes are "steamed," and passed through a solution of tartar emetic, or other salt of antimony, whereby an insoluble double tannate of antimony and colouring matter is precipitated, and constitutes a much faster colour than the single tannate of the dye-stuff.

Basic colours may be printed along with "mordant" and albumen colours.

(c) Application of Direct Dyeing Colours.—These colours have a natural affinity for the cotton fibre and therefore require no mordant. They are not very "fast," however, and, though used enormously in the dyeing of plain shades, they find but little employment in printing except for the tinting of printed goods, and for the "crepon" style, where the colours must be able to withstand the action of caustic soda.

They are printed with the addition of a slightly alkaline salt (phosphate of soda) and sulphate of soda. Amongst the hundreds of direct colours equally suitable for printing mention may be made of erica for pink; diamine, sky-blue for blues; diamine, red for reds; and diamin and chloramine from the yellow dyes. In fact, most of the benzenide, diamine, diamin and Congo dye-stuffs can be used for printing, but with the exception of the yellows none of them will resist the action of light and washing, and only the extent that the "fastness" of the basic colours will.

The general formula for printing these colours is as follows:

\[ \text{4 oz. colouring matter.} \]
\[ \text{1 oz. gum.} \]
\[ \text{1 oz. starch or tragacanth thickening.} \]
\[ \text{3 oz. phosphate of soda.} \]
\[ \text{3 oz. sulphate of soda.} \]

After printing and drying, the goods are first steamed, then slightly washed in a weak tepid soap solution and finally finished.

(d) Application of Pigment Colours.—Before the introduction of coal-tar colours, pigments and lakes played a much more important part in textile-printing than they do at present, though they are still largely used for certain styles of work. They form a series of colours more difficult to work than those already mentioned, but very fast to soap and light.

Pigment colours, being insoluble mineral precipitates or lakes, can only be fixed on the fibre mechanically; consequently they require to be applied in conjunction with vehicles which cause them to adhere to the fabric in much the same way that paint adheses to wood.

Of these vehicles, albumen is the most important and the best. It forms a smooth viscous solution with cold water, mixes readily with all the colouring matter in printing, and possesses the property of coagulating when heated to the temperature of boiling water. When cloth printed with colours containing albumen is passed through hot steam or hot acid solutions, as in the indigo discharge style, the albumen coagulates, forming a tough insoluble colloidal deposit, which firmly fixes on the fibre any colour with which it is mixed.

The colours chiefly employed in pigment printing are: chrome yellow and orange, Guignet's green or chrome green; artificial ultramarine; lamp black for greys; the various ochres for golds and browns; zinc oxide; vermillion and its substitutes, and occasionally vegetable dyes, as the purple from the indigo-root. All these substances are employed in exactly the same way and may be mixed together in any proportion to form compound shades. The amount of albumen necessary to fix them varies according to the density of shade required (between 2 and 3 oz. of whole weight of the made-up printing colour), and although it is usually considered in text-books as a thickening agent it is rarely used as such in practice on account of its expense. As a rule the colouring matter is beaten up into a smooth paste with water, and a strong solution of albumen, and then reduced to its proper strength by the addition of tragacanth mucilage or starch paste.

The following formula for printing any of these direct pigment dyes is their printness of division; the finer they are the better they print and the more beautiful is their quality of colour. If they are too coarse they give rise to innumerable defects, either by sticking in the roller or by extruding the rollers; by staining the roller, or, if they print at all, by yielding uneven masses of colour, granular and speckled in appearance and quite unsaleable. Even when finally ground for printing, they are well to clog the engraving of the rollers—a defect which is more or less successfully overcome by replacing the colour-furnishing roller in the printing machine by a revolving brush.

The following formula of dark ultramarine blue will serve as a type of all other pigment printing colours:—

\[ \text{20 lb. artificial ultramarine blue.} \]

Place in grinding machine and beat up gradually with

\[ \text{4 gal. water, 40 per cent. blood albumen solution.} \]

\[ \text{2 gal. tragacanth mucilage, 8 oz. per gal.} \]

\[ \text{\textit{Ba} = ammonia.} \]

\[ \text{\textit{Gly} = glycerin.} \]

\[ \text{\textit{Tr} = turpentine.} \]

\[ \text{\textit{OL} = olive or cotton-seed oil.} \]

Make to 8 gallons with tragacanth or water, and grind the whole until perfectly homogeneous.

The small quantities of ammonia, turpentine, glycerin and oil are added to prevent the colour from frothing during the printing process.

Chlorine yellows and oranges are frequently mixed with a little calcium nitrate to counteract the action of sulphuretted hydrogen on the lead salts.

The great disadvantage of pigment colours is that although extremely fast to light and soap they are liable to rub off, if the fabric is subjected to more friction in washing. They also impart considerable stiffness to the goods, and for these two reasons they are therefore restricted to the printing of small patterns, or are used for such styles as window-blinds where the stiffness is not objectionable. The pale shades they are used for printing the grounds or "blotsches" of multicolour patterns, the small quantity of albumen they then contain being insufficient to appreciably affect the softness of the cloth. In several discharge styles too notably indigo—they find extensive use, and on the whole they constitute a most useful class of colours.

(e) Application of Indigo.—Indigo is printed on cloth by several different methods, the chief of which are: (1) Schlieper and Baum's glucose process; (2) the hydrolysulphite process; and (3) the production of indigo on the fibre itself by means of Kalle's indigo salt and several other artificial preparations. The first and second processes depend upon the facts that indigo in presence of a calcium alkali may be converted into indigo-white by reducing agents, and that the indigo-white, being soluble in the alkali, penetrates into the fibres of the cloth, where it is subsequently re-oxidized to the insoluble indigo-blue state.

In Schlieper and Baum's process (also known as the glucose process) the cloth is first prepared in glucose, and then printed with a colour containing finely ground indigo, caustic soda and dezincing thickening (also made with caustic soda). After printing the cloth is "aged," that is, passed through damp steam for a few minutes to effect the reduction and solution of the indigo, and is then hung up in a cool chamber for a day or two, in order to re-oxidize the indigo-white to indigo by the action of the oxygen in the air. A wash in cold water finally completes the fixation of the indigo, and the cloth may then be soaked and finished as usual.

Either the printed or printed and air-dried state, or, if printed containing a metal, a brown containing 30 per cent. solution of glucose in water; the excess is squeezed out in a mangle, and the cloth dried. It is then printed with the following colours according to shade required:

<table>
<thead>
<tr>
<th>Colour</th>
<th>Dark</th>
<th>Medium</th>
<th>Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Blue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alkaline dextrine paste</td>
<td>71 oz</td>
<td>8 gal.</td>
<td>8 gal.</td>
</tr>
<tr>
<td>Caustic soda, 36° Tw.</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Indigo 20 per cent. paste</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

10 gals. 10 gals. 10 gals.

The printed goods should be dried quickly, and "aged" as soon as possible to prevent the absorption of carbonic acid gas from the air, after which the operations already mentioned may be proceeded with at leisure.

The well-known blue and red pattern produced by this process, the only difference being that, instead of white cloth, turkey red cloth is used, the strong alkali dissolving out, or "discharging," completely the colour from the parts of the cloth upon which it falls, and leaving the indigo as a blue pattern on a red ground.

In the hydrolysulphite process, which is much quicker than the preceding, the reducing agent, the indigo and the alkali are all printed together on unprepared white cloth. The goods are then "aged," and allowed to lie a short time, after which they are washed in cold water, a box containing a little indigo is thoroughly re-oxidized, and then in hot water or soap.

The hydrolysulphite printing colour is as follows:

\[ \text{200 parts hydrolysulphite N.F. (or 100 of the concentrated product).} \]

\[ \text{150 oz. alkaline dextrine paste.} \]
\[ \text{150 oz. indigo 20 per cent. paste (ground up in gum).} \]
\[ \text{200 oz. alkaline dextrine paste.} \]
\[ \text{Thickening 5 oz. ultramarine or British gum.} \]
\[ \text{50 oz. caustic soda, 70° Tw.} \]

Print, dry, "age" and wash off in a copious supply of cold water.
The third process with Kalle’s salt is not properly speaking the printing of indigo, but of a special preparation capable of forming indigo when treated with caustic alkalis. The salt is merely dissolved and thickened with gum or starch, printed, and then passed directly through a solution of caustic soda, when the indigo is immediately developed. Instead of being passed through the alkali, which is apt to cause the colour to run before it is properly developed, the cloth is more commonly printed with thickened caustic soda, whereby the indigo is equally well produced without any fear of "washing." Besides indigo, other vat dye-stuffs, such as indanthrenes, the algols, heindone and certain dyes, thin-indigo scarlet, &c., are also printed largely at the present time, yielding colours of hitherto unattained fastness to washing and to light.

(1) **Tintable Azo-Colours.** These colours do not exist as such, but require to be precipitated from the fibre itself from their components. They form a range of exceedingly fast colours, including orange, red, pink, maroon, brown, chocolate, blue and black, and are produced by the combination of various diazo-bodies with phenols, the most important of which latter is β-naphthol (beta-naphthol).

The practice of application is briefly as follows:—The bleached cloth is prepared in a solution of β-naphthol in caustic soda (naphtholate of soda), then gently dried and printed with the thickened diazotized amine required to produce the desired shade. The printing colour must be cooled with ice to prevent its decomposition; hence such colours are sometimes known as "ice colours." The two colours most extensively used are para-nitraniline red and α-naphthylamine maroon, both of which are bright fast colours, only equalled by turkey red and madder chocolate for general usefulness.

**On β-naphthol prepare the following colours may be obtained:**

Red with para-nitraniline.
Maroon with α-naphthylamine.
Orange with orthoformololuidene.
Pink with azo pink 2 B.
Chocolate with benzidine.
Brown with benzidine and orthoformololuidene.
Blue with dianisidine.
Black with dianisidine and benzidine.

Other naphthols and other bases give a still greater variety of shades. The β-naphthol requires to be freshly made, and the cloth prepared with it carefully dried, if good results are to be obtained.

Para-nitraniline is made up for printing by dissolving in hydrochloric acid. Nitrite of soda is then added, and, after standing a short time to complete the reaction, the resulting diazo-solution is mixed with thickening, and acetate of soda is then added to neutralize any free mineral acid still remaining, the presence of which would prevent the formation of the colour.

In practice the following formula have given good results:

(1) **Para-nitraniline Red**

Prepare the bleached cloth in:

\[
\begin{align*}
47 \text{ parts} & \beta\text{-naphthol.} \\
3 & \text{naphthol R.} \\
107 & \text{caustic soda, } 5^\circ \text{Tw.} \\
400 & \text{hot water.} \\
10 & \text{tartar emetic.} \\
12 & \text{tartaric acid.}
\end{align*}
\]

Make up to 1000 parts with hot water.

The cloth is passed through a trough containing this solution, the excess is squeezed out between two wooden rollers, and the cloth is gently dried and then printed with:

\[
\begin{align*}
36 \text{ parts} & \text{para-nitraniline C.} \\
100 & \text{ice.} \\
100 & \text{hydrochloric acid, } 30^\circ \text{Tw.} \\
70 & \text{water.}
\end{align*}
\]

Mix and add quickly:

\[
\begin{align*}
24 \text{ parts nitrite of soda, } 93 \text{ per cent.} \\
70 & \text{water (cold).}
\end{align*}
\]

And just before printing add further:

100 parts acetate of soda.
100 parts ice in large pieces.
400 parts tragacanth mucilage, 12 per cent.

Print, dry and wash.

A similar prepare without the naphthol R. may be used for α-naphthylamine manoons, the printing colour for which is made up as follows:

\[
\begin{align*}
36 \text{ parts} & \text{α-naphthylamine.} \\
93 & \text{hydrochloric acid, } 30^\circ \text{Tw.} \\
171 & \text{tragacanth mucilage.}
\end{align*}
\]

Grind till perfectly smooth in a mill and then add:

\[
\begin{align*}
100 & \text{parts ice.} \\
20 & \text{nitrile of soda of } 93 \text{ per cent. strength.} \\
80 & \text{water.} \\
400 & \text{starch and tragacanth thickening.} \\
25 & \text{benzine.} \\
75 & \text{acetate of soda.}
\end{align*}
\]

Print, dry and wash.

Immediately these diazo-colour pastes come in contact with the naphthol prepared cloth the colour itself is formed and fixed and requires no further treatment except that of washing to remove the naphthol from the unprinted parts of the cloth.

The other bases are diazotized in precisely the same way, the quantities of acid and nitrite of soda being varied according to the molecular weights of each base.

Several processes of printing azo-colours directly, without any previous preparation of the cloth, have been proposed, but they are not yet general as yet; those which have passed the experimental stage are not very successful on the large scale, and have, for the most part, been abandoned.

(2) **Application of Sulphur Dyes.** Of late years the class of colours known as "sulphur colours" have assumed a prominent place in textile-printing. They are really direct dyeing colours, but their special properties entitle them to be classed apart from those usually known as dyestuffs of this nature.

There are now an enormous number of sulphur-colours on the market under many different names, but, as they are all similar in general properties, it is needless to mention more than one series. The Lighter dyes are known as Biester, Lucius and Bruning will serve as well as any to exemplify the application of these dye-stuffs in printing. They comprise yellows, golds, browns, violets, blues, greys and blacks, all fairly, and some very, fast to light and soap, and, under proper conditions, easy of application to a variety of styles.

The general recipe for printing is as under:

\[
\begin{align*}
30 & \text{parts by weight of colouring matter.} \\
90 & \text{gls. water.} \\
50 & \text{china clay beaten up with} \\
50 & \text{water.} \\
40 & \text{concentrated hydro sulphur} \\
& \text{N.F., } 50 \text{ per cent. solution.} \\
700 & \text{alkaline British gum thickening.}
\end{align*}
\]

This paste is printed on unprepared bleached cloth, gently dried and then passed through a rapid steam ager, in from 4 to 7 minutes in dry steam at 212° F. to 220° F. (or twice for 3 minutes), after which the cloth is passed in the open width through the washing and soap machines, and finally dried up and finished.

The sulphur colours may be used in combination with the azo-colours, on naphthol-prepared cloth, for the production of multi-colour effects, and are entirely adapted also to the production of coloured discharges on paraintraniline red and the direct-dyeing colours.

(2) **Aniline Black.** Aniline black was discovered and first used by Lichtfuss in 1865. It is one of the fastest blacks known, and is equally useful for direct printing by itself, and for working along with printed mordants and discharge pastes. Aniline black is formed by the oxidation of aniline.

As a great deal of care is required in printing these two blacks, as if over-dried they take fire and have occasionally caused considerable damage to buildings in consequence. The blacks made with ferrocyanide, on the contrary, may be printed in conjunction with "steam" colours, and, after a preliminary passage through a rapid steam ager, and an ammonia "gassing" box, will withstand the long steaming necessary for alluring colours.

A copper aniline black may be made as follows:

\[
\begin{align*}
15 & \text{lb starch.} \\
8 & \text{lb British gum or dextrine.} \\
51 & \text{gals. water.} \\
80 & \text{lb chlorate of soda.} \\
4 & \text{gal olive oil.}
\end{align*}
\]

Boil, cool and add:

\[
\begin{align*}
8 & \text{lb aniline salt.} \\
3 & \text{lb aniline oil.} \\
3 & \text{lb sulphide of copper (precipitate pressed to a 30 per cent. paste).}
\end{align*}
\]
This black may be either hung to develop, which is the safer course, or it may be oxidized by the introduction of oxygen through steam for 2 to 3 minutes. Whenever method is adopted the printed cloth must afterwards be passed through hot bichromate—chroming—and then well washed.

The black of ferrocyanide works well in practice:

10 lb starch.
2 lb British gum.
6 lb yellow prussiate (ferrocyanide) of potash.
7 gals. water.

Boil, turn off the steam, and add:
2½ lb chlorate of soda in powder.

Cool and add:
8¼ lb aniline salt.

Print, age 4 minutes through the rapid agor, chrome, wash, and soap. If printed with alizarine steam colours it must be passed through ammonia vapour after "aging," and then be steamed for one hour before chroming and washing. The black is omitted, but the colour is then apt to become green after a short time owing to the action of sulphur dioxide present in the air.

Aniline black is now used almost exclusively for printing with all mordants for the artificial colour, or black ground goods that were formerly dyed with logwood on an iron mordant. Shirtings and all single-colour black dress goods are also executed in aniline black, which is faster to light, washing, and perspiration than all other black dyes. It must not be used in the same bath with any other black dye.

(2) Printing of Mordants.—This, the second of the great styles of textile printing, was, at one time, the most extensively practised of all, and is still the most important for all classes of work where the fastest colours are required. It may be conveniently divided into two branches: (a) the madder style, and (b) the printing of other mordants such as chrome, tannic acid, β-naphthol, etc. (a) The Madder Style.—In this style the only mordants used are those of aluminium and iron.

Aluminium alone yields various shades of red and pink when dyed up in mordants for its artificial colour, or purple and maroon. Iron alone yields with the same dye-stuffs shades varying from black to the palest lavender. Iron and aluminium mordants in combination yield colours ranging in shade from claret through all gradations of brown to the deepest blues and purples, according to which of the two mordants predominates in the mixture. Browns and allied colours may be dyed on the same mordants with either nitrocellulose alone, or with alizarine itself mixed with dyeextractions—logwood, Persian berry or quercitron bark, etc.

Both aluminium and iron mordants consist of the acetates of their respective metals. The iron mordant which gives the best results is known as "black liquor." It is a crude acetate containing a good deal of organic matter which appears to regulate the speed of its oxidation and so produce much more level colours than have ever been obtained from any other iron mordant.

Aluminium acetate in the pure state is also rarely employed, the crude commercial "red liquor" being found in practice to yield the best results, both as regards colour and ease of working. The "red liquors" vary considerably in composition, some being normal sulphate-acetates, others basic acetates, some normal sulphate-acetates, others basic sulphate-acetates, but their mode of application is always the same, that is, they are thickened, printed, aged and dyed. In all cases they are basic they decompose on boiling, or on dilution, and become utterly useless; but this rarely happens nowadays and need not be further gone into. Many difficulties occur in the printing of mordants and their subsequent dyeing, but if the following points are observed most of them may be surmounted: (1) after printing the cloth must be gently dried, otherwise the mordants become dehydrated or "burnt," and instead of dyeing up evenly they appear patchy and very light in the over-dried parts; (2) the cloth should not be used in excess; and (3) the temperature of the dye-bath must be kept as low as is consistent with the fixation of the colour. If these last two points are neglected the printed parts of the cloth, which should remain a pure white when it is finished, will be soiled beyond repair unless indeed the "whites" are cleared at the expense of weakening the colour. Iron mordants especially are liable to unevenness due to the oxidation being too slow; and this is not only noticeable in purples and lavenders, the pyrolygnite of iron or "black liquor" is frequently boiled for half an hour or more with 1 per cent. of its weight of arsenious acid, or "white arsenic," a substance which retards the oxidation when dry. Sometimes the dyes are mixed with either aluminium or iron acetates, and hung or "aged" for 2 to 3 days in a brick chamber containing moist air at about 30°C. dry bulb, and 27°C. wet bulb thermometer. In this operation the gals, lb may pass through a mixture of an anilinum powder, and chalk at a temperature of about 50°C. In this "dunng" bath they are worked altogether about ½ hours, at the end of which the mordants are thoroughly fixed, and all the thickening agents perfectly eliminated, thus leaving the cloth in the best condition to absorb the dye-stuff.

The dyeing is carried out by working the goods at 60°C. in a mixture of alizarine, a little chalk, and glue size for 1 to 1½ hours. They are then well washed, soaped, and the whites cleaned by a passage through weak bleaching powder solution, followed by a passage through steam. Further soaping and washing is then resorted to until the goods are quite clear and bright.

In the case of cloth dyed in red and pink alone the goods after dyeing are well washed, passed through a bath of alizarine oil containing oxalate of ammonia, and then steamed for one hour at 15 lb pressure. This brightens the colours by removing the brown appearance they possess after dyeing. When reds are associated with chocolates and purples, however, the oiling process must be carefully conducted, otherwise the latter suffer; frequently it is omitted altogether, the brightening being effected by vigorous soaping.

By printing the following mordants a six-colour design may be produced with a single dye-stuff and in one dyeing:

<table>
<thead>
<tr>
<th>Red</th>
<th>Pink</th>
<th>Chocolate</th>
<th>Dark Purples</th>
<th>Violet</th>
<th>Black</th>
</tr>
</thead>
<tbody>
<tr>
<td>10½ gals.</td>
<td>3 gals.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 gal.</td>
<td></td>
<td>1 gal.</td>
<td>1½ gal.</td>
<td>3 gal.</td>
<td>8 gal.</td>
</tr>
<tr>
<td>Water.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 gals.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>British gum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36 lb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetic acid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 lb</td>
<td></td>
<td>1 gal.</td>
<td>3 gal.</td>
<td>10 lb</td>
<td>1 lb</td>
</tr>
<tr>
<td>Tin crystals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>½ lb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotton-seed oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>½ gal.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 lb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The above mordants are printed on white bleached cloth, dried, hung 2 to 3 days, "dunng," dyed, washed, well soaped and washed again; then "chemicked" through weak bleaching powder solution, and finished.

The "dunng" is performed in vats through which the cloth circulates continually during the operation. As a rule dunning is done twice, the second bath being weaker than the first. The vats or "becks" contain a mixture of:

- 100 gals. water
- 10 lb chalk
- 25 lb cow-dung

at 60°C.

100 gals. water
5 lb chalk
25 lb cow-dung

This duning bath is continued until the cloth hangs in the dye liquor. When about 700 yds. of cloth have been entered in this way the two ends of it are knotted together, thus forming an endless rope which circulates continuously in and out of the dye-liquor. The vat or beck is then charged with alizarine, chalk and glue, the proportions varying according to the amount of space covered by the mordants on the cloth. If, for instance, half the surface is printed then the dye-liquor might be made up as follows, the quantities being calculated on the weight of the cloth:

- 4½ per cent. alizarine (blue shade), 20 per cent. in a sufficiency
- 14½ per cent. acetate of lime, 26½° Tw.
- 10 ', glue solution, or size, 15 per cent. of water.

The goods are entered into this solution cold. The temperature is gradually raised to 60°C., and the dyeing continued at this for several hours. The goods are then washed in a similar machine, soaped well and finished off by drying.

Aniline black may be printed along with "red liquor" and iron liquor, and many other modifications also employed, but the principle of dyeing is as before stated.

(b) The Printing of other Mordants.—Of these the most important are tannic acid, chrome mordants and β-naphthol.

For printing tannic acid the following is used:

- 5 lb tannic acid dissolved in a sufficient amount of
- 1 gal. acetic acid and added to
- 9 ' starth and tragacanth paste.
The goods are simply dried after printing and the tannic acid immediately fixed by passing through a solution of—

1 oz. tartar emetic.
1 oz. chalk.
1 gal. water at 60° C.

After washing they may be dyed up in any of the basic aniline colours. Various chrome mordants are employed in printing, amongst which may be mentioned chromium chloride, and chromium acetate. The latter is thickened with starch or gum, printed, and fixed by being passed through boiling sodium carbonate. The latter is applied in the same way but, after printing, is steamed before the carbonate treatment. Both these mordants are suitable for dying with any of the basic dyes. It is mentioned under the direct printing of mordant colours, such as alizarine, alizarine bordeaux, coeruleine and the natural dye-wood extracts. They are dyed similarly to the madder colours, with an addition of glue size to preserve the white of the unprinted parts of the cloth.

(g) The Discharge Style.—This style is now one of the most important produced. Its range is so extensive, and its modifications so numerous, that it is impossible to mention more than a few of its chief applications. It may be used for locally destroying either the colours dyed on cloth, or the mordants with which they have been prepared. In both cases the resulting pattern appears in white, or colours, on a full rich ground the beauty of which cannot be equalled by direct printing. The discharging agents consist of organic acids, caustic alkalis, oxidizing agents and reducing agents, each used according to the kind of colour or mordant to be discharged.

(a) Discharge of Iron and Aluminium Mordants.—The cloth is padded with a solution of these mordants, dried in hot air, and then padded with either the acid or acid citrate of soda, mixed with china clay to prevent the pattern running. It is then passed through the rapid ager once or twice, "dunged," washed, and dyed in the usual way for madder colours. Wherever the discharge has been printed the mordant is dissolved out, leaving a white pattern on a dyed ground.

(b) Tannate of antimony mordant is similarly discharged by printing or caustic soda. The goods are passed in like manner through the ager, well washed in water, and dyed-up in any basic aniline dye.

(c) The chrome discharge is produced by padding the goods in chromium bichromate; then drying them, and printing-on citric acid, or citrate or acid citrate of soda. They are then steamed, passed through chalk and water, well washed and dyed up in any mordant dye.

(d) Turkey red may be discharged in both white and coloured patterns by either oxidizing agents or caustic alkalis. (1) The dyed cloth is printed with strong citric acid, or arsenic acid, at 180° Tw., and then run through bleaching powder solution, whereby the phenol parts are completely decolorized. If colours are required, the citric acid is mixed with lead salts and Prussian blue, and the fabric after passing through the bleaching powder solution, is further treated in a bath of bichromate of potash which forms with the lead salts the insoluble chromates. Green is obtained by the combination of Prussian blue with the chrome yellow.

Examples:

White. 6 lb citric acid or tartaric acid.
1 gal. water.
4 lb British gum or dextrose.
Boil together.
Yellow. 15 lb British gum.
1 gal. dark British gum paste, 30 per cent.
2 lb. water.
20 lb tartaric acid.
12 lb nitrate of lead.

Print, dry, discharge through bleaching powder solution,
18° Tw., and chrome.

(e) The dyed cloth is printed with strongly alkaline discharge pastes, passed through the "ager" two or three times, and then washed off in silicate of soda. If blue, yellow and green discharges are desired they must first be passed through glucose solution, well dried, printed with the colours, aged, passed through silicate of soda,chromed in bichromate, well washed and dried. Examples:

White. 10 lb stannous chloride dissolved cold in
8 gal. alkaline thickening.
2 lb. silicate of soda, 70° Tw.

Blue. 15 lb indigo pure 20 per cent. paste.
3 gal. turpentine.
9 gal. water.
10 lb British gum paste.
7 lb alkaline thickening.
Green. 8 parts of the yellow without silicate.
1 part of blue.

If Paranitraniline red is discharged by means of the new hydro sulphate-formaldehyde compounds. The dyed cloth is printed with the following:

25 lb hydro sulphite N.F. conc., or hydralide conc.
14 lb. British gum paste.
Heat till dissolved and add—
3 lb. gal. glycerin
4 lb. starch-tragacanth thickening.

After printing, age twice for 4 minutes through dry steam at 220° F., then wash well and soap. Coloured discharges are obtained by mixing hydro sulphite, tannic acid, aniline or phenol, and basic colouring matters together. Mordant dyed fixed with chromium acetate may also be used. On a-naphthylamine maroon the above discharge white requires the addition of indulin scarlet, patent blue or anthraquinone, before it becomes effective; otherwise the procedure is the same as for paranitraniline red.

(g) Indigo is usually discharged by oxidation. For this purpose the dyed cloth is printed in two different ways. Firstly, with chloride of soda, and red or yellow prussiate of potash together with a little citric acid or citrate of soda; secondly, with chrome of potash. In the first instance, the cloth is "aged" through the rapid ager after printing, and, in the second, is passed through a vat containing hot sulphuric and oxalic acid. Coloured discharges may be obtained in both methods by adding aluminun and pigment colours to the discharging agents.

(1) Discharge by steaming—
12 lb citric acid, dissolved in:
7 lb caustic soda, 70° Tw., and add:
12 lb sodium chlorate.
5 gals. British gum paste.
Heat till dissolved, cool and add—
4 lb British gum paste.
12 lb yellow prussiate of potash.
Print, steam and wash.
Chlorate of aluminium is also used for this process, but it acts very energetically and is apt to tender the cloth.

(2) Chrome discharge.
White. 8 lb British gum paste.
12 lb bichromate of soda.
1 lb. gal. turpentine.
Yellow. 32 lb chrome yellow pigment.
3 gals. 50 per cent. albumen solution.
3 lb. thick tragacanth mucilage.
1 lb. (oil) vegetable.
12 lb bichromate of soda neutralized with
3 gal. caustic soda, 70° Tw.
1 lb. water.
Print, dry, pass through a "beck" (i.e. a bath) containing—
100 gals. water.
50 lb sulphuric acid (168° Tw).
50 lb oxalic acid.

Then wash well and dry.

With these oxidation discharges it is impossible to prevent the fibre being attacked by the discharge pastes, and it is impossible that it is partially converted into oxycellulose. Recently a method has been brought out for the production of a white discharge on indigo which is said to do away with the formation of oxycellulose and which consists in printing on a thickened solution of sodium nitrate and, after drying, running through sulphuric acid of 50° Tw.

Another method of producing white discharges on indigo consists in printing the dyed cloth with hydro sulphite N.F., then steaming and running through a boiling solution of caustic soda. Good results are thus obtained without the formation of oxycellulose, but the process is expensive.

(b) Direct dying or substantive colours can be easily discharged with the hydro sulphite discharge used for paranitraniline red (see above). It must be reduced in strength to about one-fourth for dark shades, and much weaker for lighter colours. Direct colours were formerly discharged by stannous chloride or acetate, but the hydro sulphite has almost entirely displaced these salts for white discharges.

(g) Discharges on manganese bronze are of little importance at the present time. They are effected by means of stannous chloride, colours being obtained by the addition of basic dyes and dyeweed dyes.

(j) Sulphur-colours, dyed basic colours, and some alizarine colours, are discharged with chrome and prussiate like indigo.

(a) The British or Reserve Style.—Reserves are substances which, when printed, prevent the fixation or development of mordant and colour solutions subsequently applied, and are used to produce effects similar to those obtained by discharge printing.

One method reserves these uses either madder dyed goods, steam alizarine reds and pinks, steam basic colours, vat indigo blue, insoluble azo colours, sulphur-colours and aniline black. 

TECHNOLOGY
(c) Reserves under Aluminium and Iron Mordants.—For the production of this important class of goods, use is made of the fact that alkaline citrates prevent the fixation of the mordants. The cloth is first printed with certain of the usual, or sometimes citric and tartaric acids for iron mordants), then dried, and again printed over the previous impression, with either a fine "all over" pattern or flat uniform ground, in iron or aluminium mordants. The fabric is then aged, "dunged," washed and dyed as already described, with the result that wherever the "reserve" of citrate or acid was printed a white pattern is left on a fixed process ground. The fine patterns printed over "reserves" are called "covers" and the plain grounds "pads," hence the name "cover and pad" style in cases where, as frequently happens, a design of "pads" and a light "pad" are both printed over a white "reserve." The "cover and pad" style is, for the most part, restricted to dyed alizarine purples under which red, black, dark purple and white can all be reserved at the same time, thus giving rise to very pleasing effects. For example: white cloth is first printed with four "colours," viz., citrate of soda and citric acid for the white; logwood and iron for the black; logwood and iron for the purple; and aluminium acetate at 6° T. with 8 oz. per gallon of stannous chloride for the red. (The stannous chloride acts as a resist for iron mordants.) The whole is then "covered" in a fine pattern printed with a fairly strong iron mordant, dried, and again printed, in a very weak iron mordant, with a pad roller, that is, a roller which prints a uniform ground over the whole surface of the cloth. After this last printing, the cloth is "aged" for a day or two, by being hung in "dung," washed and dried, "dunged," washed and dyed in a blue shade of alizarine. When finally washed, washed and "dunged" in bleaching powder solution the first printing pad, or red, indigo pad, is seen to stand out, clearly and sharply, from a figured background in two lighter shades of purple. This "cover and pad" style of reserve printing constitutes one of the staple processes of nearly all print-works, and is produced in enormous quantities for both home and foreign markets. Red is not often introduced as in the above example, the usual colours being white, black and two purples. The same method of working can be adopted with aluminium mordants for red and pink covers and pads, but they are better produced with the steam alizarine colours as below.

(b) Reserves under Steam Alizarine Red and Pink.—In this case a reserve composed of citrate of chromium alone, or in conjunction with the citrate of soda, gives the best results. The cloth is first prepared in alizarine oil and then printed with the following:

10 lb. china clay.
4 gal. citrate of soda, 54° T.
1 gal. citrate of chromium, 42° T.
1 gal. water.
2 lb. British gum paste.

After printing the above, the goods are dried and again printed either with "cover" or "pad" or both, in alizarine pink, dried, steamed for 1½ hrs., well washed and soaped. On leaving the stenter frame the colour with the reserve is yellow, but become quite white on soaping. Like the purples, the alizarine pinks can be reserved in colours. For blue, green, yellow and violet the ordinary steam basic colours are used with additions of citric or tartaric acid.

Example:
7 lb china clay.
62 lb British gum paste.
2 lb. methylene blue.
1 lb. citric acid.
1 gal. citric acid.
Boil, cool, and add:
1½ gals. 50 per cent. tannic acid solution in acetic acid.

Red with steam alizarine red; yellow with thioflavine in place of methylene blue in above; green a mixture of blue and yellow. These colours with the white reserve may all be printed at once. Then steam as usual, pass through a solution of tartar emetic and chalk, wash, wash and steep.

(c) Reserves under Insoluble Azo-Colors.—These are based upon the action of stannous chloride, which prevents the combination between the diazo- and &-naphthol, and the diazotized solutions of paranitraniline for red grounds; &-naphthylamine for maroon; ortho-nitrothiophene for orange, &c., &c. The cloth is then washed and soaped until the "whites" are clean.

White Resist. 5 gals. gum senegal solution.
30 lb. tin crystals.
5 lb. tartaric acid.

For heavy rollers this may be reduced with more gum.

Potassium sulphate is also used as a white reserve under insoluble azo-colours with good results.

(d) Reserves under Steam Basic Colours.—The white cloth is printed with:

20 lb china clay.
2½ gals. water.
15 lb. British gum.
20 lb. sodium tartar emetic.
20 lb. zinc sulphate.

All boiled well together, and then covered, or over-printed, with any steam basic colour—steamed one hour, passed through tartar emetic, then washed and soaped, when the reserve white above comes away, bringing along with it the colour printed upon it and leaving a white pattern on a printed ground.

(e) Reserves under vat Indigo Blue.—This was formerly a very important style, but at present is only used in special cases. Resist or reserve effects are obtained by printing the white cloth with oxidizing agents, &c., and subsequently dyeing it in the indigo vat. In addition to oxidizing agents the reserve pastes contain lead sulphate, barium sulphate, resins, fats and thickenings in various proportions. The following is a good white reserve:

15 lb. flour.
6 gals. water.

Boil, cool a little, and add:
18 lb copper sulphate powdered.
2½ lb copper nitrate, 90° T.
1 pint alizarine oil.

Yellow. 2½ gals. British gum paste.
33 lb lead sulphate, 66 per cent. paste.
18 lb zinc sulphate.
22 lb lead nitrate.

Print the white and yellow, dry, dye in the indigo vat—sour slightly in sulphuric acid, wash, and pass into a hot solution of bichromate of soda, which develops the lead yellow. Reserve whites also contain lead salts when used for white alone, but obviously the white given is best suited to white and yellow reserves, as its alkaline copper sulphate wash out before the "chroming" stage is imposed by the vat.

(f) Reserves under Sulphur Colours.—These are obtained with zinc chloride. They are not much used, but are capable of yielding fine effects.

(g) Reserves under Aniline Black.—Reserves under aniline black are produced with caustic alkalis, alkaline carbonates, silicates and sulphites, sulphocyanides, oxide of zinc and the acetates of magnesia, zinc and soda. The white and coloured reserves may be printed upon either the undeveloped black or upon the cloth before the black is applied.

In the former case the cloth is slop-padded through a mangle-box with the following black:

7½ lb aniline hydrochloride.
5 lb potassium carbonate.
4 lb potassium ferrocyanide.
10 gals. water.

It is then very carefully dried in hot air so that it becomes no darker than a pale yellow; if it is green before printing, the white is sure to be bad.

The dried padded cloth is then printed with the "resist" colours, dried and steamed 3 to 4 minutes in a rapid ager, chromed through warm bichromate of potash, and finally washed and soaped. During the steaming the black is developed all over the cloth except where the colours are printed. Here its development is prevented by the alkali or the reducing agent, whichever may be present, in the colour, and instead of a plain black dyed piece a coloured design on a black
The following formulae may be employed for white and coloured resists:

**White.**
- 8 lb starch.
- 8 lb British gum.
- 30 lb potassium sulphite, 90° Twp.
- 3 gals. water.
- 15 lb soda acetate.
- 10 lb bisulphite of soda, 66° Twp.
- ⅛ lb ultramarine blue.

Boil together.

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<td>Rhodamine 6 G. (100 per cent.)</td>
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<td>Acidine yell. G.</td>
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<td>Thionine blue O.</td>
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<td>New solid green 2 B.</td>
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<td>Methyl violet, B. x.</td>
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<td>Water</td>
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<td>Tragacanth mucilage</td>
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<td>Glycerin</td>
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<td>Albumen, 40 per cent. solution</td>
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<td>Resist paste</td>
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Print on the padded cloth, age, chrome and wash. The resist paste is as under:

**Resist Paste.**
- 10 lb zinc oxide.
- 1½ gals. magnesium acetate, 40° Twp.
- 2½ lb tragacanth mucilage (dragon).
- 1 starch paste.

For reducing the colours take 6 parts resist paste.

- 4 " starch paste.
- 4 " white resist.

Very good results can be obtained by the alternative method, i.e., printing the resists on white cloth and applying the black afterwards. The basic colours are chiefly used, though chrome yellow and ultramarine are also employed for some styles. The following formulae will serve as types of the composition of white and colours:

**White.**
- 20 lb precipitated chalk.
- 5 lb potassium sulphite, 90° Twp.
- 5 lb acetate of soda.
- ½ lb ultramarine blue for lightening.
- 1 gal. water.
- 6 " starch paste.

The whole ground together in a mill.

**Colour.**
- 2 lb basic dye-stuff.
  - 1 gal. water.
  - 2½ " starch paste.
- 17 lb zinc oxide.
- 1 gal. water.
- ½ " glycérine.
- ½ " turpentine.
- ½ " bisulphite of soda.
- 3 " starch paste.

Print on white cloth, allow to lie a day or two, then strop-pad in the Prud'homme black already given, dry, age, chrome and soap.

Pigment colours may be applied on black padded cloth as follows:

**Yellow.**
- 40 lb chrome yellow, &c. &c.
- 2½ gals. 40 per cent. albumen.
- 2½ lb tragacanth water, 6 oz. per gal.
- 6 lb stock ash.
- 1 gal. rate of citrate of soda, 40° Twp.

Other methods, varying in detail, have been used from time to time, but the above two are at the present time generally employed—especially the former, by which many fine patterns have been produced in all sorts of delicate and artistic shades.

The Treatment of Cloth after Printing.

After printing, the various classes of goods undergo many different treatments according to the character of the colours printed. These treatments include steaming, hanging in the ageing chamber, passing through tartar emetic, the chalk bath, washing, soaking, "chimming" or clearing and finishing.

1. The operation of steaming is necessary for all styles except those with the insoluble azo-colours, at dyes discharged, and some colours that are precipitated on the fibre. The short steaming necessary for most discharges, indigo blue prints, and aniline black is effected in the Mather and Platt ager, of which a sketch is here given (fig. 2) showing its principle.

It consists of an iron box A A A through which the goods (indicated by the dotted line) pass in the direction of the arrows. They enter at B, and traverse the whole chamber over a series of top and bottom rollers C C C, finally emerging at the same point B, whence they are drawn forward, by mechanical means, and plaited down on a waggon placed conveniently near. Steam enters the chamber A A A by the steam pipe D at the bottom, and escapes through the same slot (B) that the cloth enters and leaves by. An engine or electric motor drives the gearing, and the whole process is continuous.

This ager affords quite a sufficient steaming for aniline blacks, printed indigo, chlorate discharges, and for some mordants, but alizarine reds and pinks, mordant dyes generally and basic colours require much more than the 2 to 3 minutes' exposure to steam which is all that can be given in the ordinary Mather-Platt ager, although they are frequently passed through it to eliminate the greater part of the volatile acids they contain. Paranitramine red discharged with hydro sulphite also requires a modification of the ager for its success—for the steam must be very hot and very dry if any of the azo-colours are to be effectively discharged by the hydro sulphite method.

2. A longer exposure to the action of steam is obtained by means of the continuous steamer and the continuous steamer, in both of which goods may be steamed for any length of time. The cottage steamer consists (1) of a cylindrical iron box or chamber fitted with a false bottom on which rails are laid, and under which lie the pipes for the admission of steam, and for the drawing off of the condensed water; and (2) of a carriage or iron framework mounted on wheels and furnished with a series of removable rods capable of being revolved by means of spur wheel gearing. Convenient lengths of the cloth to be steamed, together with a ¼ " back grey" (a piece of unbleached calico) are then wound in the open width, into a sort of broad hank on a folding frame. As each hank, so to speak, is completed it is removed from the winding frame and hung over one of the rods, which is then placed in position on the carriage.

![Fig. 2](https://via.placeholder.com/150)

When the latter is fully loaded in this way it is run into the "cottage," the doors are closed, and steam turned in. The steaming is continued for various periods of time—from ¼ hour to 2 hours—according to the style of work in hand, and either with or without pressure, as may be required. The carriage is then withdrawn and the goods unwound in readiness for subsequent operations.

The object of enveloping the printed goods in a "back grey" is to prevent the colour from setting off from the face of one fold on to the back of the next, and also to minimize the risk of damage from drops of condensed water. This latter defect is further guarded against by heating up for an hour or so every morning before any goods are introduced.

In works where the modern continuous steaming apparatus is installed the cottage steamer is reserved for the treatment of red alizarine reds and for goods, such as heavy printed velvets, which are difficult to manipulate to the "grey." It is too complex to be adequately described without the aid of detailed sketches. Generally speaking, it may be said to consist of a long,
high, narrow chamber of brick, through which the cloth passes continuously in the form of long loops suspended from rods resting upon, and carried forward by travelling chains, situated at the top, and close to the sides, of the chamber. Steam is admitted to the chamber, and, by the ‘steam’ or power, which is carried by loops of cloth entering and emerging through slots at the top of its opposite ends.

On entering, the cloth falls over one of the slowly travelling rods and continues to run downwards until a sufficient length to form the loop is available. By this time the first rod has moved forward and a second taken its place, with the result that the cloth now falls over the second rod and commences to form the second loop. At this point—the commencement of a second loop—the second rod is raised a little by means of small pivots fixed in the bottom, and is allowed to fall in its place, and so on. The object of this bar, which clips the continuously entering cloth firmly between itself and the rod until the second loop is formed, is to prevent the cloth from being fed into the first loop, and to prevent the weight of the first loop from pulling the cloth over the second rod during the formation of the second loop. By the time this latter is complete the second rod has moved sufficiently far forward to escape contact with the pivoted brass bar, which thereupon swings back and takes up a similar position on the third rod. In this way each rod in turn is supplied with cloth in which a forward movement is continued until the other end of the steamer is reached, where both cloth and rods emerge—the former through the top of the chamber and the latter through a slotted opening at the top of the end wall.

The cloth, when passing through the steamer, may be conveyed, until the other end of the steamer is reached, where both cloth and rods emerge—the former through the top of the chamber and the latter through a slotted opening at the top of the end wall.

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FIG. 1.—Linen, dyed blue, the "reserved" parts represent the Annunciation; above the reclining figure of the Virgin Mary is the word MAPIA. Coptic, probably 6th or 7th century. 18 in. X 2 ft. 5 in.

FIG. 2.—Child's Tunic of linen dyed blue, the pattern being "reserved." Coptic, 4th century (?). 18 in. X 2 ft. 5 in.

FIG. 3.—Piece of red silk, printed in black from wood blocks, with a repeating pattern of black circles or roundels containing pairs of animals and dragonets; floriated crosses in the interspaces. Rhenish, 13th or 14th century. 15\(\frac{1}{2}\) in. X 13\(\frac{1}{2}\) in.

FIG. 4.—Piece of red silk, printed in red, green, and black from wood blocks, with a repeating pattern of black circles or roundels containing pairs of animals and dragonets; floriated crosses in the interspaces. Rhenish, 13th or 14th century. 8\(\frac{1}{2}\) in. X 13\(\frac{1}{2}\) in.

FIG. 5.—Piece of linen, printed in black from a wood block, with a pattern composed of repetitions of a lady on a turret, leafy sprays, a hound, and a bird on the wing. Rhenish, 14th century. 9\(\frac{1}{2}\) in. X 19\(\frac{3}{4}\) in.

FIG. 6.—Strip of linen printed in deep purple from a wood block, with a repeating pattern of eagles and conventional leaf and fruit forms. Rhenish, 14th or early 15th century. 20\(\frac{1}{2}\) in. X 6\(\frac{1}{2}\) in.
FIG. 7.—Portion of reddish linen lining for a chasuble printed in black from wood blocks, with a repeating pattern composed of five-lobed shapes enclosing conventional fruit device surrounded by small blossom and leaf forms. Rheinish, 15th century; from the neighbourhood of Düsseldorf. 3 ft. 8 in. x 24½ in.

FIG. 8.—Cotton print in colours. Dutch, 17th century. About 14 in. x 9 in.

FIG. 9.—Part of a coverlet of cotton, printed at Genoa, in colours, from metal plates engraved with trees, flowers, birds, and animals in the style of Indian palampores or printed calicoes, 18th century. About 6 ft. x 3 ft.

FIG. 10.—Part of a hanging of cotton, printed in red from metal plates engraved with repetitions of pictorial scenes. At the bottom is printed "D & T. P. Meißler & C. de Beutierne près Bordeaux" Bon Teint, MF. 3 ft. × 3 ft. French, second half of 18th century. 4 ft. 6 in. × 3 ft. 4 in.

FIG. 11.—Part of a cotton chair back, printed in red from a metal plate engraved with a Chinese pagoda in a landscape; in front is a woman kneeling on the ground, while a priest stands to the left holding up an image. Marked "Collins Woolmers." English, dated 1796. 2 ft. 13 in. × 24½ in.

FIG. 12.—Linen panel, with a stipple engraving printed in colours, for use as a small fire-screen. English, late 18th century. 2 ft. 4½ in. × 2 ft. 4¼ in.
**Textile-Printing**

II. Art and Archaeology

Printing patterns on textiles whether of flax, cotton or silk, by means of incised wooden blocks, is so closely related in its ornamental effects to other different methods of similar intention, such as by painting and by processes of dyeing and weaving, that it is almost impossible to determine from the picturesque indications afforded by ancient records and writings of Christian, classical or even earlier times, how far, if at all, allusion is being made in them to the blocks-printing process. Hence its original invention must probably remain a matter of inference only. As a process, the employment of which has been immensely developed and modified in Europe during the last hundred years by machinery and the adoption of stereotypes and engraved metal plates, it is doubtless traceable to a primeval use of blocks of stone, wood, &c., so cut or carved as to make impressions on surfaces of any material; and where the existence of these can be traced in ancient civilizations, e.g. of the Chinese, Egyptians and Assyrians, there is a probability that printing on permanent materials may have been practised at a very early period. Nevertheless, highly skilled as the Chinese are, and for ages have been, in ornamental weaving and other branches of textile art, there seem to be no direct evidences of their having resorted so extensively to printing for the decoration of textiles as peoples in the East Indies, those, for instance, of the Punjab and Bombay, from whose posterity 16th-century European and especially Dutch merchants bought goods for Occidental trade in "Indiennes" or printed and painted caliccoes.

The earlier history of stamping patterns by hand on to textiles in the East has still to be written, a serious attempt which has recently been made to account for the existence of this decorative process in Europe during several centuries prior to the introduction of the "Indiennes" above mentioned. As in the case of weaving and embroideries, specimens of printed stuffs have of recent years been obtained from disturbed tombs in Upper Egypt (Akhniml and elsewhere) and tell us of Egyptian-Roman use of such things. Some few of them are now lodged in European museums. For indications that earlier Egyptians, Greeks and Romans were likely to have been acquainted with the printing of textiles painted by Egyptians there are many actual examples. Apart from these there are wall paintings, e.g., those of Beni Hassan—about 2100 B.C.—in which are represented certain Asiatic people wearing costumes irregularly patterned with spots, stripes and zigzags, which may have been more readily stamped than embroidered or woven. A rather more complicated and orderly pattern well suited to stamping occurs in a painting about 1520 B.C., of Hathor and King Menepthah I. Herodotus, referring to the garments of inhabitants of the Caucasus, says that representations of various animals were dyed into them so as to be irremoveable by washing. Pliny describes "a very remarkable process employed in Egypt for the colouring of tissues. After pressing the material, which is white at first, they saturate it, not with colours, but with mordants that are calculated to absorb colour." He does not explain how this saturation is done. But as it is clearly for the purpose of obtaining a decorative effect, stamping or brushing the mordants into the material may be inferred. When this was finished the cloth was "plunged into a cauldron of boiling dye" and "removed the next moment fully coloured." It is a singular fact, too, that although the dyeing of the patterns of one uniform colour, the material when taken out of it is of various colours according to the nature of the mordants that have been respectively applied to it." Egypto-Roman bits of stuffs from Akhmim exhibit the use, some three hundred years later than the time of Pliny, of boldly cut blocks for stamping figure-subjects and patterns on to textiles. Almost concurrent

1 When Cortes conquered Mexico he sent to Charles V. cotton garments with black, red, yellow, green and blue figures. The Dutch and American Indians have a method of applying patterns in different colours to cloth (see Parnell's Dyeing and Calico Printing, p. 12).
with their discovery was that of a fragment of printed cotton at Arles in the grave of St. Caesarius, who was bishop there about A.D. 542. Equal in archaeological value are similar fragments found in an ancient tomb at Quedlinburg. These, however, are of comparatively simple patterns. Other later specimens establish the fact that more important pattern-printing on textiles had become a developed industry in parts of Europe towards the end of the 12th and the beginning of the 13th century.

According to Forrer (Die Kunst des Zeugdrucks, 1898) medieval Rhenish monasteries were the cradles of the artistic craft of ornamental stamp or block cutting. In rare monastic MSS. earlier in date than the 13th century, initial letters (especially those that recur frequently) were sometimes stamped from hand-cut blocks; and German deeds of the 14th century bear names of block cutters and textile framers as those of witnesses. Between the 11th and 14th centuries there was apparently in Germany no such weaving of rich ornamental stuffs as that carried on in Spain and Italy, but her competitive and commercial instincts led her to adapt her art of stamping to the decoration of coarse textiles, and thus to produce rather rough imitations of patterns woven in the Saracenic, Byzantine and Italian silks and brocades. Amongst the more ancient relics of Rhenish printed textiles are some of this stuff, impressed with crude and simplified versions of such patterns in gold and silver foil. Of these, and of a considerable number of later variously dyed stout linens with patterns printed in dark tones or in black, specimens have been collected from reliquaries, tombs and old churches. From these several bits of evidence Dr. Forrer propounds an opinion that the printing of patterns on textiles as carried on in several Rhenish towns preceded that of printing on paper. He proceeds to show that from about the 13th century increasing luxury and prosperity promoted a freer use of wovens and embroidered stuffs in all forms of decoration, and the sudden rise of trade into neglect, and it was not until three centuries later that it revived, very largely under the influence of trade importation into Europe quantities of Indian printed and painted calicoes.

Augsburg, famous in the 17th century for its printing on linens, &c., supplied Alsace and Switzerland with many craftsmen in this process. After the revocation of the edict of Nantes, French refugees took part in starting manufactories of both painted and printed cloths in Holland, England and Switzerland; some of the refugees were allowed back into France to do the same in Normandy; manufactories were also set up in Paris, Marseilles, Nantes and Angers; but there was still greater activity at Geneva, Neuchâtel, Zürich, St. Gall and Basel. The first textile-printing works in Great Britain are said to have been begun towards the end of the 17th century by a Frenchman on the bank's of the Thames near Richmond, and soon afterwards a more considerable factory was established at Bromley Hall in Essex; many others were opened in Surrey early in the 18th century. At Mulhouse the enterprise of Koechlin, Schmatzer and Dollfus in 1746, as well as that of Oberkampf at Jouy, led to a still wider spread of the industry in Alsace. In almost every place in Europe where it was taken up and followed, it was met by local and national prohibitions or trade protective regulations and acts, which, however, were gradually overcome.

Towards the end of the 18th century a revolution in the British manufacture of printed textiles was brought about through the invention of cylinder or roller printing from metal plates. This is usually credited to Oberkampf of Jouy, but it seems to have also occurred to a Scotsman named Bell, and was successfully applied in a large way about 1785 atMossey near Preston. From this and the calico-printing works at Manchester in 1763, and in Scotland in 1768, the present huge proportions of the industry in the United Kingdom have grown.

Illustrations accompanying this brief account merely indicate a few types of patterns used in various European countries up to the beginning of the 19th century. Typical specimens of East Indian painted and printed calicoes for coverlets and other draperies are shown in the Indian division of the Victoria and Albert Museum. These are sui generis, and therefore differ from the block of work of the 12th century, which together with a less quantity of printing on satin, silk, taffeta, crêpe and the like are principally from adaptations of weaving patterns. An interesting series of over 2500 patterns, chiefly of this character, was made by M. Corimand between 1846 and 1860, and is preserved in the National Art Library at South Kensington. For many years of the latter part of the 19th century, William Morris designed and produced attractively ingenious floral and bird patterns, admirable in contrasts of bright colours, frequently basing his arrangement of crisply defined forms in themes such as that of Persian surface ornament. The colour printing, which on its appearance in 1890, has very considerably affected numbers of British and foreign designers of printed patterns whether for textiles or wall papers.

The portion of linen hanging or valance given in Fig. 1 (Plate I.) comes from an ancient cemetery at Akhmim in Upper Egypt. The linen dyed blue bears ornamentation with figures undyed or留白 and arranged in broad branches. All are enclosed in an engraved block, of some such saturating fluid as that mentioned by Pliny. The design and cutting of the block were no doubt the work of Coptic artificers, the style of the composition being that of late antique or early Byzantine work, the dyed blue (Fig. 2) the simple trellis and blossom pattern is similarly produced by the "reserve" process, and the specimen is of the 4th century B.C. The linen in Fig. 3 is of date, i.e. 4th century A.D. Fig. 3 is from a fragment of red silk printed in red, green and black from wood-blocks, thus illustrating another method of applying colours to textiles. It is probably of Rhenish work in the 12th or 13th century, and came from the Eiffel district. The ornament, however, is a survival of a scheme of pattern which was in use in Perso-Roman weavings as early as the 7th century A.D. Fig. 4 shows a piece of red silk printed with a Rhenish adaptation of a 14th century North Italian weaver pattern possessing earlier Byzantine features. The design in Fig. 5 is another Rhenish version of a richer style of 14th-century North Italian weaving. An example of the same kind is seen in Fig. 6, a Rhenish adaptation of a 14th century North Italian pattern often employed in brocade weaving of that period. The pattern in Fig. 7 (Plate II.) is typical of a style introduced during the 15th century in sumptuous damask satins, and velvets woven at Florence, Genoa and Venice. Very different is the style exemplified in Fig. 8, taken from a Dutch 17th century "Indienne," the trade name for such prints. The repeated wide and narrow stripes recall a scheme of design which the Siculo-Saracens of the 11th century employed for brocades; the intertwining floral ornament closely resembles such as occurs in 16th-century Indian cottons; the ornamental border around the field in Fig. 9 shows the reproduction of the Persiansesque spreading tree device often used in Indian palampores from the 16th century onwards to the present day. These, however, were either painted or printed from wood-blocks. The same was the case with the"figures" for the"trellis" patterns, which were used, after the manner of the process which was started, as already mentioned, by Oberkampf and Bell in the 18th century. The remaining figures 10, 11 and 12 are from stuffs mostly printed with subjects of a pictorial character which had a vogue for some time. In Fig. 10—a French print—are family groups: shepherds and shepherdesses with their flocks; children at play; buildings, rocks, trees, Æ_; the decorative effect of which, for the purposes of curtains and furniture covers, resulted mainly from the ordered repetition of these somewhat unrelated details. A landscape with a Chinese pagoda was repeated in lengths of the English cotton printed in red and blue, the ground being of white. This may be seen in Fig. 11. Fig. 12 is from a linen panel printed in colours with a stipple engraving to be used as a small fire screen. The style reflects the pseudo-classical taste of the end of the 18th century in England. Beneath the group of figures in the original is an inscription, "London, engraved and published, August 1, 1799, by A.—Bost No. 207 Piccadilly." This sort of printing has practically disappeared; it was only done on a small scale.

AUTHORITIES.—J. Persoz, L'Impression des Tissus (Paris, 1846, see vol. i. Preface); E. A. Parnell, Dyeing and Calico Printing (London, 1848); W. Crookes, F.R.S., Dyeing and Calico Printing (London, 1844, see vol. i. Preface); Dr. R. Forrer, Die Kunst des Zeugdrucks (Strassburg, 1884).

TEXTUAL CRITICISM, a general term given to the skilled and methodical application of human judgment to the settlement of texts. By a "text" is to be understood a document written in a language known, more or less, to the inquirer, and assumed to have a meaning which has been or can be ascertained.
TEXTUAL CRITICISM

The aim of the "textual critic" may then be defined as the restoration of the text, as far as possible, to its original form, if by "original form" we understand the form intended by its author.

Texts may be either autographs or they may be transmitted texts; the latter, again, being immediate copies of autographs or copies of copies in any degree.

Autographs (which may be taken to include whatever, though not actually in the writing of its author, has been revised and attested by him) are not exempt from the operations of textual criticism. Editors of journals remove the slips of the pen of their contributors; editors of books, nowadays usually in footnotes, the similar lapses of their authors. With this branch of textual criticism, however, modern scholarship is not largely concerned. So not with immediate copies. Textual criticism is called upon to repair the mischief done to inscriptions (texts inscribed upon stones) by weathering, maltreatment or the errors of the stone-cutter. Any great collection, such as the Corpus of Latin inscriptions or the similar Corpus of Greek, will show at once its activity and ability in this direction.

The chief field of textual criticism is elsewhere. The texts of the MSS., as we have seen, were written for the most part not on stone but on papyrus, parchment or other perishable material. Of these several copies had to be made, both by way of prevention against the wear and tear of use and as a means of satisfying the desire of other persons than the original possessor to be acquainted with their contents. Had the copies made of ancient writings been mechanical reproductions of the originals, such as the photographic fac-similes of modern times, there would have been little here for textual criticism to do. The ancient texts have not come to us in this way, but through copies made by the human hand, directed more or less by the human intelligence. Now a copy made thus can in no circumstances be a quite exact rendering of that from which it is copied or its exemplar. A copy, qua copy, can never be the equal of the exemplar, and it may be much its inferior. This deterioration increases with the number of successive copyings. Let us suppose that from a text which we will call A a copy has been made which we will call B, and from this again a copy which we will call C. If the copyist of B goes wrong once and the copyist of C twice in a hundred times, then, assuming that there is no coincidence or cancelling of errors, the relative correctness of the three texts A, B, C will be 100 (absolute correctness), 99 and 97-02. If C had made his copy direct from A, his percentage would have been 98.

The importance of this must be borne in mind when we are dealing with transmitted texts, which have passed through many stages of copying.

In the Epitomé of Plautus, 1. 1. 10, the right reading habilitor, "more portly," has been preserved to us by Donatus, an ancient commentator on Terence (Ennuchus, 2. 2. 11). It was corrupted to abolitor by omission of the h and confusion of l and t, and this corruption, which is attested by the oldest extant copy, the Ambrosian palimpsest, was still further corrupted in the other copies to agilitor.

The first step towards the restoration of a text is the examination of the evidence upon which it is or is to be based. This begins with the investigation of its traditional or transmitted form. For this we have usually to rely upon manuscripts (MSS.). By manuscripts (q.v.) we understand copies of the text made before the art of printing came into general use. These may be either extant or non-extant. The evidence of extant manuscripts must be ascertained by collation. To collate a manuscript is to observe and record everything in it which may be of use towards determining what was written in the source or the sources from which it is derived. A manuscript is not usually a clean or single piece of writing; it is commonly found to contain alterations by erasure, addition or substitution. Such alterations may be due to the writer or writers of the MS., called the scribe or scribes, or to some other person or persons (for there may be several) called correctors. The relative importance of these corrections, it is obvious, may be very different. It is therefore necessary to distinguish the different hands which have been at work on the manuscript. Account must also be taken of the number of lines in each page, the number of pages in each quire, of gaps or lacunae in the manuscript, and so forth. The work cannot be considered complete till all the extant manuscripts have been collated or at least examined.

When this is done we shall have the materials for pronouncing a judgment upon the text as directly transmitted. Perhaps there is only one extant MS. of the text, as in the case of the Mss. of the Annals and Histories of Tacitus. Then this part of our work is done.

But often we have to take account of a number, and it may be a large number, of manuscripts, whose respective claims to attention we must determine. In the first place we shall discard all manuscripts which are derived by copying from other extant manuscripts. If a MS. is immediately or ultimately derived by copying from another MS., it cannot, qua copy, tell us anything that we do not know already if the latter MS. is known to us. But how can we tell that a MS. is so derived? The clue we shall have to follow is that the more the differences between them must be such as to permit of no other explanation. In the absence of explicit dates the relative age of MSS. is often hard to determine, and hence the criterion of unmistakable resemblance is one of special importance. If the MSS. agree in singular though trivial mistakes, if they omit, apparently without motive, words and passages which other MSS. preserve, we shall be safe in pronouncing that there exists a close bond of connexion between them, and if one of them shows errors which, though strange in themselves, are quite intelligible when we see what stands in the other, then we shall be justified in concluding that the second is that from which the first is derived. For the proper consideration of such points a personal examination, autopsia, of the MSS. or of facsimiles of them, is very often indispensable. It was thought at one time that a MS. of the Latin poet Propertius at Naples (Neap. 268) might have independent value as an authority for the text. But its claims were disposed of when (amongst other facts) it was observed that at book iv. 8, 3, the MS. with which it most closely agreed (F, No. 36, 49 in the Laurentian library) had a gap at the beginning of the line and only the end words "utus est tutela draconis," with the marginal note "non potuit legi" and that Neap. 268 gives the line as follows, "non potuit legi utus est tutela draconis." Accident apart, identity of reading implies identity of sources. The source of a transmitted reading may undoubtedly be the author's autograph: but if not, then it is some MS. in the line of transmission.

The peculiar resemblances of two MSS., though not sufficient to warrant the derivation of either from the other, may be sufficient to establish some connexion between them. From the axiom which has just been cited it follows that this connexion can be due only to community of source, and we thus arrive at the idea of families of MSS. Suppose that a text is preserved in seven MSS., A, B, C, D, E, F, G. If we find that of these A stands apart, showing no great similarity to any of the other six, while B, C, D on the one side, and E, F, G on the other, much resemble each other though differing considerably from the rest, we may express this by saying that B, C, D form a "family" descended from a hypothetical common "ancestor" which we may call X, and E, F, G another "family," descended from a hypothetical "ancestor" which we may call Y. The readings of X which can be deduced from considering the agreements in B, C, D will be of higher antiquity and of greater external authority than any of the readings in B, C, D taken singly. And similarly for the readings of Y and those of E, F, G. Nor shall we stop here: but we shall further compare the readings of X and Y with each other and with those of A, and thus deduce the readings of a still more remote ancestor which we may call Z. Z will be the archetype of all our existing MSS., and we may embody our results in a pedigree of manuscripts or stemma codicum as follows—
If we have done our work properly, the texts that we arrive at for X and for Y will be freer from error than the texts of the separate members of the families B, C and D, and E, F, G respectively, and that of Z freer from error than that authenticated by any existing MS.

The procedure, however, is by no means always so simple. That a text may be improved by the comparison of different MSS. is not a modern discovery. It has long been known, and the knowledge has led to the production of what are known as conflated manuscripts or Misch-codices. These are MSS. produced by "crossing" or "intermixture." In the following stemma M and N are "mixed" or "conflated" MSS., being formed by the blending of readings from the "pure" or "unmixed" codices A, B and D, E respectively.

Intermixture may take place to any extent, and the more of it there has been the more difficult does it become to trace the transmission of a text.

Whether crossing improves a given text or not depends ultimately on the knowledge and the judgment of the crosser, and these will vary indefinitely. On the whole it is probable that it does, provided it is not accompanied by other attempts at improvement. If it be, as may very well be the case, the text will probably suffer. For but a small proportion of scholars' corrections are really amendments, and a far smaller proportion of scribes'.

The "genealogical" method, as we may call it, cannot in strictness be applied to conflated MSS., as their mutual relations can rarely be with certainty disentangled. But it is often possible to detect in such MSS. a common strain, shown by their agreement in peculiar corruptions or in probable readings which these latter would have had to be discovered by conjecture. This is practically an application of the method to a portion of such manuscripts.

A special value attaches to a conflated codex when one of the MSS. from which it has been compounded has perished and its readings are thus otherwise irrecoverable. This is exemplified in the Neapolitanus of Propertius, a manuscript now at Wolfenbüttel.

It not unfrequently happens that good or instructive readings are found in manuscripts which are in general of small trustworthiness (see below), and whose relations to the general tradition it is not worth while to investigate. These readings may be cited by the name of the MS., or if still greater brevity is required as the readings of inferior MSS. (deteriores), or, as is frequently done, by the symbol S.

Non-extant Manuscripts.—Some of the most valuable of ancient MSS. have disappeared since their discovery in modern times. When this has happened we have to rely upon mere copies, many times of inferior quality, or upon the information which old scholars have given us respecting them. In the latter case what we have are not "collations," for the art of collation was not understood till the 19th century, but selections or "excerpts" of readings which we have reason to fear are often imperfect and erroneous. Further, it must not be assumed that all readings which are cited as being "ex utroque codicibus" are necessarily from older or better MSS. than we now possess or indeed from MSS. at all. Scholars since the Renaissance have not always been above inventing codices to obtain currency for their own conjectures. The codices of Bosius (1535-1580) are just as imaginary as the "old plays" which appear as the source of so many of the quotations that head the chapters of the Waverley novels, and suspicion rests on Barth, Lambinus and others.

Some texts and portions of texts of ancient writers are now only known from printed books. The metrical treatise of Terentianus is now preserved in the editio princeps (1497) alone. All known MSS. of Silius Italicus have a considerable gap in the 8th book, first filled up on the authority of Jac. Constantius (1503), and not printed with the rest of the poem till the edition of Aldus (1553). The early printed books are often called by old scholars codices impressi (lypis), "printed manuscripts," a phrase which at first seems curious to us but becomes perfectly intelligible when we examine these codices impressi and observe how closely they follow the codices scripti. By the methodical employment of these means we shall arrive at a text different from any existing one. It will not be the best one, possible or existing, nor necessarily even a good one. But it will be the most ancient one according to the direct line of transmission, and the purest in the sense of being the freest from traceable errors of copying and unauthorized interpolation.

The textual critic has occasionally to deal with the effects of oral transmission. A text so transmitted must in the lapse of time be profoundly though insensibly modified, its forms and expressions modernized, and, if widely disseminated, local variations introduced into it. This is the case with the Homeric poems, the ascription of the original form of which is a task beyond the powers of criticism. Even where, as in the Vedas, the sacred books of India, there is proof that the work has been transmitted without change through many centuries, the existence of unintelligible passages and metrical verses shows that here too there is work for textual criticism to perform, though in the opinion of most scholars it should be confined to the restoration of such forms as would be unconsciously and inevitably corrupted through changes of pronunciation and the like.

The invention of printing has naturally limited the province of textual criticism, and modified its operations. The writer's autograph, if it is preserved after it has been through the hands of the printer, has seldom more than an antiquarian value. As a source for the text it is superseded by the printed edition, and if there is more than one, then by the latest printed edition, which has been revised in proof by the author, or, in certain cases, by his representative; and the task of the textual critic is restricted to the detection of "misprints," in other words, of errors which the compositor (the modern analogue to the scribe) has made in setting up the manuscript, and which have escaped the notice of the proof-reader and the author or his representative. If, however, this revision has been neglected or incompetently performed, the number of such mistakes may be considerable.

Another question with which the textual critic of modern authors must be prepared to deal is the relative importance of different editions, each of which may have a prima facie claim to be considered authentic. Thus Shakespearean criticism must decide between the evidence of the first folio and the quartos: the critic of Shelley's poems must consider what weight is to be attached to the readings in the posthumous edition by Mrs. Shelley, and in unpublished transcripts of various poems. Where there is great or complicated divergence between the editions, as in the case of Marlowe's Faustus, the production of a resultant text which may be relied upon to represent the ultimate intention of the author is well-nigh impossible.
according to the degree in which the volition of the copyist is absent or present, as involuntary or mechanical, semi-voluntary and voluntary; or again as they affect single signs (letters, figures or symbols), words, lines or even larger units such as sentences or paragraphs.

Simple Errors of the Eye.—(a) Confusions of letters. These are very numerous, and different in different scripts or styles of writing (see Palaeography). Thus the Roman letters E and P are liable to be confused in capital script, but not in cursive (cf., C, G, in capitals, c, e in the cursive writing called Caroline in the 13th century, p, P in the angular cursive of the 13th century and later. Texts which have had a long history will often show by the letter-confusions which they exhibit that they have passed through several distinct stages of copying. It is to be observed that two different styles of writing are often found in the same manuscript, the difference being utilized for the purposes of distinction. Thus in Greek cursive MSS. notes were often written in uncials; the use of majuscules or capitals for headings and for the initial letters of titles is well known. (b) Omissions of letters. (c) Shiftings of letters, sometimes by syllables. This is common in half intelligent or half mechanical copying. In printing we find another kind which is known as "pie." (d) Confusions of symbols and abbreviations.

Examples of confusion of capital letters from Shelley's poems are: "Prometheus, i. 553, "Mark that outcry of despair" for "Hark"; Helias, 472, "Hold each to the other in loud mockery" for "Tell." Of cursive letters: Marenghi, 130, "the dim ocean" for "the dim ocean"; "the limpid" for "limpid"; "the drudge" for "drudge." Of letter-mistakes: above [One chasm of Heaven smiles like the age of Love | On the unquiet world] for "eye." (b) Translations from Goethe's Faust, i. 26, "To live more beautifully than any beast," for "beautifully;" i. 165, "eye" for "eye" (in spite of the rhyme with 163). (c) "Prometh., iv. 572, "Neither to change, nor Hatter, nor repent," for "faller." In Latin MSS. we often find a mere transposition of letters. (d) Confusion of words through abbreviations is very common in ancient MSS., where they were much employed. At a famous place in the dactylopa of 1 Timothy iii. 16, the MSS. vary between [297] or [298] and [299]. In uncial writing OC [88] might be written as [OC] or [OC].

Loss of Letters, Syllables, Words or Lines, through Similarity of Writing: Homoeographon.—When similar letters or groups of letters stand next to each other, one of these is liable to be omitted. This is the simplest case and is called haplography.

Similarity operates differently if the similar groups stand in different lines of the exemplar. Then the copyist's eye is apt to slip from the first of two similarly written groups to the second; and he will thus omit all that is between. The term homoeoteleuton ("similarity of ending") is often used of these omissions, but it is not adequate, as similarity anywhere may produce the same result.

Examples of homoeographon and haplography. Shelley's Cenci, v. 4, 130, "whose love was [a] bond to [a] kub our loves"; a similar omission in Witch of Atlas, 590. In Stanzas written in Dejection near Naples the two lines 4, 5, "The purple noon's transparent might, | The breath of the moist earth is light," were printed in the 1st edition. "The purple noon's transparent light," owing to the homoeographon "might," for "light."Omissions through Simple Negligence.—Groups of letters, words, syllables and lines are often omitted without any contributory cause. Short words or such as are not necessary to the sense are especially prone to thus disappear.

Examples of omission. Shelley's Prometheus, iii. i, 70, "No refuge! No appeal! Sink with me [then]!" Cenci, i. i, 26, "A refuge [me] from Hell!" So may the Devil! Despite their souls from Heaven!"; Helias, 657, "Bask in the [deep] blue noon divine"; Julian and Maddole, 218, where "Moans, shrieks, and curses, and blaspheming prayers" is absent in the earlier editions. The omission required for the rhyme; so lines 299-301 of the Letter to Maria Gisborne.

Repetitions: Ditography.—Letters, groups of letters, words and lines may be written twice (or even oftener) instead of once. Other repetitions of words already written and anticipations of words yet to be written are also found, through the scribe's eye wandering into the preceding or the following context. Wherever the word or group of words repeated is not the one that he has just copied loss is liable to occur.
Dittography is common enough in manuscripts but is usually detected in reading proofs. In the unique MS. of Cicero's treatise De legibus, secutus appears as "secutatus secutus." Other kinds of repetition are Shelley's Witch of Atlas, 611 seq., "Like one asleep in a green hermitage, | With gentle sleep about its eyelids playing | (sleep for smiles has come from the previous line) | Book II. 195. Where a new copyist instance in Horace, Odes, ii., 11 seq., "festus in pratis vascul ovis et canem pugnus" | where some MSS. give herdus, a reminiscence of Isaiah xi. 6, "The leopard (pardus) shall lie down with the kid." In iv. i, 20, for "trobe citræ|many MSS. have 't robin' in the old text." A curious instance in Homer's Iliad, xii. 338, "suffertur, an explanation of monstri. The celebrated passage about the three heavenly witnesses inserted in the Epistle of St John (v. 2) seems to have been originally a comment explanatory of the text.

Confusions of Words.—Words are not only changed through confusion of single letters or abbreviations, but also through general resemblance (or a semi-voluntary change) through similarity of meaning.

Shelley, Prometheus, ii. 2, 53: "There streams a plume-uplifting wind | For 'streams' In Shelley's lines, When the lamp is shivered, vv. 5-6. "Where the lust is broken, | Sweet tones are remembered not," the printed edition had "notes" for "tones." In Mrs Gaskell's Cranford, ch. xiv. (near the end), "The lunch—a hot savoury mustard-chop and a little of the cold lion sliced and fried —was now brought in 'is the reading of most if not all the editions; but 'join' should be 'lion,' the reference being to the padding, a lion with curvant eyes," described earlier in the chapter. In Shelley's The Cloud, Poets ed., 266: "For barriers of enormous cloud" for "cinereous"; "Hymn to Memory" (trans.), 57, "And through the tortoise's hard strong skin | For 'By the leopard's skin.' The Boat on the Serchio, 117, "woods of stunted trees" for "pine" ("the rhyming variety"; Prince Alphonso, 250, "And sea buds burst beneath the waves serene" for "under."

The same character frequently attunes to transpositions of words and parts of words. The copyist does not as a general rule consciously intent a change, but he falls into one through the influence of dominant associations. He substitutes an order of words which, in respect of syntax, metre or rhythm is more familiar to him. The transposition of words, if not purely accidental, as in Chaucer, "Parson's Tale," p. 689 (ed. Skeat), "God yaf (gave) his benison to Laban by the service of Jacob and to Pharao by the service of Joseph," where the MSS. transpose Laban and Pharao, are generally to a more usual order, as in Shelley's Witch of Atlas, 65, "She first was changed" to "she was first changed." A multitude of transpositions of words in part is in Shelley's: "Invocation to Misery, I. 27, And mine arm shall be thy pillow," the word 1ed. have third and "my pillow." With this we may class faulty division of sentences. Wrong punctuation is a common error and usually easy to correct.

As an example of mispunctuation we may take Shelley's Triumph of Life, 188 seq., "If thou canst, forbear | To join the dance, which I had well forborne | Said the grim Feature of my thought | "Against thee," said the grim Feature (of my thought aware) "I will unfold.""

Grammatical Assimilations.—These are often purely mechanical errors: but they may be semi-voluntary or even voluntary, the copyist desiring to set the syntax right.

Examples: Shelley: Rosalind and Helen, 63, "A sound from thee, Rosalind dear! instead of there; Blast of Arachny, 280 seq., "A sound from thee, Rosalind dear! Instead of there, Blast of Arachny," which bow the human heart with tares," for "tours.

Insertions (or Omissions) of Seemingly Unimportant Words.—These, inasmuch as they must often import some judgment on the sense of the passage copied, will be frequently semi-voluntary if not voluntary.

Examples: Shelley, Prometheus, iii. i, 5, "The soul of man like | [unextinguished fire.]" So in Triumph of Life, 265, "Whom from the flock of conquerors! | Fame singled out for her thunderbearing | union, out seems to be due to the composer.

False Recollections.—The passage which a copyist is reproducing may suggest to him something else and he will write down what is thus in his mind instead of what is before his eyes.

This is very likely to occur in a new copyist instance in Horace, Odes, ii., 11 seq., "festus in pratis vascul ovis et canem pugnus" | where some MSS. give herdus, a reminiscence of Isaiah xi. 6, "The leopard (pardus) shall lie down with the kid." In iv. i, 20, for "trobe citræ|many MSS. have 't robin' in the old text." A curious instance in Homer's Iliad, xii. 338, "suffertur, an explanation of monstri. The celebrated passage about the three heavenly witnesses inserted in the Epistle of St John (v. 2) seems to have been originally a comment explanatory of the text.

Transpositions of Lines and Passages.—This kind of transposition is really arrested loss. An accidental omission is discovered, and the person responsible, or another, places what is omitted in the margin at the foot of the page or in some other part of the text, usually adding a mark to show where it ought to have been. The next copyist may easily overlook this sign and thus the passage may be permanently displaced. In Chaucer's Canterbury Tales, most MSS. place the couplet, "And eek of many another manner crynse | Which nedyth nat referenc to this tryme," which should stand after v. 8 of the "Friar's Tale," in the Prologue to the Tale before the fourth line from the end. In the "Monk's Tale" a block of 88 lines (3565-3652) is transposed in most MSS. to follow 3596.

Interpolation.—This is the deliberate alteration of an exemplar by a semi-voluntary substitution of an omission, but when it takes the particular form of omission it is naturally very hard to detect. Interpolation then always has a motive. The most frequent motive is the removal of some difficulty in the sense, expression or metre of the text, and especially obvious gaps or corruptions which the interpolator endeavours to fill or to heal. Fraudulent interpolation, whether the fraud be pious or otherwise, does occur, but is comparatively rare. The removal or the mitigation of objectionable matter is also occasionally found. Interpolation is then a voluntary alteration, but in practice it is often hard to distinguish from other changes in which its motive is "incorrect.

The usual character of scribes' alterations is well illustrated by a passage in Bacon's Advancement of Learning, II. xix., "For these critics have often presumed that that which they understand not is false set down as: the Priest that where he found it written of St Paul Demissus est per sportam | [Acts ix. 25] "memorized his book, and made it Demissus est per postram, because sporta was an hard word, and out of his reading." Shelley in Triumph of Life, 201 seq., wrote, "And if the spark with which Heated on my spirit | Had been with proper nutriments supplied," but the printed editions made it "sentiment." The transcript used for the printed edition of Morengi apparently often corrupted what was rare and strange to what was commonplace; e.g., i. 119, "dweglobes" to "dewdrops." Interpolation is sometimes due to an inopportunely use of knowledge, as when a quotation or a narrative is made to agree with what the interpolator has read elsewhere. The text of the Bible, for example, is interpolated (as the text of the Odes, ii., iii. and iv., 250 seq., the Old Testament of the Old Testament, etc., older than those accessible to Origen, was much altered by him in order to make it conform more closely to the Hebrew text with which he was familiar, and in the Synoptic, Gospels changes are found, the aim of which is to "harmonize" the accounts given by the different evangelists. Deliberate alteration is occasionally due to disapproval of what stands in the text or even to less creditability. The interpolator leaves the text as he finds it, and introduces nothing. Interpolation is that some lines in Homer's "Catalogue of the Ships," Iliad, ii., 553-555 and 558, were introduced there to gratify the vanity or the disapproval of the Athenians. Insertions of this or of a similar character may be made by a copyist from a few words to a whole chapter or a complete poem. Literary forgery has never set any bounds to itself, and the history of every literature will supply examples of entire works being forged for the benefit and personages of repute. A notable one was the Epistles of Phalaris, a late Greek forgery, demonstrated to be such by Bentley in a treatise which is a model of what such a demonstration should be.
TEXTUAL CRITICISM

Special Conditions conducing to Corruption.—The chief of these is strangeness or difficulty in the matter to be copied. Proper names, technical expressions, quotations from foreign languages, and frequent change of subject, are all likely to cause difficulty to a scribe and error in his work.

Careful and continuous regard to the various kinds of error and defaults that are found in transcription will enable us to judge whether a reading which it is suggested stood in the archetype of our text is likely to have been corrupted to the reading, or readings, which stand in the present manuscripts or editions. If it is, we say of this reading that it is transcriptionally probable.

Some precautions must be observed. First we must rule out any proposal which assumes confusions of letters and abbreviations which are not attested for the particular tradition. Secondly, since different scribes are prone to different kinds of error, we must ever bear in mind the particular failings of the scribes responsible for the transmission of our text as these failings are revealed in the apparaus criticus.

Maxims of criticism to which we may here refer are that “harder readings are better than easier” and that “the shorter reading is generally the truest.” The first maxim is indisputable, provided we understand by “harder” harder to the scribe, and by “easier” easier to the scribe. The characteristic of scribes’ emendations or interpolations is that they are superficial. Their mark is that at the time of their making they “combine the appearance of improvement with the absence of its reality” (Westcott and Hort, New Testament, i. p. 27). The second maxim refers to the well-known fact that accretions from marginalia, &c., lengthen and at the same time weaken a text.

The virtues of a scribe are honesty and care (or in a single word fidelity) and intelligence. But it is rare to find these combined in a very high degree, and out of them we can least easily dispense with fidelity. Paradoxical as it may seem, the mechanical corruptions of a stupid but faithful copyist may tell us more than the intelligent copyings of a less faithful one.

A nice question is how far any alteration of the text of the exemplar is compatible with fidelity. Is a scribe, who recognizes under a corruption the word certainly intended, to perpetuate the error of the exemplar? Considering the liability of corruption to breed corruption we can hardly blame him if he does not, and we may say that it is no infraction to his fidelity if he makes self-evident corrections. But with these he must stop.

At certain epochs in the transmission of literature systematic efforts have been made to improve the transmitted texts, and these efforts have naturally been accompanied by a good deal of emendation both successful and unsuccessful. Such an epoch was the revival of Latin and Greek learning in the 15th century, and a modern scholar would for that reason naturally prefer to have a manuscript to work on, which was written immediately before this epoch to one which was written immediately after it.

The fidelity of a scribe has to be judged chiefly by internal tests, and these are best applied to his work in passages where there is no reasonable doubt of the correctness of the transmitted text. But there are two tests of a more objective character that may be used—orthography, and indication of lacunae or other faults in his exemplar. A scribe who preserves in his spelling the traces of a bygone age is probably trustworthy. If faithful in small things, he is likely to be faithful in great. A scribe again who scrupulously records the presence of a lacuna or illegibility in what he is copying, inspires us with confidence in the rest of his work.

As regards the use of testimonia, it may be observed to begin with that they do not of themselves depend on the trustworthiness of the texts of the writers from whom they are taken, and further upon that of the text used by the translator, the excerpator or the quota, about which we can know nothing for certain, though we may sometimes make probable inferences. In the case of quotations we must allow for failures of memory.

Many times in the course of his investigations the critic will be confronted with problems which cannot be resolved by considerations of transcriptional or documental probability. To take an instance already referred to, it is not clear at first sight whether in the couplet from Propertius Scythiae is more likely to be a misrecollection of some text of the 1st century A.D., or Scythicis some scribe’s assimilation which made its way into the transmitted text in the course of the next thousand years.

This leads us to consider Intrinsic Probability. By this is meant the likelihood that the writer of our text would at the time of writing have written, or not have written, a particular rendering. Two questions which may be separated, though they are not entirely distinct, are here involved. What was the meaning of the writer? And how did he express it? The sense may be clear though the words may no longer be determinable.

A reading may be impugned on a number of grounds: that it gives no sense or an inappropriate sense, that it involves a usage or an idiom not current at the assumed time of writing, or foreign to the reputed author, or to the style in which he then was writing, that it involves some metrical or rhythmical anomaly, or that the connexion of thought which it produces is incorrect or disorderly. These charges cannot be played off against each other. It is no answer to the objection that a reading in some Roman poet makes nonsense to say that its Latinity is perfect or its metre excellent. But they may reinforce each other, and to such corroboration great weight must be assigned.

To set the meaning of a passage in a foreign language before us we must frequently have recourse to translation. But this method of representation is a very imperfect one; we may easily impose on ourselves and others by strained and ambiguous renderings. A more subtle danger to which we are especially liable is that the correct reading of a text, which we believe to be correct in a sense which satisfies us but which would not have satisfied the ancient writer, above all we must avoid applying our own standards of taste, style and morality to the judgment of the text before us. The textual critic has no concern with what the writer ought to have thought or said; his business is solely with what he did say or think or might have said or thought.

Amongst the legitimate reasons for suspecting the correctness of a text are patent contradictions in a passage or its immediate neighbourhood, proved and inexplicable deviations from the standards for forms, constructions and usages (mere rarity or singularity is not enough), weak and purposeless repetitions of a word (if there is no reason for attributing these to the writer), violations of the laws of metre and rhythm as observed by the author, obvious breaks in the thought (incoherence) or disorderly sequence in the same (double or multiple incoherence).

Where the critic has ascertained the earliest form of a reading in his text, he will apply to it the tests of intrinsic probability. No part of a text can be considered exempt from this scrutiny, though for a very large part of it it may be dispensed with. It should, however, be here observed, that whoever takes a reading without investigation, on the authority either of a manuscript or of a great scholar, or of a number of scholars, ceases for the time being to be a textual critic.

After every such critical examination four conclusions are possible—acceptance, doubt, rejection and alteration. In other words, a critic may deliberately pronounce that what stands in the text represents what the author wrote or might well have written, that it is doubtful whether it does, that it certainly does not, or, in the last event, that it may be replaced with certainty by something that does. In the three first cases his judgment will be governed by considerations of intrinsic probability alone: but in the last it must regard transcriptional probability as well. No alteration of a text, or emendation, is entitled to approval, unless in addition to providing the sense and diction required, it also presents a reading which the evidence furnished by the tradition shows might not improbably have been corrupted to what stands in the text. These tests, and these alone, are emendations bound to satisfy; but others are often tacitly imposed upon them. Of this the transposition of lines is the most notable example. This kind,
of change is troublesome to estimate and inconvenient to adopt, as it involves placing passages where we are not accustomed to look for them; but to the question, did the author write the passage here or there? the matter of our trouble or inconvenience is wholly irrelevant. There is, however, one class of cases in which no conclusion can be drawn, documental and intrinsic probability both failing us. This is where two alternative readings, neither of which can have come from the other, have equal external support and equal intrinsic merit. Isolated discrepancies of this kind may be due to some accident to our text at a period now beyond our power to trace. Numerous and doubtfully decisive discrepancies may also be due to the fact that there was more than one edition or recension of it in early times, or to the author leaving his work in such a condition that such discrepancies must inevitably gain currency. In the case of dramas, different acting editions will give rise to them.

Up to this point all schools of textual criticism are theoretically at least in accord. But here begins a divergence which has done more than anything else to discredit the study with the outside world. It emerges because in all judgments on textual matters it is presupposed that they will be acted on, that a reading accepted will remain in printed text, and that a rejected one, enclosed between in brackets or removed, and, in this last case, something else substituted in its place.

The "conservative" critic's chief concern is for the safety of the traditional and by preference the transmitted text. He urges very rightly that if alteration is carried beyond a certain point it cuts away its own foundation, and so all certainty is destroyed. His objective is the minimum of change. And as the need of making a text compels some sort of decision in every case, the "doubtful" readings of the tradition, some of which on the evidence would be doubtlessly accepted, and others doubtfully rejected, will all appear with the accepted in the text. As to alterations (emendations) that are less than certain, his attitude is clearly if somewhat crudely expressed in the dictum that it is better to leave in the text "what if not the original reading is at least the remains of it." The corresponding thesis of the opposite school would be that it is better to present to the reader something which the author might have written than something which he could not: or, in other words, that "stopgaps" should be preferred to débris.

An editor of a corrupt and disputed text may reasonably adopt either of two methods of emendation. He may proceed on the principle that the external evidence warrants, and place all plausible suggestions for its improvement in notes or appendices. The text will be faithful but unreadable, and his work will be that of an honest man but of a textual antiquarian, not a textual critic, since he declines the duty of "the restoration of the text, as far as possible, to its original form." On the other hand, the editor will provide all necessary information about the evidence for the text in the notes of his critical apparatus; but in the text itself he will give whatever in each case is supported by the balance of the probabilities. Each and every case he will decide on its own merits and without reference to decision upon the other cases not now before him. Special consideration will be paid to "doubtful" readings, which will be distinguished in his work as "doubtfully accepted" or "doubtfully rejected." Legitimate doubt arises when the evidence pro et contra of documental and intrinsic probability is equal, or nearly equal, or when documental probability points strongly to one side and intrinsic probability to another. Illegitimate doubt is the uncertainty of the doubter as to whether he has examined the whole of the evidence. Such doubt is much more frequently felt than acknowledged, and its effect upon critical work is highly injurious. On the one hand, it is apt to take refuge in an uncritical acceptance of the traditional readings, and on the other hand, to produce a crop of hesitant and mutually destructive conjectures which a reader naturally resents as a needless waste of his time.

The so-called "conservative text" is neither an antiquarian's text nor a critic's text, but a compromise between the two. When it is conscientiously obtained, it is arrived at by handling capping, more or less heavily, intrinsic probability as compared with documental probability, or by raising the minimum of probability which shall qualify a reading for admission into the text until it is in agreement with the notions of the editor. Both of these procedures are arbitrary in their principle, and liable to be erratic in their application. The text will suffer whichever course is adopted, and it will suffer the more the more conservative is the editor, as may easily be shown. Thus, to take the latter one, if we suppose that of two editors of equal competence A requires a probability of four-fifths to admit a reading and B only three-fifths, we see that in all the cases in which the probability lies between these two fractions B will be right seven times to A's three, while outside these limits there will be no difference between them.

Many persons appear to suppose that decisions upon doubtful points can be avoided by the expedient of leaving the traditional reading in possession of the text. The rule is a simple one and easy to apply. But owing to the constitution of the human mind it has consequences which possibly they have not contemplated. The great works of classical literature are not studied for their textual specimens, and they will be studied the more the more they contain to repel and disquiet the reader. If a corruption is left in a text when something might be substituted which would at least, as a "stopgap," give the sort of sense required, then one of two things must happen. Either the sense of the passage is blotted out for the reader and the conservation of the corruption is tantamount to the expunging of the rest of the sentence, or else he will obtain the required sense by wresting the meaning of the other constituents of the context until it furnishes it. So far so good: the requisite sense has been obtained, but the price has now to be paid. And the price is that the reader's perception of the signification of the word or words so wrested is dimmed and impaired, and his power of discriminating and understanding them when he meets them again is shot with doubt and error.

In dealing with writings in dead languages this is particularly mischievous.

There are two reasons in particular why the part which emendation plays in the shaping of Greek and Latin texts is apt to be overlooked. Most people take their notions of a classical book not from its traditional form but from a "received" or revised text. The text so revised is readable, because it has been purified by the continuous emendation of scholars during several centuries. But the received conjectures which make this text acceptable have no more authority in themselves than equally good conjectures which have not yet won their way into the text, and it is clearly illogical to treat a text largely built upon conjectures as if it were now beyond the reach of conjecture. Again, it has often happened that readings which have been discovered by conjecture, and as such received into a text, have afterwards been found to have the support of MSS. Thus in one speech of Cicero, pro Caecillo, some thirty conjectures of critics were found to be attested by a single recently discovered MS. Such readings it is now commonly the practice to transfer to the credit of the MS. and to suppress the fact that they were originally discovered by emendation. These confirmanions, as they are called, should be carefully recorded in all critical texts, inasmuch as they constitute the most striking justification of the critical method.

Some examples from Shelley's poems are Prometheus, ii. 3, 50, "See st, than shapes within the mist" (Epitaph for "I see thin shapes"); 10, iv, 442, "Purple and azure, white and green" (and inserted by Rossetti); Prince Anthanor, 150 sqq. "the rugged path | Where she once saw that horsemann toil, with brief | And blighting hope, who with the news of death | Struck back body and soul as with a mortal blight" (Blighting, condemned by Rossetti, is cancelled in the Bodleian MS.).

It is a weakness of conservative critics to extol interpretation (or exegesis) at the expense of emendation. Some have even ventured to say that the successful defence of a passage in a text is a greater service than its successful correction. This is not true. The service to the text is the same, what was previously dark being now made clear. But the emendation
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deserves the higher praise as being in most instances the more difficult achievement. The fault of the opposite school, on the other hand, lies in dispisting conjectural and to regard corrections as the proper field of a scholar and gentleman. This bias is reflected in the maxim that "correction should precede interpretation," which is no more than a half-truth. For emendation must inevitably fail unless it express the meaning which the proper interpretation of the passage has shown to be required. Further, a corrector may propose the right word with the wrong meaning. Yet the custom is to give the credit of the emendation to him, and not to a successor who has seen what the right sense was and that this was the true one. This must be considered once if not twice, first assigning the wrong sense to the passage and then selecting what (in most cases) would be the wrong word to express it. The proper course would be not to mention the first conjecturer or to mention him only for his error.

One of the most vexed questions of textual criticism, and one which divides scholars more perhaps than any other, is the question to what extent admitted imperfections and inconsistencies may properly be left in a text as due to the default of an author rather than of a scribe or compositor. No universal rule is here determinable. Each case must be considered on its merits and the critic's procedure must of necessity be "eclectic." An epitaph often used with a tinge of reproach, the ground for which it is not easy to discover. Two general considerations may be indicated. If the autograph of a work is not accessible, there is no means of distinguishing between the involuntary errors of a scribe and the involuntary errors—"slips of pen"—of an author. For the latter are in fact only scribe's mistakes, the author being his own amanuensis. To take the example given under Confusions of Words above, *loves* in Cranford is probably a printer's error, but *love* is the expression that it is, an involuntary and the author's mind or pen through the accidental proximity of the "mutton chop."

Passing over this class we come to one about which there may frequently be serious doubt. What is clearly erroneous or faulty may as clearly be intended, and therefore not be removed by the critic. In Chaucer's "Miller's Tale" (3457, 3457) *astronomy* is used for *astronomie,* and *Noël* and *Noël* (Christmas) confused, "Nowell's food" (3457, 3457), because the speaker is an illiterate carpenter. In the Prologue to the "Parson's Tale" 10 there is, on the other hand, a mistake of his own, which no judgment on interpolation or removing, the context will make. The speaker being said to be "the moon's exaltation when it should be Saturn's. But this error in an astrological detail would not warrant us in assigning to the poet the blunder about Jacob and Laban in the same tale (see above). Much depends on the precision with which an error can be corrected: wherever there are more plausible ways than one of doing this, the faulty reading must be allowed to remain. Collateral as well as direct evidence must be obtained. If there are a number of instances where there is faultiness which is hard to remove, it is probable that the evil lies too deep for emendation. The author's own carelessness may be to blame, or, as in the case of Virgil and Lucan, he may not have been allowed to put the finishing touches to his work.

Certain lapses from grammatical correctness and metrical regularity that we find in the poems of Shelley are undoubtedly due to the author, though the number of these has been reduced (as Mr. Buxton Forman has pointed out) with our improved knowledge of the sources of the text. Amongst the sources we have *Probable Writings* (297), "The shadow of thy moving wings imbus / its deserts and its mountains," "To a Skylark" (86), "Thou lovest— / but never knew love's sad satisety." The solecism in the Preface to *Prometheus Unbound* (27) an interpolation, a reminiscence to the narrow principles of taste on which several of his earlier compositions were modelled *prove* at least that I am an impartial judge," would probably have been corrected by the poet if his attention had been called to it, but the two first verses, with others, cannot be removed. We may detect occasional laxity also in his handling of his verse. Lines are left unrhymed: e.g., *Julian and Maddalo* (311); *Rosalind and Helen* (366). Or the same word is used in place of another rhyming word: *Revol of Islam* (3573 and 3576, 3829 and 3831). In the * Daemon of the World* (342), Shelley himself cancelled a metrical reading for one that makes the verse a syllable too short. It is in this department of criticism that the personal equation has the freest play, and hence the natural adherents of either school of critics should be specially on their guard against their school's peculiar bias.

The part which conjectural emendation should play must obviously be very different in different texts. In the New Testament, for example, this part is very small indeed, though it cannot be altogether excluded. Colossians ii. 18 is corrupt as it appears; but the adoption of a correction recommended by Bishop Lightfoot and Dr. C. Taylor will restore it to sense. It has been maintained that emendation (being guessing) is no part of textual criticism at all, though judgment upon which this is, the case it must of course be, is not likely to be generally accepted. But it does contain an element of truth and indicates a well-founded reproach against the majority of those who practise conjecture. Nothing has discredited emendation as a means of improving texts more than the want of method, common care and research, which those addicted to it show. Some of the most distinguished scholars have offended worst. The * Millon of Bentley, England's* greatest critic, is a by-word. To examine all the causes which may vitiate emendations would mean writing a treatise upon human frailty. But it may be said that the vast majority of them should never have been made at all. Their proposers do not take even elementary precautions to be right. An inquirer who examines the stars with a shilling telescope is not likely to make observations of value, and even a trained astronomer has to allow for his "personal equation"—a point to which even a finished critic rarely attends. Successful emendation requires a rare union of qualifications—insight, prudence, patience and familiarity with the author emended and the conditions of his text. If any of these is absent, the work is apt to be worse. What is certain is that the absence of editors in a reading is no proof and often no presumption either that their agreement is independent or that their reading is right; and on the other that, though independence may generally be granted to coinciding emendations of different scholars, yet from the general constitution of the human mind it is likely that not a few of these will be coincidences in error rather than in truth.

One of the marks of a great textual critic is his attention to details. He will not consider his work upon the text complete until he has made it, as far as he can, such as the author would approve in every particular. Accordingly he will restore the spelling of the author if that can be ascertained: he will not accept the corruptions which have been introduced into it by copyists or printers, even though these may not affect its sense, nor will he modernize it so as to bring it into harmony with that of a later and to him a more famous age. Thus, to take an example, he will not print a critical text of Plautus with two letters (Y and Z) which were not part of the Latin alphabet in the age of that comedian; still less will he introduce into Latin texts distinctions, such as € and ç, which were not used till long after the middle ages.

As time goes on, textual criticism will have less and less to do. In the old texts its work will have been performed so far as it is possible. What is left will be an obstinate remainder of difficulties, for which there is no solution or only too many. In the newer texts, on the other hand, as experience has already shown, it will have from the outset but a very contracted field.
TEZPUR—THACKERAY

TEZPUR, or Tezpur, a town of British India, the administrative headquarters of Darrang district, Eastern Bengal and Assam, on the right bank of the Brahmaputra. Pop. (1901) 50,47. It is the centre of a flourishing tea industry, and contains many houses of English residences. Communications are maintained by river steamer, while a light railway runs northward through the tea-growing tract.

THA‘ALĪBI [Abu Ma‘ṣūr ‘Abd ul-Malik ibn Mahommed ibn Isma‘īl ud-Tha‘alībi] (961–1035), Arabian philologist, was born in Nishāpūr, and is said to have been at one time a furrier. Although he wrote prose and verse of his own, he was most famous for his anthologies and collections of epigrams. Like many other Arab writers, he does not always distinguish between his own and other people's work. Of the twenty-nine works known to have been written by him, the most famous is his Kitāb Ya‘imat ud-Dahr, on the poets of his own and earlier times, arranged according to the countries of the poets, and containing valuable extracts (published at Damascus, 4 vols., 1887). Another of his works, the Kitāb Fīgh ud-Lughāta, is lexicographical, the words being arranged in classes. It has been published at Paris (1861), Cairo (1867), and Beirut (1885, incomplete).

For other works see C. Brockelmann’s Geschichte der Arabischen Literatur, vol. i. (Weimar, 1898), pp. 284–296. (C. W. T.)

THACKERAY, WILLIAM MAKEPEACE (1811–1863), English novelist, only son of Richmond and Anne Thackeray (whose maiden name was Becher), was born at Calcutta on the 18th of July 1811. Both his father and his grandfather (W. R. Thackeray) had been [Indian civil servants.] His mother was only nineteen at the date of his birth, was left a widow in 1816, and afterwards married Major Henry Carmichael Smyth. Young Thackeray was brought home to England from India as a child, and was sent to private schools, first in Hampshire and then at Cambridge. He was soon removed to Charterhouse, a school which he has often referred to in a letter passage of the letter quoted by Trollope: “When I knew him better, in later years, I thought I could recognize the sensitive nature which he had as a boy.” Another illustration of this idiosyncrasy is found in the statement, which will be recognized as exact by all readers of Thackeray, that “his change of retrospective feeling about his school-days was very characteristic. In his earlier books he always spoke of the Charterhouse as Slaughter House and Smithfield. As he became famous and prosperous his memory softened, and Slaughter House was changed into Grey Friars, where the Colonel Newcome ended his life.” Even in the latter that references the bitterness which has often been so falsely read into Thackeray is not to be found. In “Mr and Mrs Frank Berry” (Men’s Wives) there is a description of a fight at Slaughter House following on an incident almost identical with that used in Vanity Fair for the fight between Dobbin and Cuff. In both cases the brutality of school life, as it then was, is very fully recognized and described, but not to the exclusion of the chivalry which may go alongside with it. In the first chapter of “Mr and Mrs Frank Berry,” Berry himself and old Hawkins both have a touch of the heroic, and in this story the bully whom Berry gallantly challenges is completely defeated, and one hears no more of him. In Vanity Fair Cuff the swaggerer is defeated as completely as is Berry's opponent, but regains his popularity by one well-timed stroke of magnanimity, and afterwards shows the truest kindness to his conqueror. Thackeray left Charterhouse in 1828 to join his mother and her husband at Larkbeare in Devonshire, near Ottery St Mary. Ottery St Mary is the “Clavering St Mary,” as Exeter and Sidmouth are respectively the “Chatteris” and “Baymouth” of Pendennis.

In February 1829 Thackeray went to Trinity College, Cambridge, and in that year contributed some engaging lines on “Timbuctoo,” the subject for the Prize Poem (the prize for which was won in that year by Tennyson), to a little paper called The Snob, a title which Thackeray afterwards utilized in the famous Book of Snobs. The first stanza has become tolerably well known, but is worth quoting as an early example of the direct comic force afterwards employed by the author in verse and prose burlesques:

“In Africa—a quarter of the world—
Men's skins are black; their hair is crisp and curled;
And somewhere there, unknown to public view,
A mighty city lies, called Timbuctoo.”

One other passage at least in The Snob, in the form of a skit on a paragraph of fashionable intelligence, seems to bear traces of Thackeray's handiwork. At Cambridge, James Spedding, Monkton Milnes (Lord Houghton), Edward FitzGerald, W. H. Thompson (afterwards Master of Trinity), and others who made their mark in later life, were among his friends. In 1830 he left Cambridge without taking a degree, and went to Weimar and to Paris. His visit to Weimar bore fruit in the keen sketches of life at a small German court which appear in Fitz-Gredy’s Confessions and in Vanity Fair. In G. H. Lewes's Life of Goethe is a letter containing Thackeray's impressions of the German poet. On his return to England in 1831 he entered the Middle Temple. He did not care to pursue the study of the law, but he found in his experience of the Temple the material for some capital scenes in Pendennis. In 1832 he came of age, and inherited a sum which, according to Trollope, “seems to have amounted to about five hundred a year.” The Arabian Nights, which was some in an Indian bank, some to play and some in two newspapers, The National Standard (with a long sub-title) and The Constitutional. In Love the Widerse these two papers are indicated under one name as The Museum, in connexion with which our friends Honeyman and Sherrick of The Newcomes are briefly brought in. Thackeray's adventurous and losses at play were utilized in his literary work on three occasions, in “A Caution to Travellers” (The Paris Sketch-Book), in the first of the Deuceace narrations (The Memoirs of Mr C. J. Yellowplush), and in Pendennis, vol. ii. chap. v., in a story (wherein Deuceace reappears) told to Captain Strong by “Gordon Almartan.” As to Deuceace, Sir Theodore Martin has related how once in the playrooms at Spa Thackeray called his attention to a certain man and said presently, “That was the original of my Deuceace.”

In 1834 or at the end of 1833 Thackeray established himself in Paris in order to study art seriously. He had, like Clive in The Newcomes, shown talent as a caricaturist from his early boyhood. His gift proved of great value to him in illustrating much of his own literary work in a fashion which, despite all incorrectness of draughtsmanship, conveyed vivid suggestions that could not have been so well given by anyone but himself. Perhaps his pencil was at its best technically in such fantastic work as is found constantly in the initial letters which he frequently used for chapters in his various kinds of work, and in those drawings made for the amusement of some child friends which were the origin of The Rose and the Ring.

In 1836 Thackeray married Isabella, daughter of Colonel Matthew Shawe. There were three daughters born of the marriage, one dying in infancy. The eldest daughter, Anne Isabella (b. 1837), married in 1877 Mr Richmond Ritchie, of the India Office, who in 1907 was created a K.C.B. She inherited literary talent from her father and wrote several charming works of fiction, notably Miss Angel (1875), and subsequently edited Thackeray's works and published some volumes of criticism and reminiscences. The younger daughter, Harriet Marion (b. 1840), married (Sir) Leslie Stephen in 1867 and died in 1875. Thackeray's own family life was early broken, for Mrs Thackeray, to quote Trollope, “became ill and her mind
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failed her," in 1840, and he "became as it were a widower to the end of his days"; Mrs Thackeray did not die till 1892.

In 1837 Thackeray came to London, worked at various kinds of journalism, and became a regular contributor to Fraser's Magazine. In this he in 1841 appeared The History of Mr Samuel Titmarsh and the Great Hoggarth Diamond, a work filled with instances of the wit, humour, satire, pathos, which found a more ordered if not a fresher expression in his later and longer works. For freshness, indeed, and for a fine perception which enables the author to perform among other feats that of keeping up throughout the story the curious simplicity of its supposed narrator's character, The Great Hoggarth Diamond can scarcely be surpassed. The characters, from Lady Drum, Lady Fanny Rakes, Lady Jane and Edmund Preston, to Brough, Mrs and Miss Brodge, Mrs Roun Grind, Gus Hoggs, and least, Samuel Titmarsh's aunt, Mrs Hogarty, with her store of "Rosolio," are full of life; the book is crammed with honest fun; and for pure pathos, the death of the child, and the meeting of the husband and wife over the empty cradle, stands, if not alone in its own line, at least in the company of very few such scenes in English fiction. The Great Hoggarth Diamond, oddly enough, met with the fate that afterwards befell one of Lever's best stories which appeared in a periodical week by week—it had to be cut short at the bidding of the editor. In 1840 came out, The Porit Sketch-Book, much of which had been written and published at an earlier date. The book contains among other things some curious divagations in criticism, along with some really fine critical work, and a very powerful sketch called "A Gambler's Death." In 1838 Thackeray had begun, in Fraser, The Yellowplush Papers, with their strange touches of humour, satire, tragedy (in one scene, the closing one of the history of Mr Deuceace), and their sublimation of fantastic bad spelling (M'Aroney for macaroni is one of the typical touches of this); and this was followed by Catherine, a strong story, and too disagreeable perhaps for its purpose, founded closely on without the ken of a criminal named Catherine Hayes, and intended to counteract the then growing practice of making ruffians and harlots prominent characters in fiction. Now, when Pendennis was coming out in serial form (1839), Miss Catherine Hayes, a singer of Irish birth and a famous prima donna (Sims Reeves described her as "the sweetest Lucia [di Lammermoor] he had ever sung with") was much before the public. A reflective passage in a number of Pendennis referred indignantly and scornfully to Catherine Hayes, the criminal of old time, coupling her name with that of a then recently notorious murderer. It would appear that Thackeray had for the moment, oddly enough, omitted to think of Miss Catherine Hayes, the justly famed soprano, while certain Irish folk were obviously ignorant or oblivious of the history of Catherine Hayes the murderess. Anyhow, there was a great outcry in the Irish press, and Thackeray was beset by private letters of indignation from enthusiastic contemporaries of the prima donna. In deference to susceptibilities ingeniously outraged Thackeray afterwards suppressed the passage which had given offence. The thing is worth mention if only because it explains the initial letter drawn by Thackeray for chap. xv., vol. ii., of Pendennis. The drawing is in itself highly comic, but must quite seem meaningless without the text.

There soon followed Flitz-Boodle's Confessions and Professions, including the series Men's Wives, already mentioned; and slightly before these, the Shabby Gentled Story, a work interrupted by Thackeray's domestic affliction and afterwards republished as an introduction to The Adventures of Philip, which took up the course of the original story many years after the supposed date of its catastrophe. In 1843 also came out the Irish Sketch-Book, and in 1844 appeared the account of the journey From Cornhill to Grand Cairo, in which was included the excellent poem of "The White Squall." In 1844 there began in Fraser the Memoirs of Barry Lyndon, called in the magazine "The Luck of Barry Lyndon, a Romance of the Last Century." "Barry Lyndon" has, with a very great difference in treatment, some resemblance to Smollett's "Ferdinand, Count Fathom"—the hero, that is to say, is or becomes a most intolerable scoundrel, who is magnificently unconscious of his own iniquity. The form and pressure of the time depicted are sought with striking verisimilitude, and in the boisterous career of Barry Lyndon there are at least the elements of a wild chivalry, simplicity, generosity, which mingle naturally with those worse qualities that, under the influence of abominable training, afterwards corrupt his whole mind and career. The man is so infatuated with and so blind to his own ruggery, he has so much clack and daring, and is on occasions so infamously treated, that it is not easy to look upon him as an entirely detestable villain until, towards the end of his course, he becomes wholly lost in brutal debauchery and cruelty. His latter career is founded on that of Andrew Robinson Stoney Bowes, who carried the widow of John, of early St. John's. There is also no doubt a touch of Casanova in Barry Lyndon's character. Thackeray became a contributor to Punch within the first year of its existence. John Leech, who was one of the earliest contributors, had been at Charterhouse with Thackeray and the two men were friends through life. Thackeray's first series contributed to Punch did not attain or indeed deserve signal success. He made his first hit with Joeamy's Diary, begun in November 1845, and may be said to have established his reputation by the Snob Papers (1846), now better known as The Book of Snobs. These, besides greatly improving Thackeray's position, provoked much discussion of various kinds. Thackeray himself was naturally accused of being a snob. To this charge he had partly given an anticipatory answer (in the third chapter) in the statement that "it is impossible, in our condition of society, not to be sometimes a Snob," and in giving the name of "Mr Snob" to the supposed historian of snobs throughout the series. Thackeray's connexion with Punch came practically to an end in 1851. The separation was due partly to differences in political opinion. His personal relations with the staff of Punch always remained friendly. The Book of Snobs, which took up to a quarter of a year, seemed to have become a portion of the picture of his to the paper, "Punch's Prize Novelists," containing some brilliant parodies of Edward Lytton Bulwer, Lever, Benjamin Disraeli (in "Coldingbby," perhaps the most perfect of the series), and others. Among minor but admirable works of the same period are found A Legend of the Rhine (a burlesque of the great Dumas's Otho's Archer), brought out in George Cruikshank's Table Book, edited by Gilbert Abbott A Beckett, Cox's Diary (on which has been founded a well-known Dutch comedy, Janus Tulp), and The Fatal Boots. This is the most fitting moment for naming some of the burlesques and parodies which Thackeray's letters give as a result of the influence of Fanny Trollope on his powers in the Edinburgh Review. It is probable that on Vanity Fair has been largely based the foolish cry, now heard less and less frequently, about Thackeray's cynicism, a cry which he himself, with his keen knowledge of men, foresaw and provided against, ample enough as one might have thought, at the end of the eighth chapter, in a passage which is perhaps the best commentary ever written on the author's method. He has explained how he wishes to describe men and women as they actually are, good, bad and indifferent, and to claim a privilege.

"Occasionally to step down from the platform, and talk about them: if they are good and kindly, to love and shake them by the hand; if they are silly, to laugh at them confidentially in the reader's sleeve; if they are wicked and heartless, to abuse them in the strongest terms politeness admits of. Otherwise you might fancy it was I who was sneering at the practice of devotion, which
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Miss Sharp finds so ridiculous; that it was I who laughed good-
humouredly at the rolling old Silenus of a baronet—whereas the
laughter comes from one who has no reverence except for pros-
perity, Vanity Fair and himself besides. Such people
there are living and flourishing in the world—Faithless, Hopeless,
Charityless: let us have at them, dear friends, with might and
main. Some there are, and very successful too, mere quacks and
fools: and it was to combat and expose such as those, no doubt,
that laughter was made."

As to another accusation which was brought against the
book when it first came out, that the colours were laid on too
thick, in the sense that the villains were too villainous, the good
people too goody-goody, the best and completest answer to
that can be found by anyone who chooses to read the work
with care. Osborne is, and is meant to be, a poor enough
creature, but he is an eminently human being, and one whose
prowess of character is developed as he allows bad influences
to tell upon his vanity and folly. The good in him is fully recog-
nized, and comes out in the beautiful passage describing his
farewell to Amelia on the eve of Waterloo, in which passage
may be also found a sufficient enough answer to the statement
that Amelia is absolutely insipid and uninteresting. So with
the companion picture of Rawdon Crawley's farewell to Becky
Sharp: who that reads it can resist sympathy, in spite of Rawdon's
Pendennis, who has his similar, bravery and devotion to his wife? As for Becky, a character
that has since been imitated a host of times, there is certainly
not much to said in her defence. We know of her, to be
sure, that she thought she would have found it easy to be good
if she had been rich, and we know all what happened when
Rawdon, released without her knowledge from a spunging-
house, surprised her alone with and singing to Lord Steyne
in the house in Mayfair. After a gross insult from Steyne,
"Rawdon Crawley, springing out, seized him by the neckcloth,
undulating, and bent under his arm, 'You lie, you dog,' said Rawdon, 'I will lie and
you villain!' And he struck the peer twice over the face with
his open hand, and flung him bleeding to the ground. It was
done all before Rebecca could interpose. She stood there
seemingly before him. She admired his husband, strong,
brave, and victorious." This admiration is, as Thackeray himself thought it, the capital touch in a scene which is as
powerful as any Thackeray ever wrote—as powerful, indeed,
as any in English fiction. Its full merit, it may be noted in
passing, has been curiously accented by an imitation of it in
Alfred Daudet's "Jeune et Vétére," where a minor character,
under the ism of the miserable Becky's guilt in the Steyne matter,
Thackeray leaves it practically open to the reader to form what
conclusion he will. There is, it should be added, a distinct
touch of good in Becky's conduct to Amelia at Ostend in
the last chapter of the book, and those who think that too little
punishment is meted out to the brilliant adventuresses in the end
may remember this to her credit. It is supreme art in the treat-
ment of her character that makes the reader understand and
feel her attractiveness, though he knows her extraordinarily
evil qualities; and in this no writer subsequent to Thackeray
who has tried to depict one of the genus Becky Sharp has even
faintly succeeded. Among the minor characters there is not
one—and this is not always the case even with Thackeray's chief
figures—who is incompletely or inconsistently depicted;
and no one who wishes fully to understand and appreciate
the book can afford to miss a word of it.

Vanity Fair was followed by Pendennis, Esmond and The
Newcomes, which appeared respectively in 1839, 1852 and 1854.
It might be more easy to pick holes critically in Pendennis than in
Vanity Fair. It赡ishes itself, after his wayish passion
and university escapades, has disagreeable touches of flabbyness
and worldliness; and the important episode of its relations
with Fanny Bolton, which Thackeray could never have treated
otherwise than delicately, is so lightly and tersely handled that
it is a little vague even to those who read between the lines.
It can hardly be said that there is adequate preparation for the
final announcement that those relations have been innocent,
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Rooms in the same year, and re-delivered in the United States in 1852 and 1853, as was afterwards the series called The Four Georges. Both sets were written for the purpose of lecturing. In 1854 was published a most delightful burlesque, The Rose and the Ring, whereof the origin has already been mentioned. In 1857 Thackeray stood unsuccessfully as a parliamentary candidate for Oxford against Mr Cardwell, and in the same year appeared the first number of The Virginians, a sequel to Esmond. This is a most unequal work—inferior, as sequels are apt to be, to Esmond as an historical romance, less compact and coherent, prone to divagation and desultoriness, yet charming enough in its lifelikeness, in the wit and wisdom of its reflections, and, as has been said, in its portrait of Beatrice grown old. The last number of The Virginians came out in 1859, and in the same year Thackeray undertook the editorship of the Cornhill Magazine. This was a task which, as readers of his Roundabout Paper "Thorns in the Cushion" will remember, the kindliness and sensitivity of his disposition made him to, and he resigned the editorship in April 1862, though he continued to write for the magazine until he died. In the Cornhill appeared from his pen Love of the Widow, previously written, with different names for some of the personages, in dramatic form; The Adventures of Philip (1861–62); the Roundabout Papers; and (1860–63) the story, unhappily never finished, called Denis Duval. Love of the Widow, changed from the dramatic to the narrative form, remains a piece of high comedy in which the characters are indicated rather than fully worked out with a bold and frank touch. The Roundabout Papers, a small storehouse of some of Thackeray's best qualities as an essayist, came out in the Cornhill Magazine simultaneously with Love of the Widow and with The Adventures of Philip. Among these papers is one differing in form from the rest, called "The Notch on the Axe—a Story at a Modita." It is an almost perfect specimen of the author's genius for burlesque story-telling; but it contains an odd instance, which a careful reader will not fail to discover, of that odd habit of inaccuracy of which Thackeray himself was conscious. The Adventures of Philip is, as has been before said, in the nature of a sequel to or a completion of A Story of Gentle Life. As with the other direct sequel, it is a work of great inequality. It contains scenes of humour, pathos, satire, which rank with Thackeray's best work; some old friends from others of the novels make brief but pleasant reappearances in its pages; there are fine sketches of journalistic, artistic and diplomatic life, and the scene from the last-named in Paris is inimitable. The Little Sister is altogether delightful; the Twysden family are terribly true and vastly diverting; the minor characters, among whom old Ridley, J. J.'s "father, should be mentioned, are wonderfully hit off; nor did Thackeray ever write a better description of the scene in that of the quarrel between Bunch, Baynes and M'Whirter in the Paris pension. Philip himself is impossible; one cannot say that the character is ill-drawn—it is not drawn at all. It is an entirely different personage in different chapters; and it has here and there a very unpleasant touch which may perhaps have come of rapid writing. Yet so admirable are many parts of the book that Philip cannot be left out of the list of Thackeray's most considerable works. Denis Duval, which reached only three numbers, promised to be a first-rate work, more or less in the Esmond manner. The author died while it was in progress, on the day before Christmas day 1863. He was buried in Kensal Green, and a bust by Marochetti was put up to his memory in Westminster Abbey.

Little has yet been said of Thackeray's performances in poetry. They formed a small but not the least significant part of his life's work. The grace and the apparent spontaneity of his versification are beyond question. Some of the more serious efforts, such as "The Chronicle of the Drum" (1841), are full of power, and instinct with true poetical feeling. Both the half-humorous, half-pathetic ballads and the wholly extravagant ones must be classed with the best work in that kind; and the translations from Béranger are as good as verse translations can be. Thackeray had the true poetical instinct, and proved it by writing poetry which equalled his prose in grace and feeling.

There can be little doubt that Thackeray will always be ranked among the foremost English writers of fiction, or that his more infrequent work as essayist and poet will go hand in hand with his wider achievements as a novelist. Many attempts have been made at many times to institute a comparison between Thackeray and Dickens as novelists. In truth it would be as much to the purpose, to borrow a homely metaphor, to compare chalk with cheese. The two authors were so radically different in their purviews, in their modes of thought, in their methods of expression, that critical comparison between them is of its nature absolutely unprofitable. It is better to recognize simply that the two novelists stood, each in his own way, distinctly above even their most distinguished contemporaries. As to preference, that is a matter with which criticism has nothing, and individual inclination has everything to do.

The books of reference that can be best commended to the student of Thackeray's life and works are Merivale's and Marzials Life of Thackeray (1891); R. H. Shepherd, Bibliography of Thackeray (1880); C. P. Johnson, The Early Writings of Thackeray (1888); Charles Whibley's Thackeray (1905), a critical commentary; the edition of Thackeray's Works with biographical introductions (1897–1900), by his daughter, Lady Ritchie; the Life of Thackeray (1880) by John Forster; the Life of Thackeray (1899) by Antony Trollope. It is curious that Trollope showed in his own autobiography far more appreciation of Thackeray's great qualities than is apparent in his Life of Thackeray. (W. H. F.)

THAÏS, Greek courtisan, who lived during the time of Alexander the Great. She accompanied him on his Asiatic campaign, and is chiefly known from the story which represents her as having persuaded the conqueror to set fire to the city of Persepolis. This anecdote forms the subject of Dryden's Ode to Saint Cecilia's Day. But its authenticity is doubtful, since it is based upon the authority of Cleitarchus, one of the least trustworthy of the historians of Alexander. Thaïs subsequently became the wife of Ptolemy Lagus, king of Egypt. Numerous anecdotes and witticisms attributed to her will be found in Athenaeus.

See Diod. Sic. xvii. 72; Plutarch, Alexander, 38; Athenaeus xiii. 576, 585; Quintus Curtius v. 7.

THALBERG, SIGISMOND (1812–1872), German pianist and composer, was born at Geneva in 1812 (May the 5th or January the 7th). In 1822 he was taken to Vienna, where, under the watchful care of Count Dietrichstein, his education was completed. He made his first appearance as a pianist at Prince Metternich's in 1826, and published his first composition—a Fantasie on Airs from "Euryanthe"—in 1828, but it was not until 1830 that he was first fairly introduced to the public, with the success of his Variations on the Air of Haspil. That time forward his only rival was Liszt (q.v.). In 1834 he was appointed "kammer-virtuus" to the emperor of Austria. He first appeared in Paris in 1837; and in 1838 he went to England, astonishing his hearers with the novel effects produced in his Variations on God Save the Queen, while he charmed them with his delicate touch and the purity of his expression. Thenceforward his career was a succession of triumphs. In order to dispense the popular idea that he could execute no music but his own, he played Beethoven's Concerto in C minor (Op. 37) at the London Wednesday Concerts, held in 1846−47 at Exeter Hall, with a keen intelligence which proved his power of interpreting the works of the great masters to be at least on a level with his wonderful technique. Besides his pianoforte compositions, which are almost innumerable, Thalberg produced two operas—Cristina, which proved a complete failure, and Florinda, which fared but little better at Her Majesty's Theatre in 1851. He played in London for the last time in 1863, and afterwards retired to his estate near Naples. He died at Naples on the 27th of April 1871.

THALE, a town of Germany, in the Prussian province of Saxony, charmingly situated under the northern declivity of the Harz Mountains, 8 m. by rail S.W. of Quedlinburg, at the entrance to the romantic gorge of the Bode, and in the
immediate vicinity of the Rosstrappe, the Hexentanzplatz and other notable points in the Harz. Pop. (1905) 13,194. It is largely frequented as a summer resort and for its saline springs. It is also a brisk manufacturing centre, its chief products being enamelled goods, iron-work and machinery. THALES OF MILETUS (649–546 B.C.), Greek physical philosopher, son of Examyus and Cleobuline, is universally recognized as the founder of Greek geometry, astronomy and philosophy. He is said by Herodotus and others to have been of Phoenician extraction, but the more common account (see Diogenes Laërtius) is that he was a native Miletian of noble birth. Zeller thinks that his ancestors belonged to the Cadmean tribe in Bocotia, who were intermingled with the Ionians of Asia Minor, and thus reconciles the conflicting statements. The nationality of Thales is certainly Greek and not Phoenician. The estimation in which he was held by his contemporaries is shown by the place he occupied as chief of the seven "wise men" of Greece; and in later times amongst the ancients his fame was quite remarkable. It is well known that this name (σοφός) was given on account of practical ability; and in accordance with this we find that Thales had been occupied with civil affairs, and indeed several instances of his political sagacity have been handed down. Of these the most remarkable is the advice, praised by Herodotus, which he gave to his fellow-countrymen "before Ionia was ruined, that the Ionians should constitute one general state in Teos, as the most central of all their cities, and that the remainder should be governed as independent states" (Herod. i. 170). It is probable, however, that in the case of Thales the application "wise man," which was given to him and to the other six in the archonship of Damasius (586 B.C.),1 was conferred on him not only on account of his political sagacity, but also for his scientific eminence (Plut. Salom. c. 3). To about the same time must be referred his celebrated prediction of the eclipse of the sun, which took place on the 28th of May 585 B.C. This event, which was of the highest importance, has given rise to much discussion. The account of it given by Herodotus (B. H. 74) contains two statements:—(1) the fact that the eclipse did actually take place during a battle between the Medes and the Lydians, that it was a total eclipse (Herodotus calls it a "night battle") that it caused a cessation of hostilities and led to a lasting peace between the contending nations; (2) that Thales had foretold the eclipse to the Ionians, and fixed the year in which it actually did take place. Various dates—ranging from 625 B.C. to 583 B.C.—have been assigned by different chronologists to this eclipse; but, since the investigations of Airy,2 the date 585 B.C. has been generally accepted (for later authorities see Eclipse and Astronomy). This date agrees nearly with that given by Piny (H. N. ii. 12). The second part of the statement of Herodotus—the reality of the prediction by Thales—has been frequently called in question, chiefly on the ground that, in order to predict a solar eclipse with any chance of success, one should have the command of certain astronomical facts which were not known until the 3rd century B.C., and then merely approximately, and only employed with that object in the following century by Hipparchus. The question, however, of the accuracy of the account as given by Herodotus (B. H. 74) has been generally accepted by most of the ancients, and with any chance of success—much whether he could state beforehand at what places the eclipse would be visible, as some have erroneously supposed, and which of course would have been quite impossible for him to do, but simply whether he

1 Breternicher (Die Geom. vor Euklides, p. 40), without stating his authority, gives "between 585 and 583 B.C." as the date of the archonship of Damasius. In this he is followed by some other recent writers, who infer the name "wise man" was conferred on Thales on account of the success of his prediction. The date 586 B.C., given above, which is taken from Clinton, is adopted by Thales, the Eclipses of Agathocles, Thales, and Xenocrates," Phil. Trans. vol. cxliii. p. 179 seqq., 1853.


3 Athenæum, Untersuchungen der wichtigeren Finsternisse, &c., p. 57., 1853.
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that he discovered many things himself, and communicated the beginnings of many to his successors, some of which he attempted in a more intuitive or sensible manner (σύμμετρας ὑποδοχήν) (op. cit., p. 65).

From these indications it is no doubt difficult to determine what Thales taught in his philosophy. This is due to his generation.

This difficulty has, however, been lessened since the translation and publication of the papyrus Rhind by Eisonlohr; and it is now generally admitted that, in the distinction made in the last century between the two forms of his work-συμμετρικά and τέχνη-recto pointing to what he derived from Egypt or arrived at in an Egyptian manner, while the invention of the discoveries which he made in accordance with the Greek spirit. To the former belong the theorems (1), (2), and (3), and to the latter especially the theorem (4), and also, probably, his solution of the two practical problems. We may suppose that Thales made use of the first of these, and inferred from the sum of the three angles of a triangle are equal to two right angles. This inference is made from (4) taken along with (2). No doubt we are informed by Proclus, on the authority of Eudemus, that the theorem Euclid I. 32 was first proved in a general way by the Pythagoreans; but, on the other hand, we learn from Geminus that the ancient geometers observed the equality to two right angles in each of the triangles - the equilateral triangle, then, in the isosceles, and lastly in the scalene (Apoll. Conica, ed. Halleius, p. 9), and it is plain that the geometers older than the Pythagoreans can be no other than Thales and his school. The theorem may have been thought by him to be evident, or may have been suggested by the contemplation of floors or walls covered with tiles of the form of equilateral triangles, or squares, or hexagons. [2] We see also in the theorem (4) the first trace of a spherical geometry. The observation of the zodiac, which is often attributed to Thales. It is worth noticing that it was in this manner that this remarkable property of the circle, with which, in fact, Euclid's postulate, was inaugurated, presented itself to the imagination of Dante:

"O se del mezzo cerchio far si puote
Triangoli sì, ch'un retto non avesse." - Par. c. xiii. 101.

3. Thales discovered the theorem that the sides of equiangular triangles are proportional. The knowledge of this theorem is distinctively attributed to Thales by Plutarch, and it was probably made use of also in his determination of the distance of a ship at sea.

Let us now consider the importance of the work of Thales. 1. In a scientific point of view: (a) we see, in the first place, that by his two theorems he founded the geometry of lines, which has ever since remained the principal part of geometry; (b) he may, in the second place, be fairly considered to have laid the foundation of algebra, for his first theorem establishes an equation in the sense of the word, while the second institutes a proportion.

2. In a philosophic point of view: we can see in these two theorems of Thales the first type of a natural law, i.e., the expression of a fixed dependence between different quantities, or, in another form, the expression of a proportional dependence, all of which is distinctly arisen.

3. Lastly, in a practical point of view: Thales furnished the first example of an application of theoretical geometry to practice, and laid the foundation of an important branch of geometrical knowledge - the heights and distances. For the further progress of geometry see PYTHAGORAS.

As to the astronomical knowledge of Thales we have the following notices:—(1) besides the prediction of the solar eclipse, Eudemus attributes to him the discovery that the circuit of the sun between the solstices is not always uniform; (2) he called the last day of the month the thirtieth (Diog. Laert. i. 24); (3) he divided the year into 365 days (Ld. i. 27); (4) he determined the position of the sun to be the 720th part of the zodiac; (5) he appears to have pointed out the constellation of the Lesser Bear to his countrymen, and instructed them to steer by it (as nearer the parts farther south). [3] (6) Thales asserted the claims of fire, and on the contrary, he conceived it to be a flat disk, and in this supposition he was followed by most of his successors in his schools, including Anaxagoras.

The doctrine of the earth, for which the researches of Anaximander had prepared the way, 2 was in fact one of the great discoveries of Pythagoras, was carried out by Plato, and remained for a long time the exclusive property of the Italian schools. 3

Philosophy.—Whilst in virtue of his political sagacity and intellectual eminence Thales held a place in the traditional list of the wise men, on the strength of the disinterested love of knowledge which appeared in his physical speculations he was accounted a "philosopher" ( αρχιτέχνης), and perhaps the genius that he usually summed up in the dogma "water is the principle, or the element, of things"; but, as the technical terms "principle" (αρχή) and "element" (ετερον) had not yet come into use, it may be conjectured that the phrase "all things are water" (πάντα ὅπως λιμέν) more exactly represents his teaching. Writings which bore his name were extant in antiquity; but as Aristotle, when he speaks of Thales's doctrine, always depends upon tradition, there can be little doubt that they were forgeries.

From Aristotle we learn (1) that Thales found in water the elements of many things; (2) that he concealed from the earth to float in the sea of the elementary fluid; (3) that he supposed all things to be full of gods; (4) that in virtue of the attraction exercised by the magnet he attributed to it a soul. Here our information ends. Aristotle's suggestion that Thales was led to his fundamental dogma by observation of the part which moisture plays in the production and the maintenance of life, and Simplicius's, that the impressibility and the binding power of water were perhaps also in his thoughts, are by admission purely conjectural. Simplicius's further suggestion that Thales conceived the element of water to be produced by thinning and thickening is plainly inconsistent with the statement of Theophrastus that the hypothesis in question was peculiar to Anaximenes. The assertion preserved by Stobaeus that Thales recognized, together with the material element "water," "mind," which penetrates and sets it in motion, is refuted by the precise testimony of Aristotle, who declares that the early physicists did not distinguish the moving cause from the material cause, and that before Hermetismus and Anaxagoras no one postulated a creative intelligence.

It would seem, then, that Thales sought amid the variety of material causes that he found such a one as was most familiar to him, namely, water, and accordingly regarded the world and all that it contains as water variously metamorphosed; and that he asked himself no questions about the manner of its transformation.

The doctrine of Thales was interpreted and developed in the course of three succeeding generations. First, Anaximander chose the "air" (αέρ) as his element, which he called "the boundless" (ἄμαλλος) and which he conceived as the original of the rest of the world. Second, Anaximenes, taking the "air" as a corporeal element intermediate between fire and air on the one hand and water and earth on the other. Lastly, Heracles, asserting the claims of fire, went on to conceive it to modify itself, not occasionally, but perpetually.

Thus Thales recognized change, but was not careful to explain it; Anaximander attributed change to two directions; Anaximenes conceived the two sorts of change as production and condensation; Heraclitus, perceiving that, if, as his predecessors had tacitly assumed, change was occasional, the interference of a moving cause was necessary, made change perpetual. All four are noticed in tracing the variety of things to a single material cause, corporeal, endowed with qualities and capable of self-transformation. A new departure was taken when the Eleatic Parmenides (q.v.), who, expressly noting that when Thales and his successors attributed to the supposed element changing qualities, they became pluralists, required that the superficial variety of nature should be distinctly distinguished from its fundamental unity. Hence, whereas Thales and his successors had confounded the One, the element, and the Many, in its modifications, the One and the Not-One or Many became with Parmenides matters for separate investigation. In this way two hitherto mixed categories (wasserige Dinge) were separated. In the same way Anaxagoras, abandoning the pursuit of the One, gave themselves to the scientific study of the Many; on the other hand, abandoning the pursuit of the Many, gave himself to the dialectical study of the One. Both successful were doomed to failure; and the result

1 Ein mathematisches Handbuch der alten Ägypter (Leipzig, 1877).
4 Ibid., p. 294.
5 Theonis Smyrnaii Platonici Liber de Astronomia, ed. Th. H. Mannhardt, C.F. Weisse u. Dr. v. Heimann, ii. 23; cf. Aratus, Phaenomena, v. 36 seq. Other discoveries in astronomy are attributed to Thales, but on authorities which are not trustworthy. He did not, for example, that "the earth is a sphere," as erroneously stated by Plutarch (Plut. Isis, i. 10; Plato, Crito, 23; cf. Aratus, Phaenomena, v. 36 seq.).
6 This is the revised interpretation of the passage in Diogenes Laëritius, i. 24 (see Wolf, Gesch. der Astron., p. 169), where σκηναὶον is probably a scribe's error for ἥκωνον. Cf. Apuleius, Florida, iv. 18, who attributes to Thales, then old, the discovery "quotiens sol magnitude sua circum quem permutat materiam." 7 In likening the earth to a cylinder Anaximander recognized its circular figure in one direction.
THALLIUM

was a scepticism from which the thought of Greece did not emerge until Plato, returning to Parmenides, declared the study of the One and the Many, jointly regarded, to be the true office of the philosopher. Thus, measure and number as the doctrine of Thales was, all the Greek schools, with the solitary exception of that of Pytha-
gorus, took their origin from it. Not in name only, but also in fact, the Ionian philosophers, was the founder of the philosophy of Greece.

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THALLIUM [symbol Tl, atomic weight 204-0 (O = 16)], a metallic element. It was discovered in 1861 by Sir William Crookes, who, during a spectroscopic examination of the flue-dust produced in the roasting of seleniferous pyrites occurring at Tilkerode in the Harz, observed a green line foreign to all then known spectra. He concluded that the mineral contained an element, now known as thallium, that gave the name of thallus, from thālλus, a green twig. Crookes presumed that his thallium was something of the order of sulphur, selenium or tellurium; but Lamy, who anticipated him in isolating the new element, found it to be a metal. Our knowledge of the chemistry of thallium is based chiefly upon the labours of Crookes.

The chemical character of thallium presents striking peculiarities. Dumas once called it the "ornithorhynchus paradoxus of metals." As an elementary substance, it is very similar in its physical properties to lead; it resembles lead chemically in its monovalent state, and it is more soluble in cold water. The thallous, Tl2, is a yellow or greenish-yellow, and the thallous, TlH, a dark green powder, resplendent with the formation of a reddish or violet vapour. When exposed to the air it becomes quickly covered with a film of oxide; the tarnished metal when plunged into water reassumes its metallic lustre, the oxide film being quickly dissolved. When kept in contact with water and air it is gradually converted into hydroxide, TlOH. It decomposes water at a red heat, liberating hydrogen and being itself converted into the hydrate. It is readily soluble in nitric and sulphuric acids, but less so in hydro-

Thallium forms two series of salts: thallous, in which the metal is monovalent; and thallic, in which it is trivalent. In the thallous series many analogies with lead compounds are observed; in the thallic some resemblance to aluminium and gold.

Thallous hydroxide, TlOH, is most conveniently prepared by decomposing the solution of the sulphate with baryta water. It crystallizes from its solution in long yellow needles, TlOH or TlOH·H2O, which dissolve readily in water, forming an intensely alkaline solution, which acts as a caustic, and like it greedily absorbs carbonic acid from the atmosphere. Unlike the alkali, it readily loses its water at 100° C. and even at the ordinary tempera-
ture, to form the oxide Tl2O, which is black or black-violet.

Thallous oxide, TlO or Tl2O, was obtained by O. Rabe (Abst. Jb., 1877, 1, 44%; 1886, 2, 260). It is obtained by evaporating an alkaline solution of thallous sulphate at low temperatures, an initial red precipitate rapidly changing into a bluish-black compound. It melts at 184° C. and decomposes on being heated in vacuo with oxygen and thallous oxide. Thallous chloride, TlCl, is readily obtained from the solution of any thallous salt, by the addition of hydrochloric acid, as a white precipitate similar in physical character to silver chloride. It is obtained by the reaction of the hydrochloric acid and the thallous chloride, and fuses below redness into a (yellow) liquid which freezes into a horn-like flexible mass. It is also formed when the metal is burnt in chlorine. The specific gravity of this "horn" thallium is 7-02. One part of the precipitated chloride is precipitated at 5° C. in 100 parts of water, and in 70 parts at 100° C. It is less soluble in dilute hydrochloric acid. Carbonate of soda solution dissolves it pretty freely. Thallous iodide, TlI, is obtained as a yellow precipitate which requires 16,000 parts of cold water for its solution, its addition of potassium iodide to a solution of a thallous salt, or by the direct union of its components. The yellow crystals melt at 100° C., and when cooled it forms a mass of a yellowish colour, changing to the original yellow on standing. Thallous bromide, TlBr, is a light yellow crystalline powder; it is formed analogously to the chloride. Thallous fluoride, TlF, forms white glistening octahedra; it is obtained by crystallizing a solution of the carbonate in hydro-

flouric acid. It resembles potassium fluoride in forming an acid salt, TlHF3. Thallous chloroplatinate, TlPtCl4, readily obtainable from thallous salt solutions by addition of platinum chloride, is a yellowish, precipitate soluble in cold water than hot.

Thallous perchlorate, TlClO4, and periodate, TlO4, are interesting inasmuch as they are isomorphous with the corresponding potassium salts. The thallous perchlorate and periodate crystals are insoluble in water, but are destroyed in cold solutions of the alkalis, but readily dissolves in the mineral acids. On thallous sul-

phides see H. Pélabon, Abst. J. C. S., 1907, ii, 770. Thallous nitrate, TlNO3, is obtained as white, rhombic prisms by crystallizing a saturated solution of the metal, or by fusing Tl2O or Tl2O·H2O, and cooling. The thallous phosphates are known. The normal salt, TlPO4, is soluble in 200 parts of water, and may be obtained by precipitation. On thallous phosphate see M. Abaye, Abst. J. C. S., 1897.

Thallic oxide, Tl2O, is obtained as a dark reddish powder, insoluble in water and alkalis, by plunging molten thallium over oxygen, or by electrolysis of water, using a thallium anode. Thallic oxide, Tl2O, is used in the preparation of thallous oxide, TlO, which is obtained by the reaction of the hydrochloric acid and the thallous chloride, and fuses below redness into a (yellow) liquid which freezes into a horn-like flexible mass. It is also formed when the metal is burnt in chlorine. The specific gravity of this "horn" thallium is 7-02. One part of the precipitated chloride is precipitated at 5° C. in 100 parts of water, and in 70 parts at 100° C. It is less soluble in dilute hydrochloric acid. Carbonate of soda solution dissolves it pretty freely. Thallous iodide, TlI, is obtained as a yellow precipitate which requires 16,000 parts of cold water for its solution, its addition of potassium iodide to a solution of a thallous salt, or by the direct union of its components. The yellow crystals melt at 100° C., and when cooled it forms a mass of a yellowish colour, changing to the original yellow on standing. Thallous bromide, TlBr, is a light yellow crystalline powder; it is formed analogously to the chloride. Thallous fluoride, TlF, forms white glistening octahedra; it is obtained by crystallizing a solution of the carbonate in hydro-

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obtained by treating the monochloride with chlorine under water; evaporation in a vacuum gives colourless deliquescent crystals of TlCl2·H2O. By heating the metal or thallous chloride in chlorine, TlCl, a yellow powder is obtained which on further heating gives 3TlCl/TlCl2, as a yellowish brown mass. The chloride when anhydrous is a crystalline mass which melts at 24°. It forms several double salts, e.g., with hydrochloric acid and the alkaline chlorides, and also with hydrobromic acid, nitric acid, phosphoric acid, and with silver nitrate in nitric acid solution; the ionization apparently not proceeding to all the chloride atoms. Thallie titide, TlI, is interesting on account of its isomorphism with rubidium and cesium tri-iodides, a resemblance which suggests the formula TlI12 for the salt, in which the metal is obviously monovalent. On the halogen compounds see V. Thomas, Abst. J.C.S. (1897), 2143; (1899), 3123 and (1900), 1593. Tl(NO3)2·8H2O, are obtained as colourless crystals on the evaporation of a solution of the oxide in the corresponding acid. The sulphate decomposes into sulphuric acid and the trioxide on warming with water, and differs from aluminium sulphate in not forming alums.

Analysis.—All thallium compounds volatile or liable to dissociation at the temperature of the flame of a Bunsen lamp impart to such flame an intense green colour. The spectrum contains a bright green wave-length 5351. From solutions containing it as thallous salt the metal is easily precipitated as chloride, iodide, or chloroplatinate by the corresponding reagents. It is precipitated as hydrogen, in the presence of free mineral acid, gives no precipitate; sulphide of ammonium, from neutral solutions, precipitates Tl2S4 and Tl2S5, and black precipitate, insoluble in excess of reagent. Thallium salts can easily be reduced by means of copper, metal of sulphur, and thus rendered amenable to the above reactions. The chloroplatinate serves for the quantitative estimation of thallium. The soluble chloroplatinate, Tl2[PtCl6], is precipitated as thallium as TlSnS4, insoluble in water, and which may be dried on a Gooch filter at 105°. It may be noted that all thallium compounds are poisonous.

The atomic weight of thallium was determined very carefully by Crookes, who found Tl = 204.2 (O = 16); this figure was confirmed by Lepierre in 1893.

THALWEG—THAMES

THALWEG (a German word compounded from Thal, valley, and Weg, way) in physical geography, a term adopted into English usage signifying the line of greatest slope along the bottom of a valley, i.e. a line drawn through the lowest points of a valley in its downward slope. It thus marks the natural direction of a watercourse.

THAMES, the chief river of England, rising in several small streams among the Cotswolds Hills in Gloucestershire. Its source is generally held to be at a place known as Thames Head, in the parish of Coates, 3 m. W. by S. of Cirencester; but claims have been made from the source of the Evenlode to that of the Evenlode tributary, the head waters of the river Churn, 5 m. S. of Cheltenham. The length of the river from Thames Head Bridge to London Bridge is 161 1/4 miles, and from London Bridge to the Nore, 471 m., a total of 209 m. The width at Oxford is about 150 ft., at Teddington 250 ft., at London Bridge 750 ft., at Gravesend 2100 ft., and between Sheerness and Shoeburyness, immediately above the Nore, 55 m. The height of Thames Head above sea-level is 336 ft., but that of Seven Springs, the adoption of which as the source would extend the length of the river by several miles, is 700 ft. The height of the river at Lechlade is 237 ft., the average fall between Lechlade and London, 143 m., being rather less than 20 in. per mile. The drainage area of the Thames is 9242 sq. m., including that of the Medway, which, as it joins the estuary immediately above Sheerness, may be considered a tributary of the Thames. The Thames forms part of the Gloucestershire-Wiltshire boundary to a point below Lechlade, thence for a short distance it separates Gloucestershire from Berkshire; after which it separates successively Oxfordshire and Berkshire, Buckinghamshire and Berkshire, Middlesex and Surrey, and finally, at its estuary, Essex and Kent. In the subsequent figures the broken figures indicate the distance in miles above London Bridge.

The upper course lies through a broad valley, between the foot-hills of the Cotswolds on the north, and the slight elevations dividing it from the Vale of White Horse on the south. The scenery is rural and pleasant; the course of the river winding. Before reaching Oxford the stream swings north, east and south to encircle the wooded hills of Wytham and Cumnor, which overlook the city from the west. The Windrush joins from the north (left) at New Bridge (1261), the Evenlode near Eyesham (119), and the Cherwell at Oxford (112). Between Lechlade and Oxford the main channel sends off many narrow branches; the waters of the Windrush are similarly distributed, and the branches in the neighbourhood of Oxford form the picturesque "backwaters" which only light pleasure boats can penetrate. The river then follows a valley confined between the hills on either side of Oxford, passes the pleasant woods of Nuncham, and at Abingdon (103) receives the Ock from the Vale of White Horse. At Dorchester (305) the Thames enters on the left, and the river then passes Wallingford (901) and the Thames tributaries from Oxford its course, though greatly winding, has here generally a south-easterly character, but it now bends eastward, and breaches the chalk hills in a narrow gap, dividing the Chilterns from the downs of Berkshire or White Horse Hills. From this point as far as Taplow the southern slopes of the Chilterns descend more or less closely upon the river; they are finely wooded, and the scenery is peculiarly beautiful, especially in early summer. The charm of the Thames is indeed maintained throughout its course; the river is narrow, and is often threaded by a road which winds through the rich valley from Richmond Hill, of the outskirts of London. The river is practically the only physical attribute to the beauty of the modern metropolitan landscape; with its burden of shipping and its industrial activity, it is less admirable. At Pangbourne (802) the Thames receives the Pang on the right, and at Reading (744) the Kennet on the same side. After passing Reading it bends northward to Henley (63), eastward past Great Marlow (57) to Bourne End (54), and southward to Taplow and Maidenhead (491), receiving the Loddon on the right near Shiplake above Henley. Winding in a south-easterly direction, it passes Eton and Windsor (432), Datchet (411), Staines (369), Kingston (32), Shepperton (30) and Sunbury (261), receiving the Coln from the left at Staines, and the Wey from the right near Shepperton. Flowing past Hampton Court, opposite to which it receives the Mole on the right, and past Kingston (204), it reaches Teddington (183). Passing Richmond (16) and Kew the river flows through London and its suburbs for a distance of about 25 m., till it has passed Woolwich. Gravesend, the principal town below Woolwich, is 264 m. from London Bridge. The estuary may be taken to extend to the North Foreland of Kent. In the vicinity of the Thames the Chartist and the Tweed have their sources; the Chars and the Tweed are the Brent at Brentford, the Wandle at Wandsworth, the Ravensbourne at Deptford, the Lea at Blackwall, the Darent just below Erith, and the Inglesbourne at Rainham, besides the Medway.

The basin of the Thames is of curiously composite character. Thus, the upper portion of the system, above the gap at Goring, is a basin in itself, defined on the west and south by the Cotswold and the Chiltern Hills, and by the Chilterns and the uplands of Northamptonshire. But there are several points at which its division from other river basins is only marked by a very low parting. Thus a well-marked depression in the Cotswolds brings the head of the (Gloucestershire) Con, one of the head-streams of the Thames, very close to that of the Isbourne, a tributary of the upper Avon; the parting between the head-streams of the Thames and the Bristol Avon sinks at one point, near Malmsbury, below 300 ft.; and head-streams of the Great Ouse rise little more than two miles from, and only some 300 ft. above, the middle valley of the Cherwell. The White Horse Hills and the Chilterns strike a direct course to this basin, but almost their entire drainage from either flank lies within it, and similarly a great part of the low-lying Weald, though marked off from the rest of the basin by the North Downs, drains into it through these hills. It may be noted further that the Kennet continues upward the line of the main valley below the Goring gap, and the Cherwell that of the main valley above it. The basin thus presents interesting problems. The river is the breasting of the Severn, Dee and other rivers of the west. The question, in fact, involves that of the development of a large part of the hydrography of England.
The Thames about Oxford is often called the Isis. Camden gave currency to the derivation of the word from the combination of the names Thame and Isis. But it can be shown conclusively that the river has borne this present designation from the earliest times. Caesar (De Bell. Gall. v. 11) says that at the time of his invasion of Britain it was called Tamesis. Dion Cassius (xl. 3) and Tacitus (Ann. xiv. 32) both call it Tames, and in no early authority is the name Isis used. In early Saxon times the river was called Thamis, as may be seen in a grant before A.D. 675 to Chertsey Abbey by the sub-king Frithwald. In the first statute passed for improving the navigation of the river near Oxford (21 Jac. I.) it is called the river of Thames, and it was only in a statute of George II. (1751) that the word Isis is used for the first time in a statutory title; but this title is rhyming verse, and as applied to the Thames in its course above Dorchester (Faerie Queen, Bk. iv. canto xi. stanza 24), but there is ample evidence to show that long before his time the name of the river throughout its course was not Isis but Thames. The word Isis is probably an academic rendering of Ouse or Isca, a common British river name, but there is no reason to suppose that it ever had much vogue except in poetry or in the immediate neighbourhood of Oxford.

The flow of the Thames varies greatly, according to the season of the year. The average flowings at Teddington for the summer months of the years 1883 to 1900 were in July 413,000,000 gallons a day, in August 395,000,000 gallons, and in September 375,000,000 gallons. The average for the whole of the years is about 350,000,000 gallons a day, and of this, after the companies have taken 130,000,000, only 220,000,000 gallons are left to pass over Teddington Weir. After a long period of dry weather the natural flow has been known to fall considerably below 200,000,000 gallons, whilst, on the other hand, in the rainy winter season, the flow in 1894 rose for a short time to as high a figure as 20,000,000,000 gallons, and the ordinary flow in winter months may be put down as 300,000,000 gallons. The importance of storage reservoirs is manifest under such conditions of flow, especially bearing in mind the growth of population in the London district and of its increasing need for water for regattas and other purposes. The Thames remains the chief source of supply for the metropolis, but apart from this the corporation of Oxford and two companies in the Staines district have powers to draw water from the river, though not in any large quantities. Throughout the whole of the Thames watershed, and especially in the 3800 sq. m. above the intakes of the water companies (at Hamptons) a title above Lechlade, the Thames Conservancy Board has the requirements of parliament that no sewage or other pollution shall be allowed to pass into the Thames, into its tributaries streams, or into the navigable watercourses. An efficient and substantial staff of inspectors constantly visiting the various parts of the watershed, and in spite of many difficulties arising from vested interests, the work is chiefly one of maintaining the quality of the Thames, and its banks are now much more picturesque than in the earlier days. So recently as 1890 the state of the river below London was such as to be dangerous to the public health. The metropolis has since then managed to improve. The work is now chiefly one of maintaining its present condition and of improving the tidal part of the river.

The Thames is navigable for rowing-boats as far upwards as Cricklade, except in dry seasons, and for barges at all times as far as Lechlade, 18 m. below Thames Head. At Ingham, three-quarters of a mile above Lechlade, the Thames and Severn canal has its junction with the Thames. This canal is the link between the two great rivers from which it takes its name, and, in other words, takes the course of the Severn. It runs to the last of the three important locks of the Severn. It is entered by the old water-bailiffs, and its importance in connexion with the navigation of the Thames was increased by the construction of a lock which prevents the water-bailiffs passing below the lock. The river was called the Seal when it was navigable, a name that is still used in connexion with the public hall of the town.

It is a common saying that the Thames was not navigable to the right of navigation, it was not until the last quarter of the 18th century that any systematic regulation of its flow in the upper reaches was attempted. Complaints of the obstructions in the Thames were not uncommon, and John Taylor, the Water Poet (1580-1653), in a poem commemorating a voyage from Oxford to London, bewails the difficulties he found on the passage. No substantial measures to remedy such state of things were adopted till 1771, when an act of parliament was passed authorizing the construction of pound locks on the Thames above Maidenhead bridge. In pursuance of this act several locks were built, and the Thames was made navigable to London, as far down as Teddington. These pound locks were arranged by the Act of 1771 to ensure an efficient head of water during the drier seasons of the year, and facilitate the escape of winter floods. The number of locks which have been made is now 724, of which the uppermost lock is at St John's, below Lechlade; the lowest is Richmond, but this is a half-tide lock, keeping the water above at a level corresponding to half of that of flood tide. Under ordinary circumstances, the sluice on this lock is shut, so that a half flood to half ebb, so that the river remains tidal up to Teddington, the next lock.

The canals in use communicating with the Thames, in addition to the Thames and Severn canal, are the Oxford canal, giving communication from that city with the north, the Kennet and Avon canal from Reading to the Bristol Avon, the Grand Junction at Brentford, the Regent's canal at Limehouse, and the Grand Surrey canal at Rotherhithe. A short cut connects Gravesend with Higham. Navigation is also carried on by the Medway to Tonbridge, on the lower parts of the Darent and Cray, from Dartford and Crayford, and on the Wey up to Guildford and Godalming. The navigation of the upper Thames above Aldermaston is little used. The Wilts and Berks canal, joining the Thames at Abingdon, is disused. By means of the Grand Junction and Oxford canals it is possible to convey goods between the Thames and the great industrial centres of England.

The trade on the upper Thames is steady, though not extensive. The vast trade at the estuary, which lies within the bounds of the city of London, continues.

The utility of the river is great in the opportunities for exercise and recreation which it affords to the public, especially to Londoners. The scene on any part of the river from Oxford down on public holidays and on Saturdays and Sundays during the summer is found to be sufficient to show how it contributes to the public enjoyment. It is only since about 1870 that this popularity has grown up. Ten years earlier even rowing-boats were few excepting at Oxford, at Oxford on the Henley Royal Regatta days, and at Putney on the eights. Steam launches did not exist on the river before 1866 or 1867, and houseboats only in the form of college barges at Oxford. But in 1890 there were 541 launches, 162 house-boats, and 11,284 rowing-boats. Each boat is registered, a small tax being charged; while there are fixed prices for the passage of locks. During the season regattas take place at many of the towns and larger villages. Of these the Henley Royal Regatta is pre-eminent by the number and importance of the entries, and by its comparative antiquity. The regattas at Molesey, Kingston, Reading, Marlow and Oxford, as well as many others, attract numerous competitors and spectators. The Oxford races at Henley, Henley races, Oxford races on Putney tideway, the summer eights and the "tories" at Oxford University, and the school races at Eton and Radley should also be mentioned.

A committee of 1393 was granted to the citizens of London to remove weirs on the Thames, and empowered the Lord Mayor to enforce its provisions. For the next four centuries it acted through the civic officials, till in 1771 a committee of the Corporation of London took over the work. In 1857 the Thames Conservancy Board was established. Its powers were increased and its constitution varied in 1864, 1866 (till which year the jurisdiction of the river above Staines was under a large body of commissioners), and 1894, but the creation of the Port of London Authority (see LONDON) limited its jurisdiction.

Fish are abundant, especially coarse fish such as pike, perch, rouget, bream, and barbel. Of trout there are many fine specimens, especially at the weirs. Salmon are known to have existed at Maidenhead so recently as 1812, but they disappeared soon after. The fish were not allowed to pass below the weir. It was the duty of Mr W. H. Grenfell, M.P., with the object of reintroducing this fish into the river, and in April 1901 and on subsequent occasions a number of young salmon were placed at Teddington by the Fishery Board. The operations of the Board have been frequently in dispute, but a committee of the House of Commons, which took much evidence on the question in the year 1884, came to the conclusion that "it is impossible to recognize anything as a genealogical record to the Thames salmon." They added that the public at large have only to know that their rights are imaginary to induce them also to be content with the present mode of extinction under which the Thames fisheries, by being given to the public for angling on the more frequented parts of the Thames." These conclusions are interesting in face of the fact that the question has arisen from time to time since 1884.

The fisheries are under the regulation of by-laws made by the Thames Conservancy, which apply to the riparian owners as well
as to the public generally. These by-laws are carried into effect by officers of the conservators, assisted by the river-keepers of the various fishing associations. The principal associations are those at Oxford, Reading, Henley, Maidenhead and Windsor, and the Thames Angling Preservation Society, whose district is from Staines to Brentford.

THAMES, a seaport and gold-mining centre in North Island, New Zealand, in the county and at the mouth of the river of its name, on the Firth of Thames, a deep inlet of the Hauraki Gulf of the east coast. Pop. (1906) 3750. It comprises under one municipality the settlement formerly called Grahamstown, with its suburbs Shortland and Tararu. It lies 42 m. S.E. of Auckland by the steamer-route, a pleasant journey among the islands of the Gulf. There is also railway communication with the Auckland (but by a circuitous route of 170 m.), and with the neighbouring districts by branch lines. The harbour is good; the industries include foundries, shipbuilding yards and saw-mills. The sea fisheries are valuable, a large part of the yield being exported to Auckland. The inland district watered by the Thames river is auriferous; Waitakiri (40 m.) and Karangahake (28 m. S. of Thames) are centres of operations. The small town of Te Aroha (32 m. by rail), on the river, besides being the centre of mining and agricultural industries, is a favourite health resort on account of its hot medicinal springs. The river is navigable for steamers of light draught. The scenery along its course is pleasant, and at Ohinemuri (70 m. from Thames it flows through a fine gorge.

THANA, or TANNA (= a fort, or police-station), a town and district of British India, in the Northern division of Bombay. The town is on the west of the Salsette creek or Thana river, just where the Great Indian Peninsula railway crosses to the mainland, 21 m. from Bombay city. Pop. (1901) 16,011.

The District of Thana has an area of 3573 sq. m. It extends along the coast for 105 m., with a breadth of 50 m., and is confounded between the Western Ghats and the sea, at the mouth of the N. territory of Damaun and by Surat district, and on the S. by Kolaba district. The district is well watered and wooded, and, except in the north-east, is a low-lying rice tract broken by hills. Most of the hills were once fortified, but the forts built on them are now dilapidated and useless. Matheran (q.v.) is a favourite summer resort for the citizens of Bombay. The only rivers of any importance are the Vaitarna and the Ulhas, the former being navigable for a distance of about 20 m. from its mouth; the latter is also navigable for parts of small craft. There are no lakes, but the Vaitarna is divided into two branches, the Ulhas; and the Tulu, formed by its confluence, supplies the city with water. In 1901 the population was 87,433, showing a decrease of 1 per cent. in the decade. The staple crop is rice. Fishing supports many of the people, and the forests yield timber and other produce. Salt is largely manufactured by evaporation along the coast. At Kurla, in Salsette island, there are cotton mills and rice mills. The district is traversed throughout its length by the Bombay and Baroda railway, and also crossed by the two branches of the Great Indian Peninsula line.

The territory comprised in the district of Thana (apart from Sambhar and the acquisitions, 1862) formed part of the dominions of the peshwa, and was annexed by the British in 1818 on the overthrow of Baji Rao. Since then the operations to put down the Koli robbers, which extended over several years, have been the only cause of serious trouble.

THANESAR (= "place of the god"), an ancient town of British India, in Karnal district of the Punjab, on the river Sarswati, 100 m. by rail N. of Delhi; pop. (1901) 5066. As the centre of the tract called Kurukshetra in the Mahabharata, it has always been a holy place, and was in the seventh century the capital of King Harshavardhana, who ruled over all northern India. The bathing-fair held here on the occasion of a solar eclipse is said to be attended by half a million pilgrims.

THANET, ISLE OF, the extreme north-eastern corner of Kent, England, insulated by two branches of the river Stour, and forming one of the eight parliamentary divisions of the county. Its name is said to be derived from Saxon tena, a beacon or fire (probably from the number of watch-fires existing on this easily ravaged coast), and numerous remains of Saxon occupation have been found, at Ostend near Ramsgate. Thanet is roughly oblong in form, its extreme measurements being about 8 m. from E. to W., and 5 m. from N. to S. The branches of the Stour dividing near Sarre take the place of the former Wantsum, a sea-passage which had diminished in breadth to half a mile in the time of Augustine. The Wantsum was guarded by the Roman strongholds of Regulibium (Reculver) in the north and Rutupiae (Richborough) in the south, and was crossed by ferries at Sarre and Wade. With the drying up of this channel and the closing of Sandwich harbour in the 12th century, the present marshlands or level to the south and west of the Isle except left. The sea-face of Thanet consists mainly of bold slopes or sheer cliffs, and the eastern extremity is thefine headland of thenorth Foreland. Containing the popular seaside resorts of Ramsgate, Broadstairs, Margate and Westgate, Thanet is served by the South-Eastern & Chatham railway, and Minster is a junction station of the lines to Ramsgate and Sandwich respectively.

THANKSGIVING DAY, in the United States, the fourth Thursday in November, annually set apart for thanksgiving by proclamation of the president and of the governors of the several states. This day is observed with religious ceremonies in the churches, and, especially in New England, as an occasion for family reunion. The Pilgrims set apart a day for thanksgiving at Plymouth immediately after their first harvest, in 1621; the Massachusetts Bay Colony for the first time in 1630, and frequently thereafter until about 1680, when it became an annual festival in that colony; and Connecticut as early as 1639 and annually after 1647, except in 1675. The Dutch in New Netherland appointed a day for giving thanks in 1644 and occasionally thereafter. During the War of Independence the Continental Congress appointed one or more thanksgiving days each year, except in 1777, each time recommending to the executives of the various states the observance of these days in their states. President Washington appointed a day of thanksgiving (Thursday, the 26th of November) in 1789, and appointed another in 1795. President Madison, in response to resolutions of Congress, set apart a day for thanksgiving at the close of the War of 1812. One was annually appointed by the governor of New York from 1817. In some of the Southern States there was opposition to the observance of such a day on the ground that it was a relic of Puritanic bigotry, but by 1858 proclamations appointing it were issued by the governors of twenty-five states and two Territories. President Lincoln appointed the fourth Thursday of November 1864, and since that time each president has annually followed his example.


THAN, a town of Germany, in Upper Alsace, 15 m. by rail N.W. of Mulhausen. Pop. (1905) 7901. It is the seat of cotton, calico and machine weaving, soap, and flax industries, and excellent wine is grown there. The (Roman Catholic) church of St Theobald (1351) is an elegant specimen of Gothic, and has a remarkably fine tower (1450-1516), 266 ft. high. Above the town are the ruins of the castle of Engellburg, destroyed by Turenne in 1675.

THAPSACUS, the "large and prosperous city" on the Arabian side of the Euphrates where Cyrus the Younger revealed to the Greeks the object of his expedition (Xen. Anab. i. 4, 11). No such place has yet been found mentioned in cuneiform texts. We may have a Semitic form of the name in the Hebrew Tiphah; but it is impossible to determine whether the one phrase "from Tiphah to Gaza" (1 Kings v. 4—iv. 24 in the English version), where the name seems to occur, is as early
as the Persian period: the Greek text is quite discrepant. Thapsus was the crossing-place of Darius Codomannus, before and after his defeat (Arrian ii. 13), and of Alexander (iii. 7), and in Strabo's time it was the usual crossing-place (xvi. 1, 21); but Tiglat-pileser I. and Assur-nasir-pal crossed considerably farther north, and we have no reason to suppose that they were not simply following the practice of those earlier times; and we do not know when the custom of crossing at Thapsus which the Hebrew text of the passage in 1 Kings may presuppose sprang up. Xenophon's army had to be content with fording the stream. Alexander, however, effected his crossing (Arrian, iii. 7) by two connected bridges (of boats?), and it was from this place that later he had the material for his fleet sent down (Arrian vii. 19; Strabo xvi. 741) to Babylon. His successors must also have valued the place, for according to Pliny (v. 87) it bore later the name of Amphipolis, perhaps bestowed on it (Steph. Byz., Appian Syr. 57) by Seleucus I., although the name, like so many others, probably failed to win acceptance; and in the time of Eratosthenes the position of Thapsus had become so central that he chose it as the point from which to make his measurements for all Asia (Strabo ii. 79, 80), and in the time of Strabo himself it was there that Arrian's harkened for transport down the Euphrates (Q. Curt. x. 1), and landed after having come by stream from lower districts (Strabo xvi. 1, 23). After Pliny the city is not again mentioned.1

After various attempts at identification (see Ritter, Erdkunde) it has apparently been correctly identified by J. P. Peters (Nation, May 23, 1890) and B. Mortiz (Sitz.-Berl. Akad., July 23, 1889). The name may survive in Kal'at Diban, "a small ruin 8 m. below Meskene, and 6 m. below the ancient Barbalissus." See J. P. Peters, Nippur, 196 ff. (H. W. H.)

THAPSUS, a low peninsula, now known as Magnisi, joined by a narrow isthmus to the mainland of Sicily, about 7 m. N.N.W. of Syracuse. The founders of Megara Hyblea settled here according to Thucydides, in the winter of 729–728 B.C., but it seems to have been deserted almost by 707, not entirely uninhabited until the Athenians used it as a naval station in their attack on Syracuse early in 414 B.C. A number of tombs were excavated in 1804, containing objects belonging to a transitional stage between the second and third Sicel period, attributable roughly to 1000-900 B.C., and with a certain proportion of Mycenean importations. See Orsi in Monumenti dei Lincei (1897), vi. 89–150.

THAR AND PARKAR, or Thur and Parkar, a district of British India in the Sind province of Bombay. Area, 13,941 sq. m. The district is divided into two portions. The western part, called the "Pat," is watered by the Eastern Nara and the Mithrau canals, which constitute the sole water-system of the district, and the presence of water has created a quantity of jungle and marsh; the other part, called the "Thar," is a desert tract of rolling sand-hills, running north-east and south-west, composed of a fine but slightly coherent sand. To the south-east of Thar is Parkar, where there are ranges of rocky hills, rising to 350 ft. above the surrounding level, and open plains of stiff clay. This portion contains the ruins of several old temples. The climate subject to considerable extremes in temperature, being excessively hot in the summer and very cold in winter, the cold increasing as the sand-hills are approached. In 1901 the population was 389,714, showing an increase of 22 per cent. in the decade. The principal crops are millets, rice, wheat, oil-seeds and cotton. Cultivation is made possible by the narrow-gauge railway from Hyderabad to Shadipalli, connected with the North-Western main line by a bridge across the Indus at Kotri, and with the Rajputana system at Jodhpur. Umarkot, the administrative headquarters of the 1 Stephanus of Byzantium gives it in a list of cities as a "Syrian town on the Euphrates," quoting from Theopompos, without noting that he has already referred to it under the name Amphipolis.

district, is on the edge of the desert. Pop. (1901) 4924. It is historically interesting as the birthplace of the emperor Akbar in 1542.

Very little is known of the early history of the district. The Suda Rajputs, said to be descendants of Parmar Soda, are supposed to have come into this part of Sind about 1226, when they quickly displaced the rulers of the country, though, according to other authorities, they did not conquer the country from the Sumnas, the dominant race, before the beginning of the 16th century. The local dynasty of the Sodas succumbed to the Kalhora's about 1750, since which period the district has been a scene of lawless and lawless to Sind. The Talpur jirga succeeded the Kalhora, and built a number of forts to overawe the people, who were lawless and addicted to robbery. On the British conquest of Sind in 1843 the greater part of the district was made over to Cutch, but in 1856 it was incorporated in the province of Sind. In 1859 a rebellion broke out, which was quickly suppressed.

THARANDT, a town of Germany, in the kingdom of Saxony, romantically situated on the Wilde Weisseritz, 9 m. S.W. of Dresden, on the Dresden-Reichenbach railway. Pop. (1905) 7130, of which there is a Protestant church, a high school, and the oldest academy of forestry in Germany (founded by Heinrich Cotta in 1811) with about sixty students. Tharandt is a favourite summer resort of the people of Dresden, one of its principal charms being the magnificent beech woods which surround it. See Donner, Tharandt (Tharandt, 1890).

THARGELIA, one of the chief Athenian festivals in honour of the Delian Apollo and Artemis, held on their birthdays, the 6th and 7th of the month Thargelion (about the 24th and 25th of May). The name, which was derived by the ancients from θαργήλη τύρων γίγαι ("to reap the land "), is more probably connected with τερα-θρανος (cf. Lat. torreco, tostus), signifying the produce of the earth "baked" by the sun. Essentially an agricultural festival, the Thargelia included a purifying and expiatory ceremony. While the people offered the first-fruits of the earth to the god in token of thankfulness, it was at the same time necessary to propitiate him, lest he might ruin the harvest by excessive heat, possibly accompanied by pestilence. The purification preceded the thanksgiving service. On the 6th a sheep was sacrificed to Demeter Chloræ on the Acropolis, and perhaps a swine was offered at the same time. The rite was performed by the woman who bore the first child born in the year. The ritual was the following. Two men, who were called φαρακις or θεμακος, the ugliest that could be found, were chosen to die, one for the men, the other (according to some, a woman) for the women. On the day of the sacrifice they were led round with strings of figs on their necks, and whipped on the genitals with rods of figwood and squills. When they reached the place of sacrifice on the shore, they were stoned to death, their bodies burnt, and the ashes thrown into the sea (or over the land, to act as a fertilizing influence). The whipping with squills and figwood was intended to stimulate the reproductive energies of the φαρακις, who represented the god of vegetation, annually slain to be born again. It is agreed that an actual human sacrifice took place on this occasion, replaced in later times by a milder form of exiliation. Thus at Leucas a criminal was annually thrown from a rock into the sea as a scapegoat; but his fall was checked by live birds and feathers attached to his person, and men watched below in small boats, who caught him and escorted him beyond the boundary of the city. Similarly, at Messalia, on the occasion of some heavy calamity (plague or famine), one of the poorest inhabitants volunteered as a scape- goat. For a year he was fed up at the public expense, then cited to be put to death, the pretense being that he was the cause of the present calamity, clothed in sacred garments, led through the city amidst executions, and cast out beyond the boundaries. The ceremony on the 7th was of a cheerful character. All kinds of first-fruits were carried in procession and offered to the god, and, as at the Pyanepsia (or Pyanopsia), εἰρήνειαν (branches of olive bound with wool), borne by children, were affixed by them to the doors of the houses. These branches, originally intended as a charm to avert failure of the crops, were afterwards regarded as forming
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part of a supplicatory service. On the second day choruses of men and boys took part in musical contests, the prize for which was a tripod. Further, on this day adopted persons were solemnly received into the genos and phratria of their adoptive parents (see APATURA).


W. Mannhardt, Antike Wald- und Feldkultur (2nd ed. by W. Heuschkel, 1904—5).

THARRAWADDY, a town and district in the Pegu division of Lower Burma. The town has a station on the railway, 68 m. N.W. from Rangoon. Pop. (1901) 1643. The district has an area of 2851 sq. m. The Pegu Yoma range separates it from Toungoo district, and forms the water-parting between the rivers Irrawaddy and Sittang; there are also many small elevations. The Irrawaddy is the principal navigable river. Another important river is the Hlaing, which runs through the district from north to south, receiving from the east, through numerous channels, the drainage of the Pegu Yoma Mountains, which fertilizes the plain on its eastern bank. There are teak forests and fuel reserves, covering an area of 732 sq. m. Among the wild animals found in the mountains are elephant, rhinoceros, bison and various kinds of feathered game. The rainfall in 1905 was 91-63 in. Pop. (1901) 905,570, showing an increase of 17 per cent. in the decade. The railway runs through the centre of the district, with ten stations. The chief towns are Gyobingauk (6076) and Thonze (6578). The staple crops are rice, but orchards and gardens are also common. The history of the district is identical with that of Hzenada (q.v.). Tharrawaddy was formed in 1878 out of that portion of Hzenada lying east of the Irrawaddy.

THARROS, an ancient town of Sardinia, situated on the west coast, on the narrow sandy isthmus of a peninsula at the north extremity of the Gulf of Oristano, now marked by the tower of S. Giovanni di Sinis. It was 12 m. W. of Othoca (Oristano) by the coast road, which went on northwest to Corsus (a milestone of 1 ft is given). In 3 Car. Insr. Ins. 1, 297, and Ins. 1, 396 it is given. In Car. Insr. Ins. 1, 415, and Ins. 1, 429, it is called "Turris in Sinis." It was of Phoenician origin, but continued to exist in Roman times, as the inscriptions show, though they give but little information (Mommsen in Car. Insr. Ins. 1, 832). It was destroyed by the Saracens in the 12th century. Scanty traces of Roman buildings may be seen, and an ancient road paved with large blocks of stone. A part of the site of the town is now invaded by the sea. The church of S. Giovanni di Sinis is a heavy building of the 8th (?) century A.D. originally cruciform, with a dome over the crossing; the transapse and dome are still preserved, but the nave with its two aisles is later. It is naturally built of materials from the old town. Close to it is a watch-tower and a spring of fresh water. The importance of Tharros may be inferred from the extent of its necropolis, which lies on the basaltic peninsula of S. Marco to the S.; on the summit of it are the remains of a nuraghe. Casual excavations are mentioned under the Spanish viceroy, but regular exploration only began in 1838, when the Roman tombs were examined. In 1850 Spano excavated many Phoenician tombs; they are rectangular or square chambers cut in the rock, measuring from 6 to 9 ft. each way, in which inhumation was the rule. The objects found—pottery, scarabs, beads, amulets, &c.—were of considerable interest. In 1872 Louis Veron opened fourteen tombs, and after that the whole countryside ransacked the necropolis, without any proper records or notes being taken, and with great damage to the objects found. Some of these objects are in the museum at Cagliari, others in private collections, and many scarabs are in the British Museum, all of which by the coins found with them are dated later than the Roman occupation (Catalogue of Gems, London, 1888, pp. 13 sqq.). In 1885—86 regular excavations were made, the results of which may be seen in the museum at Cagliari. One tomb contained some fine gold ornaments, with Roman coins of the 1st to 3rd century A.D. (F. Vivante in Notizie degli Scavi, 1886, 127; 1887, 46, 124). The objects, like those found at Sukis, show considerable traces of Egyptian influence, but are probably all of Phoenician importation—the theory of the existence of Egyptian colonies in Sardinia being quite inadmissible. Some 3 m. to the N. is the church of S. Salvatore, with underground rock-cut chambers below it, used as a baptistry (?) by the early Christians, though the walls are decorated with paintings of a decidedly pagan order.

THASOS, an island in the north of the Aegean Sea, off the coast of Thrace and the plain of the river Nestus (now the Kara-Su). The island was colonized at an early date by Phoenicians, attracted probably by its gold mines; they founded a temple of Heraclis, which still existed in the time of Herodotus. Thasus, son of Phoenix, is said to have been the leader of the Phoenicians, and to have given his name to the island. In 720 or 708 B.C. Thasos received a Greek colony from Paros. In a war which the Thracian colonists waged with the Saian, a Thracian tribe, against the Thasians, they were defeated by the Saian, who compelled them to give up their mines which had been more valuable than those on the island. From these sources the Thasians drew great wealth, their annual revenues amounting to 200 or even 300 talents. Herodotus, who visited Thasos, says that the best mines on the island were those which had been opened by the Phoenicians on the east side of the island facing Samothrace. The place was important during the Ionian revolt against Persia. After the capture of Miletus (494 B.C.) Histiaeus, the Ionian leader, landed siege to Thasos. The attack failed, but, warned by the danger, the Thasians employed their revenues to build war ships and strengthen their fortifications. This excited the suspicions of the Persians, and Darius compelled them to surrender their ships and pull down their walls. After the defeat of Xerxes the Thasians joined the Delian confederacy; but afterwards, on account of a difference about the mines and marts on the mainland, they revolted. The Athenians defeated them by sea, and, after a siege that lasted more than two years, took the capital, Thassos, probably in 463, and compelled the Thasians to destroy their walls, surrender their ships, pay an indemnity and an annual contribution (in this they was 33 talents, from the Greeks 25 talents), and resign their possessions on the mainland. In 417 B.C., at the time of the oligarchical revolution at Athens, Thasos again revolted from Athens and received a Lacedaemonian governor; but in 407 the partisans of Lacedaemon were expelled, and the Athenians under Thrasybulus were admitted. After the battle of Aegospotami (405 B.C.), Thasos again fell into the hands of the Lacedaemonians under Lysander who formed a decarchy there; but the Athenians must have recovered it, for it formed one of the subjects of dispute between them and Philip II. of Macedonia. In the embroilment between Philip III. of Macedonia and the Romans, Thasos submitted to Philip, but received its freedom at the hands of the Romans after the battle of Cynoscephalae (197 B.C.), and it was still a "free" state in the time of Pliny. After a period of Latin occupation, it was captured by the Turks in 1462; it was given by the Sultan Mahmoud II. to Mehmet Ali of Egypt, and still remains the property of the khedive. Thasos, the capital, stood on the north side of the island, and had two harbours, one of which was closed. Archilochus described Thasos as "an ass's backbone crowned with wild wood," and the description still suits the mountainous island with its forests of fir. The highest mountain, Ipsario, is 3428 ft. high. Besides its gold mines, the wine, nuts and marble of Thasos were well known in antiquity. The mines and marble quarries are no longer worked; and the chief exports are now fir timber for shipbuilding, olive oil, honey and wax. The imports consist of manufactured goods, beasts of burden and corn, for the island is too mountainous to grow enough corn for the inhabitants. The population, distributed in ten villages, is estimated at
The people are Greek Christians, and do not differ in appearance from the inhabitants of the other Greek islands. The villages are mostly situated at some distance from the sea; for the island suffered from pirates. Even in the early part of the 19th century sentinels stood on duty night and day, and at a signal of alarm the whole population, including the Turkish aga himself, used to hide in the woods.

For a description of the island and its remains of antiquity, see A. Conze, Reise auf den Inseln des thrakischen Meeres (Hanover, 1866). The island is fully described by J. H. Baker-Penoyre in "Journal of Hellenic Studies," xxix. (1909).

THATCH (O. E. thac) the word is common to many Teutonic languages in the sense of "roof," "cover"; cf. Du. dakk, Ger. Dach; from Du. dekken comes "deck"; the Indo-European root is stag, whence Gr. στέγη, roof, Lat. tegere, to cover; the French equivalent is chaume), the material employed sometimes for roofs in the place of tiles or slates; it consists of wheat straw, for which several layers are required, to the depth of from 12 to 14 in., or even extending to 18 in. Unthreshed straw is said to last from twenty-five to thirty years, and the layer of it employed, which is not marshalled, is allowed, and they constitute a durable thatch lasting from thirty to forty years or more. Thatched roofs are not now allowed in London or other towns and their vicinity, but if saturated with a solution of lime the thatch is said to be incombustible. It forms an extremely good roof, warm in winter and cool in summer.

THATON, a town and district in the Tenasserim division of Lower Burma. The town is situated below a hill range, 10 m. from the sea. It was formerly the capital of the Talay kingdom and a sea-port. Pop. (1901) 14,342. The district has an area of 1970 sq. m.; pop. (1901) 543,510, showing an increase of 29 per cent. in the decade. It was formerly a subdivision of Amherst district, but was formed in 1895 out of part of that and of Shweygin district, which has now ceased to exist. The staple crop is rice, but a good deal of tobacco also is grown. The railway from Pegu to Martaban, recently opened, passes through this district and is calculated to increase its prosperity and population.

THAXTER, CELIA (1836-1894), American poet, was born at Portsmouth, New Hampshire, on the 29th of June 1836. Her father, Thomas B. Lathig, betrothed himself with one of his associates in state politics, and retired about 1841 to the barren and isolated Isles of Shoals, ten miles off Portsmouth, where for about ten years he was keeper of the White Island lighthouse; and his daughter's girlhood was therefore spent in marine surroundings, which coloured the best of the verse she afterwards wrote. Her poems, mainly in lyrical form, deal with the beacon-light, the sea-storm, the glist of sails, the sand-piper, the flower among the rocks, &c., in characteristic and sympathetic fidelity. She also wrote prose sketches of life and scenery, Among the Isles of Shoals (1873); stories and poems for children and letters; besides a book about floriculture, An Island Garden (1894). In 1896 appeared a complete edition of her poems, edited by Sarah Orne Jewett. She married in 1831 Levi L. Thaxter (d. 1884), a devoted student of Robert Browning's poetry, and spent most of her life on Appledore, one of the Isles of Shoals, where she died on the 26th of August 1894. Her son Roland Thaxter (b. 1858), a well-known crypto- gamic botanist, became professor of botany at Harvard in 1891.

THAYER, ABBOTT HANSDON (1849- ), American artist, was born at Boston, Massachusetts, on the 12th of August 1849. He was a pupil of J. L. Gérôme at the Ecole des Beaux Arts, Paris, and became a member of the Society of American Artists (1879), of the National Academy of Design (1901), and of the Royal Academy of San Luca, Rome. As a painter of portraits, landscapes, animals and the ideal figure, he won high rank among American artists. Among his best-known pictures are, "Virgin Enthroned," "Caritas," "In Memoriam, Robert Louis Stevenson," and "Portrait of a Young Woman"; and he did some decorative work for the Walker Art Building, Bowdoin College, Maine. Thayer is also well known as a naturalist. He developed a theory of "protective coloration" in animals (see "Colours of Animals"), which has attracted considerable attention among naturalists. According to his theory, "animals are painted by nature darkest on those parts which tend to be most lighted by the sky's light, and vice versa"; and the earth-brown of the upper parts, bathed in sky-light, equals the skycolours of the belly, bathed in earth-yellow and shadow.

THAYER, JAMES BRADLEY (1831-1902), American legal writer and educationist, was born at Haverhill, Massachusetts, on the 13th of January 1831. He graduated at Harvard College in 1852, and at the Harvard Law School in 1856, in which year he was admitted to the bar of Suffolk county and began to practise in Boston. In 1873-83 he was Royall professor of law at Harvard; in 1883 he was transferred to the professorship which after 1893 was known as the Weld professorship and which he held until his death on the 14th of February 1902. He took an especial interest in the historical evolution of law. He wrote: The Origin and Scope of the American Doctrine of Constitutional Law (1883); Cases on Evidence (1892); Cases on Constitutional Law (1895); The Development of Trial by Jury (1896); A Preliminary Treatise on Evidence at the Common Law (1898), and a short life of John Marshall (1901); and edited the two volumes of Kendall's Law of Evidence (1884) and Jeremy Wright (1887), and A Westward Journey with Mr Emerson (1884).

THAYER, JOSEPH HENRY (1828-1901), American biblical scholar, was born at Boston on the 7th of November 1828. He studied at the Boston Latin School, and graduated at Harvard in 1850. Subsequently he studied theology at the Harvard Divinity School, and graduated at Andover Theological Seminary in 1857. He preached in Quincy, and in 1859-64 in Salem, Massachusetts, and in 1862-63 was chaplain of the 40th Massachusetts Volunteers. He was professor of sacred literature in Andover Seminary in 1864-82, and in 1884 succeeded Ezra Abbot as Bussey professor of New Testament criticism in the Harvard Divinity School. He died on the 26th of November 1901, soon after his resignation from the Bussey professorship. He was a member of the American Bible Review Committee and recording secretary of the New Testament company. His chief works were his translation of Grimm's Clavis Novi Testamenti (1887; revised 1889) as A Greek-English Lexicon of the New Testament, and his New Testament bibliography (1890).

THAYETMYO, a town and district in the Minbu division of Upper Burma. The town is situated on the right bank of the Irrawaddy, opposite Allamny. Pop. (1901) 15,824. The cantonment contains the wing of a British battalion and a native regiment. It enjoys a high reputation for healthiness. There is a special industry of silver work.

The district has an area of 4750 sq. m.; pop. (1901) 239,706, showing a decrease of 4 per cent. in the decade. The total rainfall in 1905 was 41-30 in. On the west is the Arakan Yoma range, and on the east the Pegu Yomas; and the face of the country, where it does not rise into mountains, is everywhere broken by low ranges of hills, many of which are barren and destitute of all vegetation. The greater part of the district is wooded, and the Yomas east and west are covered with forests, now mostly preserved. The chief river is the Irrawaddy, which traverses Thayetmyo from north to south. The drainage finds its way to the Irrawaddy by three main streams (the Pwone, Ma-h'tün and Ma-de) on the west, and by two (the Kyé-ni and Hput) on the east. Several salt and hot springs occur in many localities; petroleum is also found, and extensive lime quarries exist a few miles south of Thayetmyo. The principal wild animals are elephants, rhinoceroses, tigers, leopards, black bears and wild hog. Silver pheasants and partridges are found in large numbers, especially in the mountains. The chief products are rice, cotton, oil-seeds and tobacco; cutch is also very abundant, and the manufacture of the dyes-stuff is carried on extensively. Coal has been found in the district, and earth
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oil-wells exist, but neither coal nor oil has yet been extracted in any quantity. There are 403 sq. m. of reserved forest. Three oil-wells were sunk in 1883 at Pedaukip, but they were found unprofitable and abandoned.

On the annexation of Pegu by the British in 1852-53, Thayetmyo was formed into a subdivision of Province district; and in 1870 it was erected into a separate jurisdiction and placed under a deputy-commissioner. It was formerly in the Irrawaddy division of Lower Burma, but was transferred to Upper Burma for administrative purposes in 1896.

THEATRE (θεάτρον, "a place for seeing," from θεάω, to see), a building specially devised for dramatic representations. The drama arose from the choric dances in honour of Dionysus, which were held in a circular dancing-place (δρυγάρια, Lat. orchestra) in his precinct at the foot of the Acropolis at Athens. When the leader of the chorus held a dialogue with the remaining choreutae he mounted the table which stood beside the altar of Dionysus in the centre of the orchestra; but as the number of actors and the importance of the dialogue increased, it became necessary to erect a platform at the side of the dancing-place and a booth in which the performers could change their dresses and masks. At the same time temporary wooden stands (ἱππα) were set up for the spectators, who no longer ranged themselves around the whole ring, but only on the slope of the Acropolis, facing southward. We are told that the collapse of the ἱππα, in 449 B.C. led to the erection of a permanent theatre; this, however, was a stone building. Embankments were made for the support of the spectators' benches; the stage buildings were of wood, and, although some traces of a stone theatre belonging to the end of the 5th century have been pointed out, the "theatre of Dionysus," whose remains may still be seen (Pl. I. and II.), is in the main a work of the 4th century. It was completed soon after 340 B.C. under the administration of the statesman and financier Lycurgus. Alterations were made in the stage-buildings in the Hellenistic period, under Nero, and again in the 3rd century A.D. Although the prototype of Greek theatres, it is not the most perfectly preserved. Amongst those of purely Greek design the most typical is that of Epidaurus (Pl. I.), which was built in the latter part of the 4th century B.C. by Polyclitus the Younger. The largest known to Pausanias was that of Megalopolis, excavated by the British School at Athens in 1889-91, in which the stage buildings were replaced by the Thersilion, a large council-chamber. Others of importance for the study of the ancient theatre have been excavated at Delos, Eretria, Sicyon and Oropus. None of these, of course, is contemporary with the classical period of the Greek drama, and their stone stage-fronts belong to the Hellenistic period.

In Asia Minor we find a type of theatre (belonging to a somewhat later date) with a broader, lower and deeper stage; and the Roman theatre (see below) carries these changes still further. Before discussing their significance it will be best to describe the parts of the ancient theatre, the fullest account of which is to be found in the fifth book of Vitruvius (written in the Augustan period). Its three main divisions were the auditorium (Lat. cavea; it had no technical name in Greek), the orchestra, and the stage buildings (ἐσχήδω, literally "tent" or "booth" Lat. scena). As the orchestra was the germ of the theatre, so it determined its shape, and in the Greek theatre preserved its circular form in many instances (as at Epidaurus). In the scheme of proportions given by Vitruvius, however (see fig. 1, which carries its own explanation), a segment (ἀγγείον, prosenium) was cut off by the stage-front (προκρίνων, prosenium). The auditorium was divided by flights of seats into wedge-shaped blocks (εσχήδων, κεντρα) and also longitudinally by a gangway (δικόνων, προκριατίς). In Greece the slope of a hill was always chosen for the auditorium and furnished with stone seats in tiers like steps. The slope of the Acropolis faces south, which (as Vitruvius points out) was the worst aspect for the spectators; but this was unavoidable for religious reasons, since the performances had to be held in the precinct of Dionysus. At Athens the inner boundary was a semicircle with the ends prolonged in parallel straight lines, which gave the spectators in the wings a better view of the stage than that obtainable in those theatres where (according to the Vitruvian rule) the boundary was segmental. At Epidaurus

**FIG. 2.**

From Dörpfeld and Reichel, Das griechische Theater.

- a, double western wall.
- b, single wall.
- c, walls terminating wings of auditorium.
- d, e, diazoma.
- f, g, western boundary wall.
- h, h', wall of Neronian stage.
- i, fragment 5th-century orchestra.
- j, k, ancient masonry (?) of supporting walls.
- n, old stage buildings.
- o, Stone prosenium (1st or 2nd century B.C.)
- p, foundations of Neronian side wings.
- q, r, fragments 5th-century orchestra.
- s, 4th-century portico.
- t, old Dionysus temple.

A compromise was effected by prolonging the ends of the semicircle as segments of a curve with a longer radius. The best seats were in the lowest row; at Athens this was formed by a series of marble thrones assigned to various priests or officials whose titles may be read on those (60 out of 67) which are now preserved. The priest of Dionysus occupied the central throne. In some theatres benches with backs took the place of separate thrones. The right of sitting in reserved places was called ἀγγείον.
THEATRE

...imply according to Pliny, whose account is the only one in existence. The orchestra was of course necessary to the natural hill-slope of Greek theatres. The Roman theatre thus became an organic whole; the auditorium and stage-buildings were structurally connected, and the orchestra was entered from the wings, not by open passages (παράθεσις) as in Greece, but by vaulted corridors. The orchestra was no longer used for the performances (whether dramatic, musical or merely spectacular), but was reserved for senators and other persons of distinction. Hence (as Vitruvius points out) arose the necessity for lowering and enlarging the stage. It is hard to say when this change was made or at what date it was first introduced into Italy (if it did not originate in the west). The larger of the two theatres at Pompeii dates from the Hellenistic period, but was thrice reconstructed, and it is not clear to what date we are to assign the low stage of Roman pattern; perhaps it belongs to the 1st century B.C. The theatre of the Roman colony of Pompeii founded by Sulla (B.C. 80). The theatre of Pompeii (see below) is said by Plutarch to have been copied from that of Mytilene, which suggests that the Roman theatre was derived from a late Greek model; and this is made probable by the existence of transitional forms.

During the Republican period the erection of permanent theatres with seats for the spectators was thought to savour of Greek luxury and to be unworthy of the stern simplicity of the Roman citizens. Thus in 134 B.C. Scipio Nasica induced the senate to demolish the first stone theatre which had been begun by C. Cassius Longinus ("tuanquam intutile et nocturnum publicus moribus," Liv. Epit. 48). Even in 55 B.C., when Pompey began the theatre of which remains still exist in Rome, he thought it wise to place a shrine to Venus Victrix at the top of the cavea, as a sort of excuse for having stone seats below it— the seats theoretically serving as steps to reach the temple. This theatre, which was completed in 52 B.C., is spoken of by Vitruvius as "the stone theatre," par excellence: it is said by Pliny to have held 40,000 people. It was also used as an amphitheatre for the bloody shows in which the Romans took greater pleasure than in the purer intellectual enjoyment of the drama. At its inauguration 500 lions and 20 elephants were killed by gladiators. Near it two other theatres were erected, one begun by Julius Caesar and finished by Augustus in 13 B.C., under the name of his nephew Marcellus, and another built about the same date by Cornelius Balbus (Suet. Aug. 39; Pliny, H. N. xxxvi. 59). Scanty remains exist of this last theatre, but the ruins of the theatre of Marcellus are among the most imposing of the buildings of ancient Rome.

A long account is given by Pliny (H. N. xxxvi. 5 and 114) of one of the most magnificent temporary theatre built by the aedile M. Aemilius Scaurus in 58 B.C. It is said to have held the incredible number of 80,000 people, and was a work of the most costly splendour. Still less credible is the account which Pliny gives (H. N. xxxvi. 176) of two wooden theatres built by C. Curio in 50 B.C., which were made to revolve on pivots, so that the two together could form an amphitheatre in the afternoon, after having been used as two separate theatres in the morning.

All Roman provincial towns of any importance possessed at least one theatre; many of these are partly preserved. On

1 Huelsen has shown that this statement is exaggerated, and estimates the number of spectators at 9000 to 10,000.
2 According to Livy (xl. 51), the theatre of Marcellus was built on the site of an earlier one erected by Aemilius Lepidus.

Fig. 3.—Diagram showing the principle on which the Roman theatre was planned according to Vitruvius.
EPIDAURUS, THE THEATRE FROM THE WEST.

ATHENS, THE THEATRE OF DIONYSUS FROM THE ACROPOLIS.
PLATE II.

THEATRE

ATHENS, PRINCIPAL SEATS IN THE THEATRE OF DIONYSUS.

ASPENDUS, THE STAGE WALL.

INTERIOR OF THEATRE, ORANGE.
Pl. II. will be found reproductions of two of the most important—that of Aspendus in Pamphyllia, which illustrates the Eastern type showing Hellenistic influence, and that of Acharnai (Orange) in South Gaul. Covered theatres were sometimes built, whether on account of climatic conditions (as at Aosta) or more commonly for musical performances. These latter were generally called Odeon (Gr. ὀδέαω, a place for singing). The best preserved is the Odeum of Herodes Atticus, at the south-west angle of the Athenian Acropolis, which has a semicircular orchestra. It was built in the reign of Hadrian by Herodes Atticus, a wealthy Greek, who spent enormous sums in beautifying the city of Athens, in honour of his wife Regilla. Its cavea, which is excavated in the rock, held about 6000 people; it was connected with the great Dionysiac theatre by a long and lofty passageway. This, which it is probable remains still exist, probably a late restoration of the stoa built by Eumenes II. of Pergamum. It was also a common practice to build a small covered theatre in the neighbourhood of an open one, where performances might take place in bad weather. We have an example of this at Pompeii. The Romans used scenery and stage effects of more elaboration than was the custom in Greece. Vitruvius (iii. 7) mentions three sorts of movable scenery:—(1) for the tragic drama, façades with columns representing public buildings; (2) for comic plays, private houses with practicable windows and balconies; and (3) for the satyrlic drama, rustic scenes, with mountains, caverns and trees.

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The Modern Theatre

During the middle ages miracle plays with sacred scenes were the favourite kind of drama; no special buildings were erected for these, as they were represented either in churches or in temporary booths. In the 16th century the revival of the secular drama, which was so important a part of the literature of England, was carried on in tents, wooden sheds, or courtyards of inns, mostly by strolling actors of a very low class. It was not till towards the close of the century that a permanent building was constructed and licensed for dramatic representations, under the management of Shakespeare and Burbage. The first building specially erected in London for dramatic purposes was built in 1576–77 by the actor James Burbage. It was constructed of timber, and stood in Holywell Lane, Shoreditch, till 1598, when it was pulled down; it was known as "The Theatre" by excellence. Of almost equally early date was the "Curtain," theatre, also in Shoreditch; so called from the plot of ground, known as "The Curtain," on which it stood. It probably continued in use till the general closing of theatres by order of the parliament in 1642. The "Globe" theatre, famous for its association with Shakespeare, was built by James Burbage, who used the materials of "The Theatre," in the year 1599. Its site was in Southwark, in the Bankside, near the "Bear Gardens." It was an octagonal structure of wood, with lath and plaster between the main framework. It was burnt in 1613, rebuilt, and finally pulled down and its site built over in 1644. Its name was derived from its sign of Atlas supporting the globe. Near it were two less important theatres, "The Rose," opened in 1592 by Henslowe, and "The Swan" (see below), opened in 1598 and partly owned also by Henslowe; but the Globe, the latter was an octagonal wood-and-plaster building. The "Blackfriars" theatre, another of the Burbages' ventures, was built in 1596, near the old Dominican friary. The "Fortune" theatre was built by Edward Alleyn, the actor, in 1599, at a cost, including the site, of £1320. It stood between Whitecross Street and Golding Lane. It stood as late as 1819, when a drawing of it was given by Wilkinson (Londina illustrata, 1819). The "Red Bull" theatre was probably originally the galleryed court of an inn, which was adapted for dramatic purposes towards the close of Elizabeth's reign. Other early theatres were the "Hope," or "Paris Garden" theatre, the "Whitefriars" and the "Salisbury Court" theatres, and the "Newington" theatre. A curious panoramic view of London, engraved by Visscher in 1616, shows the Globe, the Hope and the Swan theatres.

The plan of the first English theatres appears to have had no connexion with those of classical times, as was the case in Italy: it was evidently produced in an almost accidental way by the early custom of erecting a temporary platform or stage in the middle of the open courtyard of an inn, in which the galleries all round the court formed boxes for the chief spectators, while the poorer part of the audience stood in the court on all sides of the central stage. Something similar to this arrangement, unsuitable though it now seems, was reproduced even in buildings, such as the Globe, the Fortune and the Swan, which were specially designed for the drama. In these and other early theatres there was a central platform for the stage, surrounded by seats except on one side, where there was a "green-room" or "tirenye-howe." The upper galleries or boxes completely surrounded the stage, even the space over the girders being occupied by boxes. This being the arrangement, it is easy to understand that stage pictures of the most cases, though not in all—the Fortune theatre, for example, was square. An interesting specification and contract for the building of the Fortune theatre (see below) is printed by Halliwell-Phillipps (op. cit. infra, p. 164). In all its details the Fortune is specified to be like the Globe, except that it is to be square in plan, and with timbers of heavier scantling. The walls are to be of wood and plaster, the roof tiled, with lead gutters, the stage of oak, with a "shadow" or cover over it, and the "tirenye-howe" to have glazed windows. Two sorts of cases are mentioned for scenery, in one of which the audience is to see "theatrical penny rooms." A woodcut showing this arrangement of the interior is given in a collection of plays edited by Kirkman in 1672. The vexed question of the construction of these theatres has been much discussed in recent years. In 1888 a drawing of the Swan theatre (fig. 4), apparently copied from a rough drawing in a London letter from the traveller Johannes de Witt, was discovered by Dr Karl Gaedertz in a manuscript volume in the Utrecht University library, consisting of the commonplace book of Arend van Buchell (1565–1641). While undoubtedly authentic, and probably broadly accurate, this copy of a sketch can be regarded, however, as giving the regular or typical plan of the contemporary theatre, as in some respects it does not fulfil the known conditions of the stage. What that typical plan was, if (as is probable) one actually existed, has led to much learned conjecture and great difference of opinion as regards the details required by the interpretation of contemporary stage directions on the necessities of the action in contemporary drama. The ingenious reconstruction (fig. 5), drawn by W. H. Godfrey in 1907, the Fortune theatre, following the builder's specifications, appears to approach very nearly to satisfying all the requirements. See "The Elizabethan Stage," in the Quarterly Review (London, April 1908).

In the 16th and 17th centuries a favourite kind of theatrical representation was in the form of "masques," with processions of grotesquely attired actors and temporary scenic effects of great splendour and mechanical ingenuity. In the reigns of James I.
and Charles I., Ben Jonson and the architect Inigo Jones worked together in the production of these "masques," Jonson writing the words and Inigo Jones devising the scenic effects, the latter being very costly and complicated, with gorgeous buildings, landscapes, and clouds or mountains, which opened to display mimic deities, thrown into relief by coloured lights. These masques were a form of opera, in which Ben Jonson's words were set to music. Ben Jonson received no more for his libretto than Inigo Jones did for his scenic devices, and was not unnaturally annoyed at the secondary place which he was made to occupy; he therefore revenged himself by writing severe satires on Inigo Jones and the system which placed the literary and mechanical parts of the opera on the same footing. In an autograph MS. which still exists this satirical line occurs—"Painting and carpentry are the soul of masque" (see Cunningham, Life of Inigo Jones, London, 1848).

In Italy, during the 16th century, the drama occupied a more important position, and several theatres were erected, professedly on the model of the classic theatre of Vitruvius. One of these, the Teatro Olimpico at Vicenza, still exists; it was designed by Palladio, but was not completed till 1584, four years after his death. It has an architectural scena, with various orders of columns, rows of statues in niches, and the three doors of the classic theatre; but the whole is painted with strong perspective effects which are very unclassical in spirit. Scamozzi, Palladio's pupil, who completed the Teatro Olimpico, built another pseudo-classical theatre in 1588 at Sabbionetta for the duke Vespasiano Gonzaga, but this does not now exist.

In France the miracle play developed into the secular drama rather earlier than in England. In the reign of Louis XI., about 1467, the "Brothers of the Passion" had a theatre which was partly religious and partly satirical. In the 16th century Catherine de' Medici is said to have spent incredible sums on the dresses and scenery for the representation of the Italian ballet; and in the middle of the 17th century the regular opera was introduced at Paris.

At the end of the 18th century the theatres of San Carlo at Naples, La Scala at Milan, and La Fenice at Venice were the finest in Europe; all these were rebuilt in the 19th century,

![Fig. 5.—The Fortune Theatre; restoration of Walter H. Godfrey.](image)

but have been eclipsed by the later theatres of London, Paris, St. Petersburg and other great cities of Europe and America, both in size and architectural splendour.

**Authorities.**—Much valuable information about the early theatres of London is given by Wilkinson, Londina illustrata (1819), in which are engravings of some of them. See also Collier, Hist. of Dramatic Poetry (1879); Halliwell-Phillips, Life of Shakespeare (1883); R. Lowe, Life of T. Betterton; Malone, History of the Stage (1790), republished by Boswell in 1821; the publications of the New Shakespeare Society; the Ninth Report of the Historical MSS. Commission; and a series of articles on early London theatres, by T. F. Ordish, in The Antiquary, vols. xi., xii., and xiv. (1885-86).

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**Modern Stage Mechanism.**

A movement known as "Stage Reform" originated in Austria about 1880, with the primary object of encouraging the greatest possible imitation of nature in the presentation of opera and drama. The rudiments of art as understood by painters, sculptors, architects and the cultured public of the day were to be applied to the stage, and a true scenic art was to take the place of the nondescript mounting previously given. To facilitate the efforts of the scenic artist, the fullest application of modern science, notably of mechanics and hydraulics, and the introduction of up-to-date methods of lighting were considered essential. The numerous fatal conflagrations which had originated on the stage caused the question of protection from fire to be closely associated with this movement,
and the enterprise made great headway, more particularly on account of the protective measures against fire proposed soon after the burning of the old Ring Theatre at Vienna. The movement gradually developed throughout Austria and Germany and spread beyond the frontiers of these countries. Concurrently, independent movements originated elsewhere, and from 1883 to 1895 a transitional period may be said to have existed for the stage, both in Europe and in the United States, but by the close of the 19th century the necessity for reform was recognized in every country. During the transition time various unsatisfactory experiments were made, some of the boldest experiments proving costly failures, yet serving, because of such features as were valuable, as a basis for further developments. Great Britain and France were almost the last countries touched by this movement, although in England throughout the 'nineties there was considerable improvement in actual scenic art and stage-mounting, as far as this could be brought about without the aid of improved stage mechanism.

Among those primarily responsible for this new epoch in scenic art in Great Britain were Sir Henry Irving and Mr Beerbohm Tree, both actor-managers, Mr Hubert von Herkomer, R.A., Sir L. Alma-Tadema, R.A., and Mr Edwin O. Sachs, architect. Although almost last in the application of stage reform in its best sense, England really completed the experimental period with the modernization of the Royal Opera House, Covent Garden, where, by the opening of the season of 1902, the directorate were provided with the latest improvements of mechanical skill for the almost complete re-equipment of stage scenery. This work of remodelling was carried out by the Grand Opera Syndicate, with Mr Edwin O. Sachs as technical adviser and architect. Modern mechanism has also been applied at the Apollo Theatre, London, where, however, the stage equipment was bodily imported from the Continent and does not include any mechanically or electrically driven parts, manual labour alone being used. The stage mechanism which was employed in the equipment of the Royal Opera House, Covent Garden, embodies the Sachs system of dividing the stage-floor into a few large sections and working them with the aid of electrical power; the Brandt system of counter-weighting for the suspension of all scenery from above, the application of light in four colours by electricity, and the designing of all scenery to accord as much as possible with nature, the whole mounting being built up on the basis of a flat stage as distinct from the sloping stage of old.

The classification of stages generally, both home and foreign, whether for the production of opera or plays, should be made as follows: wood stages, wood and iron stages, and iron stages, with subdivisions according to the power chiefly employed in working the appliances. These subsections are: manual labour, hydraulics and electricity. Owing to the almost entire absence of steam for motor power in connexion with stage machinery, a separate subdivision for appliances where steam is employed is not required. With the wood stage and the wood and iron stage manual labour alone is utilized. But in the iron stage manual labour, hydraulic power and electric power are either used individually, or a combination of any two or three of these classes is applied. The first series of stages built in accordance with the principles of Stage Reform was erected on what was termed the "asphaleia" system, in which direct hydraulic power was utilized throughout. The stage-floor is divided into innumerable small sections supported on rams (some working telescopically), whilst everything suspended from above is also worked mechanically by hydraulic power. Nearly every country, and the Budapest Opera House and the Municipal Theatre at Wiesbaden, used the "asphaleia" system, showed somewhat larger sections. These are suspended by cables and worked indirectly by small hydraulic rams placed at the side, whilst the whole of the top work is manipulated by manual labour with the partial assistance of counter-weights. The next type is the Brandt type, where the number of divisions of the stage is further reduced to a few medium-sized sections, worked by means of a combination of a central hydraulic ram and suspended cables duly counter-weighted. The top work in this case is entirely counter-weighted, and requires the least possible manual labour for manipulation. An example will be found at the Wiesbaden Court Theatre. We next have the Sachs system, where electric power is substituted for hydraulic power, the number of stage divisions limited to several large sections, suspended on cables partly counter-weighted and partly worked by electric motors, while the whole of the top work is balanced on a system similar to that of the Brandt, with intermediate electric motors for the manipulation of particularly heavy loads. It is this last system that has been adopted at the Covent Garden Opera House, with the modification that the top work is entirely operated on the latest development of the Brandt system of manual labour and counter-weights. Another example of the Sachs system, as far as individual stage sections are concerned, will be found in a portion of the Theatre Royal, Drury Lane.

Regarding the question of expense and practicability, the hydraulic system has generally been found to be expensive and impracticable. The system of the Court Theatre, Vienna, though practicable, is costly both in capital and annual outlay. The Brandt method of equipping the upper stage mechanism has been found particularly suitable for medium-sized theatres, and not expensive. The Sachs system has been found practicable, of moderate initial cost and minimum annual outlay. The advantages of electricity over hydraulic power have been most marked both in capital and in annual expense. There is of course a far greater initial outlay required to-day than with the wooden stages of old but the saving in staff and wear and tear of the scenery, and the absence of expensive temporary make-shifts, repairs and reinstatements, compensate for this by a material reduction of annual charges. It is known as a fact that upon an overhaul of the Covent Garden equipment being ordered after five years' running, the contractors could not find anything to do in the way of repairs or reinstatements. The stage carpenter has long reigned supreme in England and France, although in England there are already one or two notable exceptions of men who are advancing to the position of engineers rather than carpenters. In Germany and Austria the stage carpenter is already being replaced in most theatres by men of engineering or technical training, as the more complex arrangements of a modern stage demand intelligent and careful control. It is merely a question of time for the engineer to obtain general control in these matters.

Regarding the actual designing and painting of the scenery, the English scene-painter may now be considered in advance of his Continental and American colleagues, although the productions of some notable ateliers at Vienna and Munich run the English scene-painter's work very closely. In 1890 Vienna was in advance of England in scene-painting, but the English scene-painters have since then rapidly come to the front, and it is to be anticipated that it will never again be necessary to import scenery from Austria, as has been the case, both at the Theatre Royal, Drury Lane, and at the Royal Opera House, Covent Garden. As a matter of fact, scenery from Covent Garden and Drury Lane is already exported to the United States. The position of the scene-painter is particularly difficult, inasmuch as whilst artistic temperament and thorough knowledge of art are essential for the practice of his vocation, it is equally essential that he should be thoroughly practical, and to a considerable extent a mechanical artist. In recognition among artists and there is unfortunately a tendency to depreciate his work.

During the period of interregnum in stage reform there appeared a number of faddist inventions which, while creating public interest, cannot be considered of lasting practical utility. Thus in the United States an attempt was made to have a large platform constructed like a lift, bodily rising and falling, with three different tiers or stages on which scenery could be mounted at different levels
and then raised or lowered into position. Again, at Munich, a scheme of turn-tables based on the Japanese revolving stage was put forward, but this can only be looked upon as an interesting experiment of little practical value.

Numerous methods of illuminating the stage have similarly been attempted, with the aid of search-lights, and prosenium lights, or by the absence of foot-lights, and the like, but the general method of lighting the stage from the top with battens, from the side with wing-ladders, and from below with foot-lights, if carefully regulated and skilfully handled, produces excellent results. The lighting arrangements as practised at the Royal Opera House, Covent Garden, in which building the lighting engineer is Mr. Crawshaw and the consulting engineer for the lighting installation was Mr. Bowles, leave nothing to be desired from an artist's point of view. The great difficulty of the light coming too strongly from below, i.e., from the foot-lights, can be overcome by the regulation and colouring of the lights.

As examples of modern mechanism, two photographs have been reproduced showing views of the electrical stage "bridges" of the Royal Opera House, Covent Garden, and of the Theatre Royal, Drury Lane, respectively, both on the Sachs system (see Pl. III.). A small general plan and section of the Covent Garden stage are also shown (see fig. 6), and another illustration (see Pl. IV.) presents the "gridiron" at Covent Garden on the Brandt system.

The following is a detailed description of the Covent Garden installation.

The stage may be described as consisting of a series of six horizontal sections running parallel with the curtain line from front to back, each section being 8 ft. wide, and the whole being followed by a large back or rear stage. The first section contains nothing but a plain "carpet cut," and openings to take the old-fashioned "grave" trap, "star" trap, or other similar contrivances. The second and third sections comprise large bridges, which can be raised 6 ft. above the stage or lowered 8 ft. below the stage, constructed in two levels, on the lower level of which appliances can be installed for the purpose of raising minor platforms above stage level or sinking traps and the like. The fourth, fifth and sixth sections comprise large bridges running right across the stage front, which can be raised 5 ft. above the stage or lowered 8 ft. below it. The back stage has no openings or mechanism beyond certain trap-doors to a scenery store. An electrical mechanism for raising and lowering scenery for storage purposes. Between the various sections of the stage, long longitudinal flaps, 2 ft. wide, are formed, which can be easily opened to allow scenery to pass in and through the stage, or be lowered below for transformation scenes and the like.

Each section is equipped with what is termed a "chariot," to hold "wing" lights placed on so-called wing ladders. All the electrical bridges are worked from the "mezzanine" level and from ordinary switch-boards, and can be raised and lowered at various speeds, and take loads up to 2 tons. They can be moved without vibration or noise at a cost of about 4d. for power on a full rise when loaded.

Above the stage level each section has its series of lines to take cloths, borders, &c. Each section has a battery, from which the electric battens are suspended, and has also a large wooden lattice girder, from which heavy pieces of scenery can be hung. There are, on the average, about ten lines for ordinary battens, a girder batten, and a light batten to each section; besides these lines, there are the equipments of flying apparatus and the like, whilst in front there are, of course, the necessary lines for tableaux curtains, act-drops and draperies. Everything that is suspended from above can be worked at stage level or at either of the gallery levels, every scene being counter-weighted to a nicety, so that one man can easily handle it. No mechanical contrivance is required, and in practice quite a number of scenes can be rapidly changed in a very short time. Throughout the structure and mechanism steel has been used, with iron pulleys and wire cable; and the inflammable materials have been abolished to the flooring of the gridiron and galleries and the hardwood flooring of the stage and mezzanine. In other words, an absolute minimum of inflammable material replaces what was almost a maximum; and seeing that the electric light has been installed, the risk of an outbreak of fire or its spread has been materially reduced.

No mention of stage mechanism would be complete unless mention were made of the necessity of providing a carefully made and easily worked fire-resisting curtain of substantial but light construction. On the Continent metal curtains are favoured. In England the double asbestos curtain is more common. The London County Council prefer a steel framing with asbestos wire-wove cloth on both faces, the intervening space being filled with slag wool, well rammed and packed. Such curtains are somewhat heavy and require counter-weighting to a nicety, but if well made and fitted may be deemed satisfactory. It is advisable to fit drenchers above fire-resisting curtains and to arrange the working of the curtain that it can be lowered from four points, i.e., from both sides of the stage, from the prompt side flies and from the stage door. According to the Lord Chamberlain's rules, fire resisting curtains must be lowered once during a performance. This is a wise measure for testing the efficiency of the appliances.

Authors.—Modern Opera Houses and Theatres, 3 vols., grand folio, by Edwin O. Sachs (1896-99); Stage Construction, 1 vol., by Edwin O. Sachs (1896); Mechanical Contrivances and Appliances on Stage Mechanism, by Edwin O. Sachs (1895-97); Fires and Public Entertainments, 1 vol., quarto, by Edwin O. Sachs (1897); Le Théâtre, 1 vol., oct., by Charles Garnier (1871); Les Théâtres...
SACHS' ELECTRICAL STAGE "BRIDGES," ROYAL OPERA HOUSE, COVENT GARDEN.

SACHS' ELECTRICAL STAGE "BRIDGES," THEATRE ROYAL, DRURY LANE.
"Spectacle"

The appeal to the eye has been the essential feature of dramatic production in its many stages of development from the earliest times of the miracle plays and "moralties," mummers and morris-dancers, down through the centuries, in the form of masques and ballets, to the luxuriance of scenic and costume display that is lavished on the latest forms of theatrical entertainment. Considering the enormous advance that has been made in mechanical appliances, more especially in the increased powers of illumination supplied by gas and electricity, as compared with oil and candles, we must acknowledge that the artistic achievement of spectacle has barely kept pace with the times. If we may credit the veracity of contemporary chroniclers, the most elaborate effects and illusions were successfully attempted in the various courtly entertainments that are recorded under the Tudor and Stuart dynasties, and found perhaps their most sumptuous expression in the courts of Louis XIV. and Louis XV. It would be a difficult task for the most experienced of modern stage managers to rival the splendours of apparel and the ingenious devices that were exploited in increasing magnificence during successive periods, as described by Froissart, Holinshed, Cavendish, Stow, Pepys and other writers. The sums expended on these entertainments were prodigious, and a perusal of the extraordinarily detailed descriptions of such lavishly appointed masques as those designed by Inigo Jones in particular renders credible the statement that a certain masque presented before Charles I. at the Inns of Court in 1633 cost £21,000. Spectacle in its earlier phases appears to have existed chiefly in connexion with court and civic ceremonial; as evidenced in the wonderful pageantry of the Field of Cloth of Gold; in such princely entertainments as the Revels at Kenilworth, when the Earl of Leicester welcomed Queen Elizabeth to his magnificent fêtes; and in the blend of the imaginings of Ben Jonson, decorated by Inigo Jones, such as the Inns of Court masque, already cited. The scenic effects and illusions which had evidently been brought to great perfection in these masques were not devoted to the service of the drama in the public theatres until Davenant introduced them at the period of the Restoration, although simple scenery, probably mere background "cloths," had been seen on the stage as early as 1605. The built-up stage pictures, familiar to us as "set-scenes," are said to owe their origin to Philip James de Loutherbourg, R.A., and to have been first used in 1777; but it is probable that some such building as that anticipated by the plans of the sensations had not already enjoyed a term of popularity in view of the contemporary paintings and engravings of the epoch of Louis XIV., who was himself not averse from appearing (in 1653) as "Le Roi Soleil" in the midst of an entourage combining much that was artistic and fanciful with the most pompous and most absurd incongruities of character and costume. A greater measure of elegance and refinement distinguished the spectacles of the reign of Louis XV., inspired by the delicate art of Watteau, Boucher and Lancret, and preserved for our delectation in their delightful canvases. Under the French Revolution the spectacular ballet lost much of its prestige. Only the few scenic features were for a time principally associated with the fêtes inaugurated by the Republic and presented in the classic costume, which the severity of the new régime adopted as a reaction, or as a protest against the frivolities and furbelows of the obliterated monarchy. The Festival of the Supreme Being, decreed by the National Convention, designed by David and conducted by Robespierre, was perhaps the most impressive spectacle of the close of the 18th century.

The 19th century saw spectacle devoted almost exclusively to theatrical entertainment. In London, melodrama, both of the grand and comic, clothed itself with the most elaborate picturesque display. Among the earlier, its chief exponents were the Adelphi and Astley's, was first illuminated by gas in 1817-18, the Cataract of the Ganges, with its cascade of real water and its prancing steeds, made a great sensation in 1823, and the same stage in 1842, under Macready's management, displayed the "moving wave" effect in the Sicilian views, painted by William Clarkson Stanfield for Acts and Galatea. The Lyceum Theatre from 1847 to 1855 introduced a long series of elegant extravaganza from the pen of J. R. Planché, elaborately illustrated tableaux of extraordinary variety. The Golden Branch, the King of the Peacocks and the Island of Washington were the most remarkable of these productions, and were noteworthy as originating the fantastic fairy pictures that became known as "transformation scenes," and were copied and popularized in all directions. Beverly's skilful brush was at a later date employed at Drury Lane to enhance the attractions of a succession of spectacular versions of Sir Walter Scott's novels, Amy Robsart (1870), Rob Roy (with a beautiful panorama of the Rhine scenery), Rebecca, England in the Days of Charles II., and others. Later still, under the régime of Sir Henry Irving, the spectacle at Drury Lane assumed even more costly proportions. In modern melodramas, representing well-known localities with extraordinary fidelity and all kinds of disasters from earthquakes to avalanches, have been alternated with sumptuously mounted pantomimes (so-called), in which the nominal fairy-tales were almost smothered by the paraphernalia of scenery and costume. It is remarkable that, for a "run" of ten weeks only, such a sum as £15,000 each can have been profitably expended on more than one of these productions.

London playgoers will recall the processional glories of A Dream of Fair Women, designed by Alfred Thompson; The Land of Fairy Tales, with the Slide and the Mirror; The Paradise of the Birds (Babes in the Wood), and The Gods and Goddesses of Olympus (Jack and the Beanstalk), for which Mr Wil helm was responsible. The Armada, a historical drama (1888), also deserves to be remembered for its spectacular features. In addition to the names of Clarkson Stanfield and Beverly, already cited as masters of scenic art, it must not be forgotten that David Roberts was also devoted to the embellishment of the stage; and the names of Grieve, the Tellbins (father and son), Hawes Craven, and J. Harker have in successive years carried on the best traditions of the art. Alfred Thompson was one of the first to revive the conventionalities of fanciful stage costume, and to impart a French lightness of touch and delicacy of colour. A ballet, Yolande, which he dressed for the Alhambra in 'the sixties, was the first Japanese spectacle to grace the English stage; and Sir Henry was also mainly responsible for the attractions of Babu and Bijou, which cost upwards of £11,000 at Covent Garden Theatre in 1872, and was at the time considered to have surpassed all former spectacle accomplishments. It achieved, however, merely a succès d'estime, and has bequeathed to a later generation only the recollections of its Spring "choir of boys, and of the brilliant dances, Henriette d'Hervilly (who delighted the great days of the ballet, when Taglioni, Cerito, Elsler, Duverney and other "Déeses de la Danse," appeared under Lumley's management at the old Her Majesty's Theatre in the Haymarket. Since the memorable season of 1884-5, when Sir Henry Irving, Sir John Philip and the Spaister and spectacle have been honourably associated. Charles Kean's revivals at the Princess's Theatre (1850-59) deservedly attracted considerable attention for the splendour and accuracy of their architecture. Byron's Sardanapalus was also a triumph for the same management in 1853; and the same theatre three
decades later witnessed the production (December 1883) by Wilson Barrett, in the rebuilt Haymarket Theatre, of The Statues and the Man, a trashy modern melodrama, and a sensation. It was promptly mounted so exquisitely as to gain Ruskin's enthusiastic praise. But undoubtedly the earliest noteworthy alliance of spectacle with Shakespeare was made by Sir Henry Irving at the Lyceum. The art of the producer had reached a peak by 1882, after a celebration of 12 years' production and artistic distinction to his productions. "Ravenswood" and the sumptuously presented 

Henry VIII., (1892) owed much to the co-operation of Mr. Arthur Cecil, and the rarest credit can be given to the collaboration of 

Mrs. Patrick Campbell and Coriolanus (1901), whilst Sir Edward Burne-Jones inspired the decoration of King Arthur (1895). In Tennyson's Cup (produced in January 1881) and in the beautiful revival of Romeo and Juliet, and Other Plays, at the Haymarket in 1894 (produced by Mr. Daly), Shakespeare's poetic drama were also finely illustrated by Mr. Beerbohm Tree, who secured Sir Lawrence Alma-Tadema's interest for Hypatia at the Haymarket, and Julius Caesar at the new His Majesty's; whilst for his later productions, King John, A Midsummer Night's Dream, Herod (by Stephen Phillips), Twelfth Night (1901), and such later plays as his revival of Antony and Cleopatra (1907), he was assisted by the designs of Percy Anderson, an artist who made his mark in the costume and scenery field as no other. The Theatres were attended by the 15th century dresses for the Beauty Stone. Spectacular features of exceptional refinement distinguished the pantomime of Cinderella, presented by Mr. Oscar Barrett at the Lyceum Theatre (1896) and produced by Mr. Daly. This production also enjoyed a prosperous season in New York.

The system of international exchange seems to hold good in stage spectacle as in other cases, and in return for English successes the American Enterprise's "Eliza Doolittle" and "Spain" were successfully produced in London. Other entertainments of a more absolutely spectacular order found acceptance in London. In conjunction with Barium and Bailey's Hippodrome, Mr. Kraly, the "show" of the day, produced a still more stupendous, fantastic and audacious entertainment the following season, Venit, designed by the same artist. A spectacle on these lines may be regarded as the outcome of such ballets as have long been popular on the continent of Europe—especially in Italy, where grace of movement and spontaneity of gesture are natural to the people, and greatly facilitate such an enterprise as the famous Excisior ballet of Manzotti, which lasted a whole evening, in several acts, and required the services of hundreds of figures. Excisior was originally produced at La Scala, Milan, in January 1881, and was subsequently given with great success at the Eden Theatre, Paris, in 1883. The revival of this ballet at the Empire Theatre, London, has been associated with some memorable triumphs of spectacle with which the name of Mr. Wilde was closely identified as designer. (C. Wl.)

**Law Relating to Theatres.**

It was not until comparatively late in Roman history that acting became a distinct calling. The troops of public actors (ministeria publica) were generally slaves, and their earnings enriched their masters more than themselves.

The regulation of the theatre by legislation (except as to structure, which belongs chiefly to the upper class, in Roman law, depended almost wholly upon constitutions of Theodosius and Valentinian, incorporated in the Theodosian Code (Tit. xxv, 5, 6, 7), and a century later to a large extent adopted by Justinian. In the end, it is an administrative law between the doctrines of Christianity and the old Roman love of public spectacles of all kinds. It deals less with theatrical representations proper than with gladiatorial contests and chariot races.

The first code ordained that the sadistic tendencies were to be made to serve the good of society and to be administered to actors save where death was imminent, and only on condition that the calling should be denounced in case of recovery. The death penalty was not to be imposed to the stage provided they lived an honest life. An actress was to be allowed to quit the stage in order to become a nun. There were also numerous sumptuary regulations as to the dress of actors. None of these laws, however, are as direct as those of the later Justinian, but what follows was incorporated in Cod. xi. 40 (De Spectaculis et Sceniciis), which consists entirely of extracts from the Theodosian Code of a very miscellaneous nature. Provision was made for the better regulation of the theatre's administration at certain periods, but only in the proscription of a theatre. A governor of a province was entitled to take the money raised for public games for the purpose of repairing the city walls, provided that he gave a receipt for them. Theatres were to be built or adopted for the public at the expense of the governor, and religious ceremonies were encouraged to build theatres (Dig. i. 10, 3). By Novell cxvii., it was grounded for divorce if a wife went to the theatre with her husband. No licence was required for the construction of the building committed to certain magistrates (Novell cxviii. 2).

**England.**—In England, as in other countries of western Europe, theatrical legislation was of comparatively recent introduction. Such legislation was unnecessary as long as the theatre was under the control of the Church and actors under its protection, the Church having turned to its own uses what it was powerless to prevent. The earliest regulations were therefore, as might be expected, made by the Church rather than by the state. The ecclesiastical ordinances were generally in opposition to the introduction of plays, sometimes even extending to the suppression of the act of playing, and at other times to the prescription of particular parts of the play, such as the necessity of adding religious materials, as well as provisions for the safety of the building and the audience (Tacitus, Anm. iv. 63; Leone Const. ii. 25). The seats were also protected by the building of the building committed to certain magistrates (Novel cxvii. 2).

The Reformation marks the period of transition from the ecclesiastical to the non-ecclesiastical authority over the drama. Precautions began to be taken by the crown and the legislature against the acting of unauthorized plays, by unauthorized persons, and in unauthorized places, and the acting of plays objectionable to the designation of churches, though they were sometimes extended to permitting attendance of the faithful as spectators at plays even of a harmless kind. Sacraments and Christian burial were denied by the canon law to actors, whose gains, said St Thomas, were acquired ex turpi causa, and who, if they exceeded what was proper, might be in mortal sin. It was a doubtful point as to whether spectators might not be in similar case. The same law forbade plays to be acted by the clergy, even under the plea of custom, as in Christmas week, and followed the code of Justinian in enjoining the clergy not to conspire with the actors or be present at plays (see Decretals, iii. 13, 15. De Vi de et Honestate Cleric. At least as varied as canon lxxxv. of the canons of the Church of England enacted that churchwardens were not to suffer plays in churches, chapels or churchyards. The latest occurrence of such a play seems to have been at Oxford in 1592.

The legislation refers to the period of transition from the ecclesiastical to the non-ecclesiastical authority over the drama. Precautions began to be taken by the crown and the legislature against the acting of unauthorized plays, by unauthorized persons, and in unauthorized places, and the acting of plays objectionable to the designation of churches, though they were sometimes extended to permitting attendance of the faithful as spectators at plays even of a harmless kind. The history of the legislation on this subject is very curious. An act of the year 1572 enacted that "all fencers, bearers, common players of interludes, and minstrels (not belonging to any baron of this realm, or to any other honourable person of greater degree), wandering abroad without the licence of two justices at the least, were subject to be grievously whipped and burned through the girtle of the right ear with a hot iron of any convenient weight," and authorized any person to be punished by 39 Eliz. c. 4, under which the punishment of the strolling player is less severe, and there is no mention of justices. The jurisdiction of justices over the theatre disappears from legislation.

1 The word ludi seems sometimes to include, sometimes to exclude, dramatic performances. Its meaning in a particular instance depends on the context.

2 If one may judge from Horace's line (Sat., i. 10, 38): Quae neque in aede somni certantia justica Tarpa.

3 A large number of such ordinances will be found cited in P. Codini, Opr. Roman., c. 22, De ludis dramaticis, et Spec. jact. ad monumenta mariana, De Spectaculis. They followed the almost unanimous condemnation by the Christian fathers. See, for example, Chrysostom, Contra Ludos et Thesaur.; Tertullian, De Spectaculis; Augustine, De Civ. Diet. i. 31, Confessions, ii. 2; Dill, Roman Society, pp. 47, 117.

4 For this reason it appears to have been the custom in France for noblemen to be married under the name of musicians. See Hist. parlementaire de la Bretagne, xvi. 38. The difficulties attending the burial of Molière are well known.
from that time until 1788. In 39 Eliz. c. 4 there is a remarkable exception in favour of persons licensed by Dutton of Dutton in Cheshire, in accordance with his claim to liberty and jurisdiction in Cheshire and Chester, established in favour of his ancestor by proceedings in quo warranto in 1499.1 The stricter wording of this act as to the licence seems to show that the licence had been abused, perhaps that in some cases privileges had been assumed without authority. In 14 Eliz. c. 30 the privileges of a player attached by service of a noble or licence from justices, in the later act only by service of a noble, and this was to be attested under his hand and arms. The spirit of the acts of Elizabeth frequently appears in later legislation, and the unauthorized player was a vagabond as late as the Vagrancy Act of 1744, which was law till 1824. He is not named in the Vagrancy Act of 1824. The Theatre Act of 1737 narrowed the definition of a player of interludes, for the purposes of punishment as a vagabond, to mean a person acting interludes, &c., in a place where he had no legal settlement. Before the Restoration there were privileged places as well as privileged persons, e.g. the court, the universities, and the inns of court. With the Restoration privilege became practically confined to the theatres in the possession of those companies (or their representatives) established by the letters patent of Charles II. in 1662. In spite of the patents other and unprivileged theatres gradually arose.2 In 1735 Sir John Barnard introduced a bill "to restrain the number of playhouses for playing of interludes, and for the better regulation of common players."3 On Walpole's wishing to add a clause giving parliament the privileges of a player attached by service of a noble or licence from justices, the mover withdrew the bill. In 1737 Walpole introduced a bill of his own for the same purpose, there being then six theatres in London. The immediate cause of the bill is said to have been the production of a political extravaganza of Fielding's, The Golden Rump. The bill passed, and the act of 10 Geo. II. c. 28 regulated the theatre for more than a century. Its effect was to make it impossible to establish any theatre except in the city of Westminster and in places where the king should in person reside, and during such residence only. The act did not confine the prerogative within the city of Westminster, but as a matter of policy it was not exercised in favour of the non-privileged theatres, except those where the "legitimate drama" was not performed. The legitimate drama was thus confined to Covent Garden, Drury Lane and the Haymarket from 1737 to 1843. In the provinces patent theatres were established at Bath by 8 Geo. III. c. 10, at Liverpool by 11 Geo. III. c. 16, and at Bristol by 18 Geo. III. c. 8, the act of 1737 being in each case repealed pro tanto. The acting of plays at the universities was forbidden by 10 Geo. II. c. 19. It is not a little remarkable that the universities, once possessing unusual dramatic privileges, should not only have lost those privileges, but have in addition become subject to special disabilities. The restrictions upon the drama were found very inconvenient in the large towns, especially in those which did not possess patent theatres. In one direction the difficulty was met by the lord chamberlain granting annual licences for performances of operas, pantomimes and other spectacles not regarded as legitimate drama. In another direction relief was given by the act of 1738 (28 Geo. III. c. 39), under which licences for occasional performances might be granted in general or quarter sessions for a period of not more than sixty days. The rights of patent theatres were preserved by the prohibition to grant such a licence to any theatre within eight miles of a patent theatre. During this period (1737–1843) there were several decisions of the courts which confirmed the operation of the act of 1737 as creating a monopoly. The exclusive rights of the patent theatres were also recognized in the Disorderly Houses Act, 1751, and in private acts dealing with Covent Garden and Drury Lane, and regulating the rights of parties, the application of charitable funds, &c. (see 16 Geo. III. cc. 13, 31; 50 Geo. III. c. cxcv.; 52 Geo. III. c. xix.; 1 Geo. IV. c. lx.). The results of theatrical monopoly were beneficial neither to the public nor to the monopolists themselves. In 1832 a select committee of the House of Commons recommended the legal recognition of "stage-right" and the abolition of theatrical monopoly. The recommendations of the report as to stage-right were carried out immediately by Bulwer Lytton's Act, 3 & 4 Will. IV. c. 15 (see COPYRIGHT). But it was not till eleven years later that the Theatres Act, 1843, was passed, a previous bill on the same lines having been rejected by the House of Lords. The act of 1843 inaugurated a more liberal policy, and there is now complete "free trade" in theatres, subject to the conditions imposed by the act. The growth of theatres since that time has been enormous. Nor does the extension seem to have been attended with the social dangers anticipated by some of the witnesses before the committee of 1832.

The suppression of objectionable plays was the ground of many early statutes and proclamations. While the religious drama was drying out, the theatre was used as a vehicle for enforcing religious and political views not always as orthodox as those of a miracle play. Thus the act of 34 & 35 Hen. VIII. c. 1 made it criminal to play in an interlude contrary to the orthodox faith and practice, or to have the books of that kind. In theatres seems to have been a crying evil of the time. Stephen Gosson attacked it as early as 1579 in his School of Abuse. The first business of the government of Edward VI. was to pass an act reciting that the most holy and blessed sacrament was named in plays by such vile and unseemly words as Christian ears did abhor to hear rehearsed, and infecting fine and imprisonment upon any person advisedly contemning, despising or reviling the said most blessed sacrament (1 Edw. VI. c. 1). A proclamation of the same king in 1549 forbade the acting of interludes in English on account of their dealing with sacred subjects. In 1556 the council called attention to certain lewd persons in the livery of Sir F. Leke representing plays and interludes reflecting upon the queen and her consort and the formalities of the mass. The same queen forbade the recurrence of such a representation as the mask given by Sir Thomas Pope in honour of the Princess Elizabeth at Hatfield, for she "misliked these follies." By the Act of Uniformity, 1 Eliz. c. 2, it was made an offence punishable by a fine of a hundred marks to speak anything in the derogation, degrading or despising of the Book of Common Prayer in any interludes or plays. In 1605 an Act to restrain the Abuses of Players 4 made it an offence punishable by a fine of £10 to jestingly or profanely speak or use certain sacred names in any stage play, interlude, show, may-game or pageant (3 Jac. I. c. 21). In consequence of the appearance of players in the characters of the king of Spain and of Condor, an ordinance of James I. forbade the representation on the stage of any living Christian king. The first act of the reign of Charles I. forbade acting on Sunday. Puritan opposition to the theatre culminated in the ordinance of 1648, making it a crime even to be present as a spectator at a play. After the Restoration there are few royal proclamations or ordinances, the necessary jurisdiction being exercised almost entirely by parliament and the lord chamberlain. Among the few post-Restoration royal proclamations is that of 25th of February 1664–5, restraining any but the company of the Duke of York's theatre from entering at the attiring house of the theatre, and that of the 27th of February 1668–9 against immorality in plays. Preventive censorship of the drama by an officer of state dates from the reign of Elizabeth. The master of the revels (see REVETS) appears to have been the dramatic censor from 1545 to

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1. The "advowsey" as it was called, over the Cheshire minstrels lasted until 1756, when the latest minstrel court was held at Chester.

2. Interludes were acted in the open air at Berriew in Montgomeryshire as late as 1819, when the players were indicted before the Great Sessions of Wales. They had been prohibited in the Declaration of Sports (1633) and in the Propositions of Ussbridge (1644).


4. For the anti-theatrical Puritan literature see Courthope, History of English Poetry, ii. 381.
1624, when he was superseded by his official superior, the lord chamberlain. In some cases the supervision was put into commission. Thus with Tilney, the master of the revels in 1581, were associated by order of the privy council a divine and a statesman. In other cases it was delegated, as to Daniel the poet by warrant in 1603. The proposal to give statutory authority to the jurisdiction of the lord chamberlain led, as has been already stated, to the withdrawal of Sir John Barnard's bill in 1735, and to considerable debate before the bill of 1737 became law, to which Lord Chatham's objection to the bill in the House of Lords was not unreasonable. "If the players," said he, "are to be punished, let it be by the laws of their country, and not by the will of an irresponsible despot." A stage play must now be duly licensed before performance. § 12 of the act of 1843 prescribes that a copy of every new play and of every addition to an old play, and of every new prologue or epilogue or addition thereto (such copy to be signed by the master or manager), shall be sent to the lord chamberlain, and, if the lord chamberlain does not forbid it within seven days, it may be represented. § 13 empowers the lord chamberlain to fix the scale of fees for examination; the fee is now two guineas for a play of three or more acts, one guinea for a play of less than three acts. All plays represented previously to the act are held to be licensed. A play once licensed is licensed once for all unless the licence be revoked under § 14. The examination is the duty of a special officer of the lord chamberlain's department, the examiner of stage plays. In spite of occasional lapses of judgment, a belief in the wisdom generally shown in the exercise of the censorship has been confirmed by the report of the select committee of the House of Commons in 1879 and the joint committee of both Houses in 1909. The censorship has been consistently supported in recent years by theatrical managers, but violently opposed by an advanced section of dramatic authors. There have been instances, no doubt, where perhaps both the lord chamberlain and his subordinate officer, the examiner of stage plays, have been somewhat nice in their objections. Thus, during the illness of George III., King Lear was not performed. George Colman, when examiner, showed an extraordinary antipathy to such words as "heaven" or "angel." The lord chamberlain's powers are still occasionally exercised against scriptural dramas, less frequently for political reasons. Later instances are Oscar Wilde's Salomé (1892), Joseph of Canada (1896), Maeterlinck's Monna Vanna (1902), Housman's Bethlehem (1902), Gilbert and Sullivan's Mikado (temporarily in 1907), and a play by Laurence Housman dealing with George IV. (1910). Before 1866 the lord chamberlain appears to have taken into consideration the wants of the neighbourhood before granting a licence, but since that year such a course has been abandoned. The joint committee in 1909 recommended that it should be optional for an author to submit a play for licence, and legal to perform an unlicensed play whether submitted or not, the risk of police intervention being taken. They also recommended that the reasons for which a licence should be refused should be: indecency, offensive personalities, the representation of an invidious manner of a living person or a person recently dead, violation of the sentiments of religious reverence, the presence of anything like conducing to crime or vice, or to cause a breach with a friendly power, or a breach of the peace.

A theatre may be defined with sufficient accuracy for the present purpose as a building in which a stage is regularly performed, to the following in the law that there are a considerable number of different persons, corporate and unincorporate, with jurisdiction over theatres. A consolidation of the law and the granting of jurisdiction in the province of a chamberlain for the United Kingdom would probably be convenient. The committee of 1866 recommended the transfer to the lord chamberlain of the regulation of all places of amusement, and an appeal from him to a higher authority in cases, and the suspension of his authority to preventive censorship in all public entertainments; but no legislation resulted. The committee of 1909 recommended the abolition of any distinction between theatres and music-halls. Several bills for the amendment of the law have been introduced, but without success in the face of more burning political questions. Building.—A theatre (at any rate to make it such a building as can be licensed) must be a permanent building, not a mere tent or temporary building. Regulations as to conditions of structural fitness from the county council necessary as a condition precedent for licence in the case of all theatres of a supercificial area of not less than 500 sq. ft. It is licensed after the passing of an examination of the building and its equipment. The regulations prescribe the excitement of emotion and the representation of action. The question whether a performance is a stage-play or not seems to be one of fact, and any building which is not likely to be usually by itself or its arrangement, and its performance, to be considered a stage-play, but it would be otherwise with a ballet divertissement. § 14 empowers the lord chamberlain to forbid the acting of any stage-play in Great Britain whenever he may recommend such a step by reason that it is or may become... more than notice of the local acts of 1888. To regulate the price of their articles, or if so much noise be heard in the neighbourhood as to interfere with the ordinary occupations of life. Very curious instances of proceedings at common law are recorded. In the case of the local acts of 1888, 1904, 1905 and 1915, players were indicted for riot and unlawful assembly. In the grand jury of Middlesex presented the two play-houses; and the old garden on Bankside, the Paris garden of Henry VIII. act v. 33 as riotous and disorderly nuisances. Performances on Sunday, Good Friday, and Christmas day are illegal. Regulations as to the sale of intoxicating liquors during the performances, and the making of provisions for the sanitary maintenance of the places, as well as by local acts and rules made by county councils. It is frequently a condition of the licence granted to provincial theatres that no excisable liquors shall be sold or consumed on the premises. The examination which takes place according to the annual value of the theatre up to a maximum of £20. The Dangerous Performances Acts, 1879 and 1897, forbid under a penalty of £10 any public exhibition or performance whereby the life or limbs of a child under the age of sixteen, or a boy, eighteen if a girl, shall be endangered. It also makes the employer of any such child indictable for assault where an accident causing actual bodily harm has happened to the child, and enables the court on conviction of the employer to order him to pay the child compensation not exceeding £20. The Prevention of Cruelty to Children Act 1904 forbids a child to appear in any public enter- tainment to the tune of any licence under a penalty of £20. The performance must be for hire. § 16 of the act of 1843 makes a building one in which acting for hire takes place, not only where money is taken directly or indirectly, but also where the purchase or hire of the stage space is a matter. Where there is no hire or purchase performed in a place in which excisable liquor is sold. In the case of Shelley v. Bethell, 1883 (Law Reports, 12 Q.B.D. 11), it was held that the proprietor of a private theatre was liable to penalties under the act, though he lent the theatre gratuitously, because tickets of admission were sold in aid of a charity.

**Licensed Building.**—By § 2 of the act of 1843 all theatres (other than patent theatres) must be licensed. By § 7 no licence

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1 It was probably through his influence that the expletives in Shakespeare were edited. The quarto of 1622 contains more than the folio of 1623.  
2 Dryden's words in the "Essay on Satire" (addressed to the earl of Dorset, lord chamberlain) still describe the duties of the office. As lord chamberlain I know you are absolute by your own will, in that which you can by any force make the stage. You can banish from thence scurrility and proflaenacy, and restrain the licentious insolence of poets and their actors in all things that shock the public quiet or the reputation of private persons under the notion of humour."
is to be granted except to the actual and responsible manager, who is to be bound by himself and two sureties for due observance of rules, and to the management of the theatre where the plays were produced, in addition to the licence for each metropolitan theatre other than the patent theatres (as far as at least as they are included in the boroughs named in the act of 1843) are licensed by the lord chamberlain. By § 4 his fee on granting such licences is fixed at £10, but if he grants the licence from the asylum it shall be £15. In case the theatre is licensed, the lord chamberlain appears to have no power to make such rules for enforcing order and decency. He can only issue regulations for the management of the theatre where any riot or misbehaviour has taken place. He has issued a code of regulations.

Provincial theatres fall under three different licensing authorities. The lord chamberlain has power to confer a licence for the larger and theatres situated in the places where the king occasionally resides, but only during the time of such occasional residence (§ 3). Theatres and halls in London, Cambridge, or within 44 miles of London licensed by the justices having power but before any such licence can come into force the consent of the chancellor or vice-chancellor must be given. The rules made by the justices for the management of the theatre are subject to the approval of the chancellor or vice-chancellor, who may also impose such conditions upon the licence as he thinks fit. In case of any breach of the rules or conditions, he may annul the licence (§ 10). All other provincial theatres are licensed by the county councils or county borough councils under the act of 1888, in case of a special and temporary performance, where justices shall, in all cases for special performances for the time being, licence the same into operation. The regulations of the London County Council are dated the 27th of July 1897. Penalties are imposed by the act for keeping or acting in an unlicensed theatre, and for producing or exhibiting upon any unlicensed theatre is unenforceable.

Music Halls.—Music was at no time the object of restrictions as severe as those imposed upon the drama. The present English act governing music halls, the Prohibitory Houses Act 1751, was passed probably in consequence of the publication in 1750 of Fielding's Inquiry into the Causes of the late Increase of Robbers. It is remarkable that the two works were of the same writer should from opposite causes have led to both theatre and music-hall legislation of lasting importance. The act was originally passed for a term of three years, but was made perpetual by 3 Geo. II. c. 10. It applied to all places within 20 miles of London, and to the walls of such houses as were not used for religious worship, and where no body of music was allowed to perform. Every such music hall must be licensed at the Michaelmas quarter sessions, the licence to be signed under the hands and seals of four or more justices. The licence may be granted for a year or quarter only. Public notice of the licence is to be given by affixing over the door the inscription "Licensed in pursuance of act of parliament for," with the addition of words showing the purpose. The penalty for keeping an unlicensed music hall is £100. This act is amended as to Middlesex by the Music and Dancing Licences (Middlesex) Act 1894, putting the licensing into the hands of the county council. Regulations were made by the county council for the security of those using the premises, and by other county councils and the City of London in June 1901. Music halls beyond the radius of 20 m. from London and Westminster are mainly governed by the Public Health Act 1890, the licensing authority being the licensing justices. There is no penalty in the act for keeping music halls open later than 2 a.m., though the only remedy for anything objectionable is for the licensing authority to withdraw the licence or refuse to renew it.

Scotland.—In Scotland the theatre has always exercised a considerably more influence than in England, and there has been little exclusively Scottish legislation on the subject. 1555, c. 40, disallowed certain amusements of a semi-theatrical kind by enacting that there was to be chosen Robbers Hereby, but John, abbot of unreason, or queen of May. A proclamation of James VI. in 1574, and 1579, c. 12, followed the lines of English legislation of 1642. Dancing in public places, such as ball-rocks, was prohibited. In 1674 the General Assembly claimed to license plays, and forbade representations on Sunday. As in England, the licensing power seems then to have passed from the Kirk to the Lords, and the Lord George was a theatre at Edinburgh. 1672, c. 21, exempted comedians while upon the stage from the summmary provisions of the act respecting apparel. The chamberlain of Scotland, while such an office existed, was not obliged to license plays. In certain police jurisdiction over theatres. The Theatres Act 1843 extends to Scotland, as did also the previous act of 1737, and further provisions are made by the Burgh Police Act 1867.

Ireland.—Theatrical legislation, as far as it went, was based upon English models. Thus ridicule of the liturgy was forbidden by 2 Eliz. c. 2 (Ir.); common players of interludes and wandering minstrels were deemed vagabonds, 10 & 11 Car. I. c. 4 (Ir.). In 1785 an act was passed to enable the crown to grant letters patent for erecting new public halls or theatres to be used for the amusement and entertainment of the inhabitants of Dublin, with the grant of an annual revenue of £200, of which the majority of entertainment for the benefit of the Dublin lying-in hospital and exhibitions of horsemanship or puppet-shows. The existing theatres of Dublin did not apply to Ireland, except the Public Health Act 1890, s. 51.

British Colonies.—There is a large amount of legislation. An example is the Victoria Act, No 1430 (1857), giving the chief secretary the power to cancels the licence of any theatre if used on Sunday without special permit.

United States.—Public entertainments, dramatic or other, are usually regulated by the counties or municipalities, and are not subject to federal legislation. It is extremely rare that there is no act of Congress on the subject, except one in 1897 imposing a temporary war tax on the theatres. In most states there is state legislation, requiring places of public entertainment to be licensed by the proper authority. In many states it is a condition of the licence that intoxicating liquors shall not be sold in such places. Other conditions, more or less usual, are that there shall be no Sunday or dangerous performances, that acrobats shall be properly protected, and that female waiters shall not be employed. Structural qualifications are in some cases made necessary. Thus in 1883 the New York legislature passed an act containing many sections conferring powers on the police authorities, and there is a characteristic piece of legislation is the New York Act of 1873, c. 186, enacting that no citizen is to be excluded from a theatre by reason of race, colour or previous condition of servitude. This has been merely a confirmation of the prohibitions already in force in art. xiv. of the amendments to the constitution of the United States. There are two curious and conflicting decisions of other states on the matter. Michigan held that a manager could discriminate against a person of colour, Michigan that he could not (see Green's Digest, vol. i. 642).

Continental Europe.—The principal points in which the continental theatre differs from the English are that Sunday is the most important day, and that the theatre is often owned or subsidized by the state or a municipality. In France there has been much legislation since the days of the Revolution, the principal law being one of 1876, which has a long list of regulations, and there has been the subject of much discussion. The censure préalable was abolished in 1906. The object is attained by police penalties. Most of the authorities will be found in Dallor, Supplices, vol. xviii., and, for the older law, Lacan, La Legislation et la jurisprudence des théatres (1853), and Maugrás, Les Comédiens hors de la loi (1887), may be consulted. Italy has produced at least two modern works on the subject, Rivalta, Storia e Sistema del Diritto dei Teatri (1886), and Tabanelli, Codice del Teatro (1901). What strikes one in how little special legislation is there on the subject. The penal code meets most cases. Spain retained the autos sacramentales much longer than France. The new law of 1868 observes the censure and, for the position begins very early. The Siete Partidas enacts that the clergy are not to take part as actors or spectators in scurrilous plays (conjuraciones), the canon of Toledo regrets that the government had not appointed a censor to prevent the acting of plays not only injurious to morals but also offending against the classical rules of the drama. The concern is considerable, and theITU of Lawyer of the Ottoman Empire, the details will be found in G. Young, Corps de droit ottoman, vol. ii. 320 (1904).

THEBES (Θῆβαι), the Greek name of the ancient capital of Upper Egypt, presumably an Egyptian name (e.g. Zemi, seen in αἰγυπτικά, ζημιά assimilated to that of the Greek city. It occurs in Homer (II. ix. 351-4) where it has the epithet ἐκατονθυλῶς, "hundred-gated," probably derived in the first place from the gateways of its endless temples, though perhaps misunderstood if it referred to a city with a hundred gates in the circuit of its walls. Thebes was always called Semele, and its vast temple enclosures in different quarters would form as many fortresses in case of siege or tumult. Its Egyptian name was Wesi (or Wisi?), later Ne, "the city" (sometimes Ne-Amun, hence No-Amon in Nahum iii. 8), and different quarters were known by special names. In non-literary Greek Thebes was regularly called Diospolis the Great. Ammon, Amen-Rê, or Amenronasher ("Ammon-Rê king of the gods") was its deity, with his consort Mut and their child Khons. Mont also was a local deity and Hathor presided over the western cliffs of Thebes. In very ancient times the city lay on the east bank of the Nile, although the necropolis was still confined to the west bank, a vast city of temples, priests and necropolis people, to which

1 The councils may delegate their authority to justices, a district council, or a committee of their own body, such as the Theatre and Music Hall Committee of the London County Council.
were added royal palaces and their accompaniments, covered the western shore as far back as the desert hills. The chief nucleus of the ancient Wési was a town about the temple of Karnak; it probably reaches back to the prehistoric period. At Dra\b\'ab\'u\'l nagg, opposite to it, are tombs of its princes under the 19th Dynasty. The temple of Karnak is no doubt of immemorial antiquity. Perhaps no sculpture earlier than the 19th Dynasty has survived there, but Senwosret I. changed statues to his predecessors of the 19th Dynasty who had probably showed their devotion to Ammon in a substantial manner, and Cheops of the 19th Dynasty was named in it. After the end of the Old Kingdom Thebes grew from an obscure provincial town to be the seat of a strong line of princes who contended for supremacy with Heracleopolis and eventually triumphed in the 18th Dynasty of Manetho. The most important monument of the Middle Kingdom now extant at Thebes is the funerary temple of Menthotep III. of this dynasty, which has been revealed by the excavations of the Egypt Exploration Fund at Deir el Bahri (see Architecture, section Egyptian, fig. 4); and the period is well represented by an abundance of statues of the 19th and 20th dynasties from the temple of Karnak. The name Amenemhe, so common in the 19th Dynasty, shows the importance of the Theban god at this time. It was not, however, till the 20th Dynasty, the beginning of the New Empire, that the whole site began to be occupied by monuments which have survived to the present day. The early rulers of this dynasty down to Tuthmosis III. developed Karnak, and on the west bank built the great funerary temple, of which fragments of temples and sections of the Medinet Habu, and began the long series of royal tombs in the famous Valley of the Tombs of the Kings far back in the desert behind Deir el Bahri. Amenemhe III. continuing, transformed western Thebes monumentally: built three great temples in addition, that of Mont on the north of Karnak, the temple of Mut on the south and the temple of Ammon at Luxor, and connected the last two with the state temple of Karnak by avenues of sphinxes. On the west bank of the huge colossi of Memnon marked the entrance of his funerary temple, a magnificent building which was afterwards destroyed, and the great lake of Birket Habu was dug and embanked in front of his brick palace at the extreme south. The chief energies of this king in fact were expended on developing the south extremity of Thebes on both banks. The city and its monuments now covered an area about three miles square. After this Thebes experienced a serious set-back with the heresy of Akhenaton, the son of Amenemhe III. He moved his capital northward to Akhetaton (El Amarna) and strove to suppress the worship of Ammon, doing infinite damage to the monuments of Thebes by defacing his name and figure. After about twenty years, however, the reaction came, Thebes was again the capital, and a little later under Seti (Sethos I.) and Rameses II. of the 20th Dynasty it was raised to greater architectural magnificence than ever. These two kings built the great columnar hall of Karnak, added a large court with pylons to Luxor, and on the west bank built the funerary temple of Seti I. Karnu, and the Ramessum with its gigantic colossus, besides other edifices of which only traces remain. Under the 20th and 21st Dynasties Thebes was at the height of its greatness. Conquering Pharaohs brought home trains of prisoners and spoil, embassies came thither of strange people in every variety of costume and of every hue of skin, from Ethiopia, Puoni (Punt), Mesopotamia, Asia Minor, Libya, and the islands of the Mediterranean, bringing precious stones, rare animals, beautiful slaves, costly garments and vessels of gold and silver, while the ground shook with the movement of colossal architraves, statues and obelisks. The tombs of the 20th Dynasty on the west bank and the sculptures in the temples reflect the brilliancy of these days, but even the reign of Rameses II. marks the beginning of the decline of Thebes. The enormous constructive energy of the proud Pharaoh, instead of being concentrated on the capital, was expended with almost equal lavishness on other parts of the country. In every city he left his mark. A great temple at Tanis boasted a larger colossus than existed in Thebes: Helopolis and Memphis must have been lavishly adorned, and the temples of Abu Simbel (q.v.) alone would have been sufficient to satisfy the ambition of many of the great Pharaohs. After, Rameses II. the efforts of all his successors combined could add little to the wonders of Thebes. The temple and tower of Rameses III. (XXth Dynasty) at Medinet Habu, his tomb in the Biban el Moluk, the temple of Khons (Rameses III. and later) and the court of Sheshonk I. (XXIInd Dynasty) at Karnak are the only great achievements.

For the rest there are the tombs of many kings in the Biban el Moluk and a good deal of comparatively petty construction and tinkering, with the help of stone robbed from older structures. Earlier and greater kings had remorselessly destroyed buildings which interfered with their own plans. The "Memnon" temple of Amenemhe III. had already gone, sacrificed perhaps to Akhenaton's god. Rameses II. had plundered his predecessors' monuments for materials. Hitherto Thebes had been glorified by the process, but henceforth it was rather to perish. The tide of prosperity was flowing northward and such monumental energy as remained was expended more widely. For several centuries after the fall of the New Empire Thebes was but one of several alternating or contemporaneous capitals. Memphis, Tanis, Bubastis, Sais, Heracleopolis had at one time or another at least equal claims. The Ethiopian conquerors of Egypt made Thebes their Egyptian capital, but the wide decision of the Nile-Pontic route for the trade and commerce of the Mediterranean, brought in anew the long-pausing hopes of Egypt, and the Persian king Cambyses II. in the reign of Darius I. did not neglect it, and during the XXVth Dynasty Ptolemaios, a wealthy priest and official, excavated for himself the greatest private tomb that ever was made. Probably every king that included Thebes in his realm, except the Assyrians and the Persians, left his memorial there in chapels erected or sculptures added. Of the Persians, however, not even Darius is traceable at Thebes; on the other hand, there is no support for the tradition that Cambyses destroyed its monuments. Ptolemy I. gave a new capital to the upper country in the Greek foundation of Ptolemais, and thus struck a fresh blow at the prosperity of Thebes. For a short period in the reign of Euphrates II., when Upper Egypt was in rebellion against the Ptolemaic rulers, Thebes was the capital of independent native dynasts. In a later rebellion, Thebes was captured after a three years' siege and severely punished by Lathyrus (Ptolemy X., Soter II.).

In the reign of Augustus, having joined in the insurrection against the tax-gatherers, it was destroyed by Cornelius Gallus and became a collection of villages. Though its vast buildings have since served as quarries for mill-stones and for the limeburner, Thebes still offers the greatest assemblage of monumental ruins in the world.

The following paragraphs enumerate the principal groups of monuments. On the east bank at Karnu stand the great east temple of Amen-Rê with its obelisks of Hatshepsut and Tuthmosis I. and the vast columnar hall of Rameses II.; the temple of Mut and the well-preserved temple of Khons; the temple of Luxor and avenues of rams and sphinxes connecting all these. These temples are described in the articles KARNAK, LUXOR and Architecture: Egyptian. On the west bank, in front of the necropolis, on the edge of the desert or projecting into the cultivation, was a low row of temples: the northernmost, placed far in front of the others, is the well-preserved temple of Seti I. at Karnu; then follow the Ramessum and Medinet Habu; and the foundations of many others can be traced. The temple of Amenemhe III., to which the colossal of "Memmon" were attached, was again far forward of the line. The Ramessum contains the remains of a stupendous seated colossus, in black granite, of its builder Rameses II., thrown on its face. When perfect it was probably 57 ft. high and weighed about 1000 tons, surpassing the "Memnon" statues of Amenemhe III. in size and weight. The temple of Rameses III. at Medinet Habu, sculptured with very interesting scenes from his Syrian, Libyan and other wars and from religious festivals, is remarkable also for the unique entrance-tower.
which probably formed part of the royal palace. Northward
and far back in the foot-hills is the Ptolemaic temple of Deir el
Medina, and beyond under the cliffs of Deir el Bahri the terrace
of Queen Hatshepsut, the walls of which are adorned
with scenes from her expedition to Puoni (Somailand) in search
of incense trees, and many other subjects. The necropolis
extends from Kurna in the north through Drau abu'l Nagga,
the Assasif, and Sheikh abd el Kurna to Kurnet Murrai of Medinat el-Fedwa. The tombs of the XVIIIth Dynasty
Far behind Medinet Habu are the Tombs of the Queens, where
royal relatives of the XXth Dynasty are buried; and imme-
diately behind the lofty cliffs of Deir el Bahri, but accessible
only by a very circuitous route from Kurna, are the tombs of
the kings (from Tethmosis I. onward to the end of the XXth
Dynasty) in the Biban el Moluk and the Western Valley. They
are decorated with religious scenes and texts, especially those
which describe the passage of the sun through the underworld.
Those of Seti I. and Rameses III. are the most remarkable.
These royal sepulchres are long galleries excavated in the rock
with chambers at intervals: in one of the innermost chambers
was laid the body in its sarcophagus. In the XXIst Dynasty,
when tomb robberies were rife and most of their valubales had
been stolen, the royal mummies were removed from place to
place and at last deposited for safety in the tomb of Amen-
ophis II. and in the burial-place of the priest-kings at Deir el
Bahri. The finding of the two cachettes nearly intact has been
among the greatest marvels of archaeological discovery, and
the systematic exploration of the Valley of the Tombs of the
Kings by Theodore M. Davis has been annually rewarded with
results of the highest interest.

See Baedecker's Egypt; E. Naville, (Temple of) Deir el Bahari,
in introduction and parts i.-v. (London, 1894-1900); W. M. F.
Petrеi, Six Temples at Thebes (ruined temples on west bank),
(London, 1897); G. Daressy, Notice explicative des ruines de
Memphite de la Deir el Bahari; G. Mommsen, Les M. de
Deir el Bahari "in Mémoires de la mission archéologique française
au Caire, tome I.; and many other works. (F. Ll. G.)

THEBES (anciently Thесае, or in poetry sometimes Θῆβαι,
in modern Greek Θήβα, or, according to the corrected pronunciation, Thееае), an ancient Greek city in Boeotia, is
situated on low hilly ground of gentle slope a little north of the
range of Cithaeron, which divides Boeotia from Attica, and on
the north-western slope of the Bеoetian plain, about 44 m. from Atbeine, whence it is reached by two carriage-roads and by railway since 1904. It has about 4800 inhabitants, and is the seat of a bishop. The present town occupies the site of the ancient citadel, the Cadmea; two fragments of ancient wall are visible on the north, and another, belonging either to the citadel or the outer wall, on the south. Two streams, rising a little south of the town, and separated by an average distance of about half a mile, flow on the two sides, and are lost in the plain. These are the ancient Ismerus on the east and Dirce (Διρέα) on the west, which gave to the town its name Διρεάων. The Dirce, now Plakōtissas, has several springs. From the west side of the Cadmea another copious fountain (Paraporti) falls to the Dirce. In a suburb to the east is another (Fountain of St Theodore), and north-west are two more. The Cadmea itself is supplied
with water brought from an unknown source to the south by
works supposed of prehistoric antiquity. It now enters the
town by an aqueduct of twenty arches of Frankish construction.
The waters of Thebes are celebrated both by Pindar and by
the Athenian poets, and the site is still, as described by Dicae-
archus (3rd century B.C.), "all springs," κάθε χώρος ῥάζα. One, from which emerges a spring still supplied his table, is still called "the spring of the cadis." Some
of the marble basins, seats, &c., remain, and, with the fragments
of wall above mentioned, are the only relics of the classic time.
The most curious of later buildings is the church of St Luke,
south-east of the Cadmea, believed to contain the tomb of the
evangelist. From the abundance of water the place is favour-
able to gardens, and the neighbouring plain is extremely fertile.
But the population is scanty, and the town at present of no
importance.

History.—The record of the earliest days of Thebes was pre-
served among the Greeks in an abundant mass of legends
which rival the myths of Troy in their wide ramifications and
the influence which they exerted upon the literature of the
classical age. Five main cycles of story may be distinguished:
(1) the foundation of the citadel Cadmea by Cadmus, and the
growth of the Spartan or " Sown Men" (probably an etiological
myth designed to explain the origin of the Theban nobility
which is named in historical times); (2) the building of a
"seven-gated" wall by banquet, and the formation of
the seven gates of Zethus, Antiope and Dirce; (3) the tale of the "house
of Lauis," culminating in the adventures of Oedipus and the wars
of the "Seven" and the Epigon; (4) the advent of Dionysus;
and (5) the exploits of Heracles. It is difficult to extract any
historical fact out of this maze of myths; the various groups
cannot be fully co-ordinated, and a further perplexing feature
is the neglect of Thebes in the Homeric poems. At most it
seems safe to infer that it was one of the first Greek
communities to be drawn together within a fortified city, that it
reputed its importance in prehistoric as in later days to its mense,
and that its original "Cadmean" population was distinct from other inhabitants of Boeotia such as the Minyae of
Orchomenus.

In the period of great invasions from the north Thebes
received settlers of that stock which in historical times was homo-
geneously spread over Boeotia. The central position and
military security of the city naturally tended to raise it to a
commanding position among the Boecotians, and from early
days its inhabitants endeavoured to establish a complete
supremacy over their kinmen in the outlying towns. This
centralizing policy is as much the central fact of Theban
history as the counteracting effort of the smaller towns to
resist absorption forms the main chapter of the story of
Boeotia. No details of the earlier history of Thebes have been preserved,
except that it was governed by a land-holding aristocracy who
secured their integrity by rigid statutes about the owner-
ship of property and its transmission. In the late 6th century
the Thebans were brought for the first time into hostile con-
tact with the Athenians, who helped the small fortress of
Plataea to maintain its independence against them, and in 506
reduced it into a tributary of Attica. The aversion to Athens
served to explain the unpatriotic attitude which Thebes dis-
played during the great Persian invasion. Though a
contingent of 700 was sent to Thermopylae and remained there
with Leonidas to the end, the governing aristocracy soon after
joined the enemy with great readiness and fought zealously
on his behalf at the battle of Plataea (479). The victorious Greeks
subsequently punished Thebes by depriving it of the presidency
of the Boeotian League, and an attempt by the Spartans to
expel it from the Delphic amphictyony was only frustrated by
the intercession of Athens. In 457 Sparta, needing a counter-
poise against Athens in central Greece, reversed her policy
and reinstated Thebes as the dominant power in Boeotia. The
great fortress served this purpose well by holding out as a
base of resistance when the Athenians overran and occupied the
rest of the country (457-447). In the Peloponnesian War the
Thebans, embittered by the support which Athens gave to the
smaller Boeotian towns, and especially to Plataea, which they
vainly attempted to reduce in 431, were firm allies of Sparta,
which in turn helped them to besiege Plataea and allowed them
to destroy the town after capture (427). In 424 at the head
of the Boeotian levy they inflicted a severe defeat upon an invading
force which came from Athens and Thespiae, and for the first
time had a distinct seat of the effects of that firm military organization which eventually
raised them to predominant power in Greece. After the
dowfall of Athens at the end of the Peloponnesian War
Thebans, finding that Sparta intended to protect the states
which they desired to annex, broke off the alliance. In 404
they had urged the complete destruction of Athens, in 403
they secretly supported the restoration of its democracy in order
in which the aeronautic against Sparta. A few years
later, influenced perhaps in part by Persian gold, they forced on the
so-called Corinthian War and formed the nucleus of the league against Sparta. At the battles of Haliautos (395) and Coronela (394) they again proved their rising military capacity by standing their ground against the Spartans. The result of the war was especially disastrous to Thebes, as the general settlement of 387 stipulated the complete autonomy of all Greek towns and so withdrew the other Boeotians from its political control. Its power was further curtailed in 382, when a Spartan force occupied the citadel by a treacherous coup-de-main. Three years later the Spartan garrison was overthrown, and the Athenian constitutions were set up in place of the traditional oligarchy. In the consequent wars with Sparta the Theban army, trained and led by Epaminondas and Pelopidas (q.v.), proved itself the best in Greece. Some years of desultory fighting, in which Thebes established its control over all Boeotia, culminated in 371 in a remarkable victory over the pick of the Spartans at Leuctra (q.v.). The winners were hailed throughout Greece as champions of the oppressed. They carried their arms into Peloponnesus and at the head of a large coalition permanently crippled the power of Sparta. Similar expeditions were sent to the Epirotan and Macedonian coasts to settle the affairs of those countries. But the predominance of Thebes was short-lived. The states which she protected were indisposed to commit themselves permanently to her tutelage, and the renewed rivalry of Athens, which had been linked with Thebes since 395 in a common fear of Sparta, but since 371 had endeavoured to maintain the balance of power against her ally, prevented the formation of a Theban empire. With the death of Epaminondas in 362 the city sank again to the position of a secondary power. In a war with the neighbouring state of Phocis (356-346) it could not even maintain its predominance in Greece, and was aided by inviting Philip II of Macedon to crush the Phocians it had extended that monarch's power within dangerous proximity to its frontiers. A rebellion of feeling was completed in 338 by the orator Demosthenes, who persuaded Thebes to join Athens in the Theban attempt fought bravely on behalf of Grecian liberty in the decisive battle of Chaeronea, and bore the brunt of the slaughter. Philip was content to deprive Thebes of her dominion over Boeotia; but an unsuccessful revolt in 335 against his son Alexander was punished by the Macedonians, who sent Thebes to the house of the poet Pindar. Though restored in 315 by Cassander, Thebes never again played a prominent part in history. It suffered from the establishment of Chalcis as the chief fortress of central Greece, and was severely handled by the Roman conquerors Mummium and Sulla. Strabo describes it as a mere village, and in Pausanias's time (A.D. 170) its citadel alone was inhabited. During the Byzantine period it served as a place of refuge against foreign invaders, and from the 10th century became a centre of the new silk trade. Though severely plundered by the Normans in 1146 it recovered its prosperity and was selected by the Frankish dynasty de la Roche as its capital. In 1337 it was destroyed by the Catalans and passed out of history.

The most famous monument of ancient Thebes was the outer wall with its seven gates, which even as late as the 6th century B.C. was probably the largest of artificial Greek fortresses. The gates vary in names; but the same ones are the bastions of Proeitides, Electra, Neistae or Neitae, and Homoloiades; Pausanias gives the others as Oggyiae, Hyspistae, Crenaeae. There is evidence that the gate Electra was on the south, and near it was the tomb of the Thebans who fell at the capture by Alexander. The gates were shown to Pausanias as Neitae and Proeitides led respectively north-west and north-east. Two of the springs have been identified with some probability. The chief of these is the Ligma, which Oedipus is said to have purged himself from the pollution of homicide, and the Paraporti with the dragon-guarded fountain of Ares (see CADMUS). Diaecaurus, referring to the town of Caria, says (De re divina, ii. 56), "The circuit of the city is 1,170, 35 m. and 55 m.; the smaller fairly corresponds to the 45 m. over which the extant remains have been traced; it consisted of sun-dried brick on a stone foundation. Beyond this the topography is wholly uncertain. From the interest of the site in history and still more in literature, as the scene of so many dramas, the temptation to fix details has been specially strong. Conjectural plans or descriptions, differing widely, are given by Leake, Forchhammer, Ulrichs, Burrian, Fabriusc and others (references below). There are two main difficulties: the authenticity of Caro and the place and time of the catastrophe. It was written at a time when the lower city was deserted, and only the temples and the gates left; and the references to Thebes in the Attic dramatists are, like those to Mycenaean and the Ilium, a later device. The sequel of Thebes is centred in the poet Pindar. It had a flourishing school of painting in the 4th century, of which the most famous representation was Aristides, who excelled in pathetic subjects. Thebes was written about 300, 300 B.C. by Thucydides, Xenophon (Hellanico, passim), Diodorus xii., xii.; Pausanias ix. 5-17; M. Müller, Geschichte Thebens (Leipzig, 1879); E. v. Seeck, Geschichte Wandels (ambrosianische Heiligen) (Dorpat, 1884). pp. 44-246; E. Fabricius, Theben (Freiburg im Breisgau, 1890); E. Funk, De Thebanorum actis, 378-362 (Berlin, 1890); B. V. Head, Historia Numorum (Oxford, 1887), pp. 259-599. See also Boeotia throughout.

THEBES, ROMANCE OF. The French Roman de Thèbes is a poem of some 10,000 lines which appears to have been based, not on the Thebaid of Statius, but on an abridgment of that work. This view is supported by the omission of incidents and details which, in spite of the altered conditions under which the poem was composed, would naturally have been preserved in any imitation of the Thebaid, while again certain modifications of theStatian version can hardly be due to the author's invention but point to an ancient origin. As in other poems of the same kind, the marvellous disappears; the Greeks adopt the French methods of warfare and the French code of chivalric love. The Roman dates from the 12th century (c. 1150-155), and is written, not in the iroades of the chansons de geste, but in octosyllabic rhymed couplets. It was once attributed to Benoît de Sainte-Mère; but all that can be said is that the Thèbes is prior to the Thébaïdes of Philipe de Thèbes, of which Benoît de Sainte-Mère was the compiler. The Thèbes is preserved also in several French prose redactions, the first of which, printed in the 17th century under the name of Edipus, belongs to the early years of the 15th century, and originally formed part of a compilation of ancient history, Histoire ancienne jusqu'à César. The first volume of Les histoires de Paul Crosse traduites en français contains a free and amplified version of the Thèbes. The Romance of Thèbes, written about 1420 by John Lydgate as a supplementary Canterbury Tale, was printed by Wynkyn de Worde about 1490. From the Roman de Thèbes also were possibly derived the French romans d'aventures, such as Le ciel d'un bout, and the English romans d'aventures, such as about the end of the 12th century by Hue de Rotelande, an Anglo-Norman trouvère who lived in Credenhill, near Hereford. The author asserts that he translated from a Latin book lent him by Gilbert Fitz-Baderon, 4th lord of Monmouth, but in reality he has written romances of chivalry on the usual lines, the names of the characters alone being derived from antiquity.

See L. Constans, La Légende d'Oedipe étudiée dans l'antiquité au moyen âge et dans les temps modernes (Paris, 1881), and in the section "L'Épopée antique" in De Julleville's Histoire de la langue de la litt. française; Le Roman de Thèbes, ed. L. Constans (Soc. des anciens textes français (Paris, 1890); G. Ellis, Specimens of Early English Mevilsh Romances, iii. (1805).

THECLA, ST., one of the most celebrated saints in the Greek Church (where she is commemorated on the 24th of September) and in the Latin Church (where her festival is the 23rd of September). She is honoured with the title of "protomartyr." The centre of her cult was Seleucia, in Isauria. Her basilica, south of Seleucia, on the mountain, was long a very popular place of pilgrimage, and is mentioned in the two books of St. Basil of Seleucia. The great popularity of the saint is due more particularly to her Acta, which in all their forms derive from the apocryphal work known as the Acta Pauli et Theclae. According to her Acta, Thecla was born of illustrious parentage at Iconium, and came under the personal teaching of the Apostle Paul. In her eighteenth year, having broken her engagement with Thamyris, to whom she had been betrothed, she was accused by her relations of being a Christian. Armed with the sign of the cross, she threw herself on the pyre, but the flames were extinguished by a sudden rain. She then went to
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Antioch, where she was exposed to wild beasts, then fastened to bulls in order that she might be torn asunder, and finally thrown into a pit full of serpents; but she was delivered from all these perils. She converted many heathen. Returning to Iconium, she withdrew into a mountain solitude, and became distinguished by many virtues and miracles. In spite of their highly fabulous character, which caused them to be more than once condemned by the Church, the Acts of Paul and Thecla, which date back to the 3rd century, affording the most interesting monuments of ancient Christian literature.

See Acta Sancctorum, September, vi. 546–568; J. A. Lipsius, Acta apostolorum apocrypha (Leipzig, 1891), i. 235–269; C. Schmidt, Acta Pauli (Leipzig, 1903), where an attempt is made to prove that Paul himself was the author of the Thecla Acts, considered as an integral part of the Acta Pauli; see also APOCRYPHAL LITERATURE.


THEFT, the act of stealing or robbing. In English legal usage the term is still used to denote robbing or stealing or of cattle. The O.E. word pœfes or piefes is formed from pœf, thief or pœf, to steal, and cognate with Gr. πιθεω, to deprive. The O.E. stelan, to steal, appears also in other Teut. languages, cf. Du. stelen, Swed. stjåla, Goth. stílan, &c. It has been doubtfully connected with Gr. ἀπορρίπτω, to deprive.

THEGN, or Thane, an Anglo-Saxon word meaning an aristocratic person or chief. The O.E. deor, to speak, and cognate with Gr. ῥιχων, a child. From the first, however, it had a military significance, and its usual Latin translation was miles, although minister was often used. J. Bosworth (Anglo-Saxon Dictionary, new ed. by T. N. Toller) describes a thane as "one engaged in a king's or a queen's service, whether in the household or in the country," and adds, "the word in this case seems gradually to have acquired a technical meaning, and to become a term denoting a class, containing, however, several degrees." The precursor of the thane was the geateth, the companion of the king or great lord, the member of his comitatus, and the word thane began to be used to describe a military geateth. It is only used once in the laws before the time of Aethelstan (c. 985–1014), but more frequently in the charters. H. M. Chadwick (Studies on Anglo-Saxon Institutions, 1905) says that "the sense of subordination must have been inherent in the word from the earliest time, but it has no connexion with the German dienien, to serve. In the course of time it extended its meaning and was more generally used. The thane became a member of a territorial nobility, and the dignity of thegead was attainable by those who fulfilled certain conditions. Thus from a document of uncertain date, possibly about the time of Alfred the Great, and translated by Stubbs (Select Charters) as "Of people's ranks and laws," we learn—"And if a ceorl throwe, so that he had fully hies of his own land, church and kitchen, bellhouse and burgh-gate-seat, and special duty in the king's hall, then was he thanecorth of thane-right worthy." And again—"And if a merchant throwe, so that he farre thred over the wide sea by his own means, then was he thanecorth of thane-right worthy." In like manner a successful thane might hope to become an earl. In addition to the thanes there were others who were thanes on account of their birth, and thus thanehood was peculiarly associated with the nobility. The superior or inferior to the earl, the member of a kingly family, but he was superior to the ceorl, and, says Chadwick, "from the time of Aethelstan the distinction between thane and ceorl was the broad line of demarcation between the classes of society." His status is shown by his wergild. Over a large part of England this was fixed at 1200 shillings, or six times that of the ceorl. He was the twelfthynd of men, the laws, divided from the twywynde man or ceorl.

The increase in the number of thanes produced in time a subdivision of the order. There arose a class of king's thanes, corresponding to the earlier thegns, and a larger class of inferior thanes, some of them the thegns of bishops or of other thanes. A king's thane was a person of great importance, the contemporary idea being shown by the Latin translation of the words as comes. He had certain special privileges. No one could save the king who had the right of jurisdiction over him, while by a law of Canute we learn that he paid a larger heriot than an ordinary thane.

But, like all other words of the kind, the word theng was slowly changing its meaning, and, as Stubbs says (Const. Eng., vol. i.), "the very name, like that of the geateth, has different senses in different ages and kingdoms, but the original idea of military service runs through all the meanings of them, as that of personal association is traceable in all the applications of geateth." After the Norman Conquest the thegns appear to have been merged in the class of knights.

The twelve senior thegns of the hundred play a part, the nature of which is rather doubtful, in the development of the English system of justice. By a law of Athelred they "seem to have acted as the judicial committee of the court for the purposes of accusation" (W. S. Holdsworth, History of English Law, vol. i. 1903), and they have some connexion with the grand jury of modern times.

The word thane was used in Scotland until the 15th century, to describe an hereditary non-military tenant of the crown.

(A. W. H.)

THEINNI, or HSENWI, one of the Northern Shan States of Burma. It is called by the Shan Hsenwi, and also officially so designated, but is better known by the Chinese name of Theinni. It was by far the largest of the cis-Salween Shan states, and at one time included not only all the territory of the present states of North and South Hsenwi, but also Kehsi Mansam, Mong Haung, and Mong Nawng, besides having a sort of protectorate over Mang Lèn and other Wa states east of the Salween. These had, however, fallen away in Burmese times, and at the period before the British annexation Theinni was divided into five parts by name; but there was no central authority, and the whole state was in hopeless disorder. This continued until the appearance of British troops in March 1888, when it was divided into two states—North Theinni, which was assigned to a successful adventurer, Hkun Sang, of Tôn Hông, and South Theinni, which went to Nawmpong, of the old Shan ruling house. North Theinni has an area of 6330 sq. m., and a population (1901) of 118,325 persons; estimated revenue, £6000. South Theinni has an area of 2400 sq. m., with a population (in 1901) of 67,836; estimated revenue, £4000.

The northern part of North Theinni is a mass of hills affected by the west-north-west fault which divides the Nam Tu or Myit-nge valley, and has thrown up a series of parallel ranges which extend northwards to the Shweli (Lung Kiang), without altogether destroying the north and south trend which is the characteristic of the Shan hills as a whole. In the valleys between these hills are numerous tracts under rice cultivation, some circular or oval, some mere ridges along the river banks. The southern portion is much more flat land, along the sides of the Nam Tu, its tributaries the Nam Yao and the Nam Nim, and the Nam Yek flowing into the Salween. This was formerly populated, and still remains the most valuable portion of the state. A large thane residence was built near the head of the Salween, and marking the southern border of the rift in the hills, divides North from South Theinni. Both north and south of the Nam Tu there are many peaks which rise to 6000 ft., and several over 7000 ft. The northern portion is almost consistent enough in its altitude of about 4000 ft. to be called a plateau. It has large, grassy, upland downs. This part of the state has fallen almost entirely into the hands of the Chinese, who has divided it into the Shan and Hsenwi (Nam Tu and Kiang) valley, and in the Nam Tu and other valleys in the southern part of the state. The line of the Nam Mao is the lowest portion of North Theinni, being little over 2000 ft. above sea-level. The other peaks are over 4000 ft. above sea-level, and by the spurs which that peak sends north and south. Apart from this it consists of broken hill-country of no great extent, but open terrean, in the latter consisting of the half of the state. It is watered by numerous streams, of which the chief is the Nam Pang, an affluent of the Salween. The chief river in the northern state, apart from the Salween, is the Nam
Tu or Myit-nge, which rises on the Irrawaddy-Salween watershed, not far from the latter river, and flows westwards through the state into Taungbaing or Thilaw, and eventually into the Irrawaddy at Amarapura. The three first of these rivers form a considerable tributary, the Nam Paw, which has its entire course in Theinni territory, and is large enough to be fordable in the dry weather, and only passable by boats in the rains. Its delta or small delta, caused by the alluvial deposits which it has dried up many of the springs, but as a whole North Theinni is very well watered. Considerable deposits of coal, or rather of lignite, exist in both North and South Theinni, but do not appear to be so valuable in quality. Gold is washed in many of the streams in a fictitious way. Limestone exists in large quantities. No valuable timber exists to any considerable extent. There is some teak in the lower part of the North Theinni forests, and the pine tree and great forest redwood are found in this part. The forests cover some of the ranges, but, as elsewhere in the Shan states, varieties of the oak and chestnut are the commonest forest trees. The climate of the state as a whole is temperate. In the plain of the uplands there are yearly frosts in January, February, and March, but in the greater part of the state the thermometer rarely falls to freezing-point, and in the hot weather does not exceed ninety degrees for any length of time. The average rainfall seems to be about 60 in. yearly. After the disruption of the ancient Shan empire at Tali by Kubbai Khan, Theinni seems to have been the centre of the independent Shan kingdom, with various capitals in the Shwe and Nath Shan States. This last capital was probably named from the Burmese about 1738, and the country was divided into various estates, with appointment orders from Ava. Numerous rebellions and civil wars have reduced Theinni from its position as the centre of Shan independence to a condition of mere desolation. It has regained much population since the British occupation in 1888, but is still far from its old prosperity. Much may be expected from the art works that have been made, from the English and British influence. The Shan are a tall, long-haired people.

Aseni, the capital of North Theinni, stands near the north bank of the Nam Tu. The ruins of the old capital lie at a short distance, and show it to have been a large and well-built town, with a number of houses variously estimated at from three to ten thousand. Mong Yai is the capital of South Theinni, with a population of about 2000. Lashio, the headquarters of the southern Shan State, is in North Theinni. The races found in Theinni comprise Shans, Kachins, Chinese, Burmese, Lihsaws, Wa, Palungs and Yanglam. The Shans and Kachins vastly predominate, and are nearly equal in numbers. (J. G. Sc.)

**THEISM (Gr. θεία, god), literally, and in its widest sense, the belief in a supernatural First Cause. The term has several changed meanings. (1) It appears for the first time in 18th-century English as an occasional synonym for "deism" (q.v.), and therefore as applying to those who believed in God but not in Christianity. Later criticism, orthodox and heterodox, upon the English deists inclines to charge them with the conception of a divine absentee, who wound up the machine of nature and left it to run untended. That was the general 18th-century way of thinking. God was apt to be thought of as purely transcendent, not immanent in the world. (2) In the 19th century theism is generally used of positive belief in God, either in a personal or a great First Cause; its most explicit form is a declaration, but unassociated with any peculiarities of 18th-century deities. If the word "deism" emphasizes a negative element—rejection of church Christianity—"theism" generally emphasizes the positive element—belief in God. (3) There is also a third usage. "Theism" was reclaimed by Theodore Parker, F. W. Newman, Frances Power Cobbe, and others, for their more modern speculative belief in God, which, while non-Christian or at least non-orthodox, held to an immanent God, continually revealing himself—in the moral consciousness. The ambiguity cannot be cured. We use the word in this article in the second sense.**

1. From this point of view theism is a synonym for Natural Theology, or almost so. But the expression Natural Theology itself has a history. (1) The "three theologies"—Natural, Apologetic, and Catholic—theology, recognized by the early Roman Stoics—probably on the suggestion of a passage in Aristotle's *Metaphysics*, xi. 8—are named by St Augustine (Latinizing the Greek terms) as the "three theologies." (2) Another sense of "theism" may be found in the *Critique of Pure Reason*, "Transcendental Dialectic," Book II, chaps. iii. and vii. It is curious, but, unless for the study of the "abstract" or unquestioned faith of a philosophical theologian, it cannot be pressed. (3)"Cf. Theology," Natorp's article quoted there gives the reference to the passage in Aristotle, but does not recognize its connexion with the last Stoical distinction.
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Theologians generally after him). The name "theism" makes that requirement less emphatic (see below).

Another kindred term is "Natural Religion." We meet with this in the titles of two Latin works by German authors Natu-Religion. in reply to Lord Herbert of Cherbury. They use it with strong condemnation, from the standpoint of rigorous Christian orthodoxy; but it comes into England within very few years upon the Christian side—religion against irreligion—in Bishop John Wilkins's Principles and Duties of Natural Religion (1678). The author died 1672, and left the book unfinished; but the language of the title occurs in the first sentence; so it is undoubtedly Wilkins, as well as sanctioned by his editor and connexion through marriage, Tillotson, afterwards the archbishop. We meet with "Natural Religion" again in Samuel Clarke's works, and notably in Bishop Joseph Butler's Analogy (1736). Thus, as employed by most writers, "Natural Religion" connotes neutrality or even friendliness towards Christianity; just as is the case with theism in sense (2), or with Natural Theology. "Deist," or sometimes "theist" in sense (1), or Naturalist, is a term of repugnance with English 18th-century apologists, but not with Natural Religion. If there is any reference between their "theism," or "Natural Theology" on the one hand, and Natural Religion on the other, it is to be found in the more practical character attaching to natural "religion." While Romans i. 19 and 20 (yet cf. Acts xiv. 17, xvii. 24, &c.) is the main New Testament passage which seems to recognize a Natural Theology, Rom. ii. 14. 15 may be said to assert Natural Religion. When the expression Natural Theology comes to the front one more with Archdeacon W. Paley (1802), this is a sort of after-birth or anachronism.

Natural Law.—We do not pretend that Law of Nature—the jurist's term, not of course that of inductive science—is Natural Law. It is a term of distinction, of great importance historically, bearing the marks of the Stoic doctrine of "nature," and helping to turn men's minds towards a "natural" theology. A pantheist may believe in Law of Nature and go no further; a theist who accepts Law of Nature has a large instalment of natural theology ready made to his hand; including an idealist, or else an intuitionist, scheme of ethics. Both jux naturale and lex naturalis are as early as Cicero, and the jux generium of the Roman lawyers is earlier still. Ambrose of Milan (Epistles ix. 71) quotes it. It is intelligible in its main—i.e., the passage already referred to, under "Natural Religion"—as an attempt of St Paul's words suggest that form of thought and may conceivably have been suggested by it. J. G. Ritchie's Natural Rights, from the point of view of a very hostile (evolutionary) idealism, sketches the early history of the phrase Natural Law.

The philosopher in Abelard's Dialogus inter Judaeum Philosophum et Christianum expects to be saved ex sola legi naturali; here "law of nature" is fully equivalent to Natural Religion, and the word sola sets it in contrast with Christianity. Not to speak of the canonists, Thomas Aquinas gives natural law an important place; while Melanchthon, drawing from Aquinas, gives it an entrance into Protestant thought. Zwinglei and Calvin on the other hand prefer the positive view of law as instituted by God far back in history in the days of the Old Covenant; but, when excesses or controversy puts pressure upon them, they fall into line and reiterate the appeal to a Natural Law. Richard Hooker, again with traces of Aquinas, uses the conception as a weapon against Puritanism, with its aggressive positivism of scriptural precept. Natural Law, he claims, leaves room for discretionary arrangements like episcopacy; Scripture does not mean to supersede the light of reason. It is intelligible that Locke (Treatises of Civil Government) should have a relish in quoting Hooker against the divine-right royalism of Sir John Filmer; but in Locke there is already a revival of belief in the (beau-ideal) "state" of nature and a growing emphasis upon natural rights; ideas which, heralded by Rousseau, echoed round the world in the French Revolution. Locke had spent some years in Holland, the country of Grotius, who, with help from other great lawyers, and under a misapprehension as to the meaning of the Roman jus gentium, shaped modern concepts of international law by an appeal to law of nature. This moral ideal rendered considerable services to civilization; we must not forget these, in the offence which the myth of a primitive golden age may offer to our historic sense. The kernel is sound enough though the husk is a poor thing. Finally, it is of some interest to note that Chr. Wolff, in the intervals of his chequered theological career, lectured and wrote as a jurist upon the Law of Nature.

"Philo-phy of religion" is the modern term. It is again not exactly a synonym, though more nearly so than the last. The new phrase indicates that we are to approach the thought of God through a study of religious beliefs and practices; "theism" tended to make God a purely scientific inference from the facts of nature. But "philosophy of religion" can be construed in many different ways. An investigating historian might set out to find out perhaps one who definitely disbelieves and rejects theism—may yet interest himself in tracing out the psychology of religion. Or a philosopher like Hegel, armed with a metaphysical theory, may descend upon the facts of religion and interpret them in its light, till they almost lose their original significance, which we might provisionally define as consisting in this, that the believer in any religion finds himself helped or (as he claims) saved by it. Again, we must not be misled by verbal idiosyn-krases. What James Martineau calls A Study of Religion is really in the main a re-statement of old theological arguments.

[Wallace's Gifford Lecture may be consulted upon this phrase also. He observes with truth that Natural Theology, if you remove from it the idea of subordination to Christianity as (claiming to be) a special revelation, tends to pass into a philosophy of religion. But it does not follow that the new standpoint involves what Wallace seems to hint, though he conceals his meaning behind complimentary rhetoric—rejection of church Christianity. A. M. Fairbairn's Phil. of the Christian Religion shows by its very title that an effort is being made to combine great confidence in metaphysics with strong belief in the uniqueness of Christianity and the effort will be found to fail. Possibly, fuller study of religions may help theologians to formulate the imperial claims of Christianity more happily than in the dry contrast between what is "revealed" and what is "natural." But that contrast is traditional; and it is implied in the ordinary theological usage of such phrases as "natural theology" or "natural religion" and almost of theism."

Comparative religion, or, as some call it, history of religion, is yet another modern study, closely akin to the last discussed, although more strictly confined to registering the sequence of religious phenomena and less disposed towards criticizing them or seeking in them for the keys of our present religion. Comparative religion is a special locus in the history of religion. The historian observes and records, in different lands and ages, the rise or explicit utterance of belief in one God.

Some uncertainty may be felt whether pantheism should rank as a theism. Is unity the main point? Or is it personality rather of prime importance, though doubtless presupposing unity? (Usage does not allow us to rank polytheism simply as a form of theism.) E. Troeltsch, Kultur der Gegenwart, Teil I, Abs. 4, p. 170, finds that the wisdom of the priests, in one land after another, rises to the thought of divine unity. That suggests pantheism, the usual form of such esoteric wisdom. Professor T. W. Rhys Davids (American Lectures, P. 37) sums up that, when the name of an earlier deity is

1 Recorded in J. G. Walsh's Bibliotheca Theologica Selecta (1751).
2 See Wallace's Gifford Lecture.
3 For the influence of that conception in theology, especially through the medium of Isidore of Seville, see successive chapters in A. J. Carlyle's Hist. of Mediæval Political Thought in the West, vol. i.
4 See (with writers already mentioned) Sir H. Maine's Ancient Law.
5 See his Introduction.
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attached to the object of supreme worship, monothelism proper is approached; while, when a new thought-construction is put in the supreme place, there is a tendency rather towards pantheism. So far as this is true, theism (proper) would seem to be an accident of language.

There is a further problem; whether monothelism is of very early occurrence. Belief in a primitive historical revelation, once universal among Christians, has almost disappeared; but belief in a very early and highly moral theism is stoutly defended, chiefly on Australian evidence, by Andrew Lang (The Making of Religion and other works). If Lang is right—"primitive" peoples drew typical theistic inferences, and argued to God from nature and from conscience, though without displacing other types of religious belief and practice. In many regions—Egypt, Babylonia, &c.—individual investigators of the great religions have thought they found traces of an early—one hesitates to write, of a "prIMITIVE"—monothelism. Perhaps J. Legge, who finds true theism at the dawn of Chinese history, is the most authoritative representative of such views.

Passing to later times, we can watch a theory of monothelism rising, and dying down again, during what our scholars distinguish as the Brahmanical period of Indian religion.

Brahmanism, as distinguished from the Brahmanical period of Indian religion.

The supreme god, Isvara, has the personal name Prajapatı, Visvakarman or some other. But this theism is lifeless—a "palace and shallow deism, which India has often confessed with the lips, but which has never won the homage of her heart." The thought of India is upon the side of pantheism. Again, the heretical Egyptian king Amenophis IV., or Akhenaton, one of the sovereigns to whose government the celebrated Tell el-Amarna letters from Palestine were addressed, was a zealous champion of the exclusive claims of the sun-disk God, Ra; but his policy died with him. In Babylonia a mutilated inscription printed by T. Pinches (Transactions of Victoria Institute, vol. 26), identifying (so far as preserved) thirteen other Gods with Marduk, has been hailed by Friedrich Delitzsch (Babel und Bibel) as the great fountain-head of monothelism, and has influenced the bold if very precariously conjectures of H. Winckler.

Of more assured importance was the Zoroastrian faith—"pure moral dualism if not theism" (L. H. Mills)—which proved its seal by persecutions. But later times nearly strangled Zoroastrian piety, not only by laws of ritual purity but also by newly evolved secondary deities—personified attributes, and the like. So that here again theism, if theism it was, did not continue in strength. If we understand by theism not simple belief in a divine unity, but such faith in one divine person as will constitute the basis for a popular religion, then—unless we allow a doubtful exception in Zoroastrianism—we must agree with those historians of religion who affirm that the world has known only a single living monothelism, viz. that of the Old Testament, along with what are historically the daughter faiths, Christianity and Islam.

The theist believes that he can further trace many incomplete workings of the monotheistic instinct in the history of religion.

Incompleteness of theist impulse.

Not only is it true, as A. Mensies observes, that "Reason knows only God, not Gods"; if we take religion as saving help, no worshipper possesses religion in full security until he has gone straight to the fountain-head, and gained the friendship of the God of Gods. Indian Vedic henotheism (otherwise called kathenotheism);

Semitic monolatry, so important as the probable starting-point of religious development in Israel; the Greek use of "Zeus" almost as we say "God"—even the attempt to arrange deities in a monarchical pantheon, all show the tendency, though it so seldom attains a real victory.

1 A. Barth, Religions of India, Eng. trans., pp. 29, 30, 69. We may probably extend this hostile judgment to the theism of the modern Sámsé-as.

2 The centralizing of worship at Babylon by its last king, Nabonidos, hardly seems to have amounted to monothelism.

The two terms are explicitly identified by F. Max Müller, their inventor (e.g. Hibbert Lectures, chap. vi. p. 271).

II. We have already suggested that theism covers more ground than the name at first may suggest. It can never quite confine attention to the problem of the being of God. Where God is believed in at all, it is believed that upon God everything else depends. With the thought of God, accordingly, there is correlated a modification in thoughts upon all other subjects; and a full system of theism must discourse of "God, of the world, of the Soul," like Matthew Arnold's Moses. In other words there must be doctrines regarding matter and mind, the world and the self, as well as those about God. Absolute theism, which is believed to exist behind both, revealing Himself through them. This way of approaching theism is illustrated in A. C. Fraser's Gifford Lectures, or in earlier times in the writings of Christian Wolff, whose sciences, according to the slightly different nomenclature which Kant imposed on them, were "rational psychology," "rational cosmology," and "rational theology." Kant swept away, so far as his influence extended, such "dogmatic metaphysics" and the old-fashioned theism which it constituted or included; but Kant himself introduced, in his own more sceptical yet also coherent system of doctrine, a new type of theism. He defines God, Freedom, Immortality, the three "postulates" of the "practical reason." It is tempting to try to correlate the members of this triad with the individual members of the older triad. But that would only mislead us; free will and immortality are really predicates ascribed—on whatever grounds—to the soul; and it is natural that in theism the soul of man should be a topic second in importance only to God Himself. Every theistic system, or almost every one, makes provision in some way for Kant's three postulates. Accordingly, even in a hurried survey of the history of theism, we must try to question the systems we are reviewing upon their attitude towards human freedom and immortality, as well as upon their doctrine of God. Sometimes it will be found that free will is asserted as an assured fact, as a datum, and so as a ground of inference to God. But sometimes free will is rather a probandum. In Christian theology, much labour has been spent upon vindicating man's freedom against God's intrusion, or upon blotting out human power in order to leave room for the divine. Theism suggests at the very outset that we should rather expect to find a correlation between the two. If there is a God at all, he must be thought of as the guarantee of freedom in man and as the pledge of his immortality.

The mention of Christian theology may remind us that, for the majority of theists in medieval and modern times, theist proper has ranked only as a secondary wisdom. It is possible for Christians to work out natural theology in separate detail; but we cannot wonder if they rarely attempt the task, believing as they do that they have a fuller revelation of religious truth elsewhere. In point of fact, as we look to history, we find that theism has been much simplified and cut down. First of all, attention has been concentrated upon God. One does not suggest that this concentration was an error. On the contrary, even Christian theology makes at least the effort to show that the thought of God regulates the whole system of belief. Yet while an adequate doctrine of God may settle everything in principle, we ought to remember that there are applications of the principle, apart from which we do not see our way clearly. As a second step in concentration, attention is almost confined to the question "Does God exist?" and to theistic proofs as answering "Yes." The further question "What is God?" is shunned, as if there could be no two opinions regarding that; whereas in truth there are two hundred opinions. A. B. Hulse feels that so strongly that the natural theology section of his Apologetics entirely omits the question "Does God exist?" in favour of the question "What is God?" Perhaps that is equally one-sided. When we do find theism dealing with the question "What is God?" it tends to borrow from scholastic forms of Christian theology the scheme of Being and Attributes (see e.g. Wolff). But such a scheme gives at best an

Subordinate elements of theism.
external preliminary description of the object to which it is applied.  

So our wealth of material narrows down in the ordinary handling to a single question. God, the world, the soul, free will, immortality, optimism; What then is God? All these questions, and perhaps others, tend to conceal themselves behind a single discussion: Does God exist? But further still. Either the fuller or the narrower way of dealing with theism will differ according to the philosophical standpoint of the particular theist who speaks to the question. As long as the battle of the philosophies endures, theism can hardly be unified. Its history is not so much that of a single evolving doctrine, but rather the history of many and diverse theistic schemes.

III. It may help us if we rapidly review at this point the leading types of philosophy in their application to the theistic problem. Grouping and naming are fixed here for one special purpose. From other points of view they may perhaps appear open to blame; but it is hoped they will throw light upon our present study.

The simplest basis for philosophy is empiricism. Such a philosophy makes little serious attempt at constructive work in antiquity; but, upon the first great victories of physical science in modern times, a desire arose to extend the new and wonderfully fruitful method to the ultimate problems of speculation. Let us take experience as our teacher! Let us stand upon realities—upon facts! Difficulty may be found in carrying out this empiricist programme; but at the outset no one dreams of failure. Beginning with the certainties of everyday experience, it reaches theism at last by means of an analogical argument. Many objects in nature, organisms especially, seem to resemble the works of human design; therefore with high probability we infer a designing mind behind nature, adequate to the production of these special results. Having got such a mind, we may next inquire whether, on the principle of parsimony, it will not account for more; perhaps for everything in nature! But the starting-point of the argument in question is the purely empirical evidence of a single fact or set of facts; it proceeds by way of analogy, not of strict demonstration; and it claims for its results nothing more than probability. From Socrates, in Xenophon's Memorabilia, downwards, the argument is tolerably common; it is notable in Cicero; in the modern discussion it dominates the 18th-century mode of thought, is confidently appealed to though not worked out by Butler, and is fully stated by Paley. The argument does not necessarily imply empiricism in philosophy; still, it is peculiarly characteristic of empiricism. In ethics empiricism begins by recognizing that man possesses sensations, and so is liable to pleasures and pains. Hence, early empiricism makes ethics simply a calculus of pleasures ("hedonism"). We may doubt, with W. E. H. Lecky, whether such a philosophy affords a basis for natural theology at all; but the attempt is made. As J. S. Mill tried to reconcile criminal law and its punishments with his very hard type of determinism by saying that law was needed in order to weight the scale, and in order to hold out a prospect of penalties which might deter from crime and impel towards good citizenship, so Paley held that virtue was not merely obedience to God but obedience "for the sake of eternal happiness." A second type of hedonism—less ignoble, but perhaps also less logical—calls men to seek the happiness of others. Paley includes that too; virtue is "doing good to mankind," in obedience to God, for the sake of heaven.

The second type of philosophy, for our purpose, is intuitionism. It finds its chance in the misadventures of empiricism. The Scottish philosophy of Thomas Reid and his successors is immediately related to David Hume's scepticism. It is no more than the genuine outcome of Locke's sensationalist appeal to experience when ripened or forced on by the imaterialism of Bishop Berkeley—God and the soul alone; not God, world and soul. And so the Scotsmen fell back upon the witness of consciousness. They did not make much use of the word "intuition," which may indeed be taken in different senses, e.g. of visionary experiences as well as of the principles of "common sense" (i.e. universal beliefs). They spoke of 'natural realism' and a 'natural dualism' of mind and matter (restituting here the element which Berkeley had struck out). Still, they do not repudiate the word "intuition," and kindred writers make it prominent. The term is borrowed from, Sight, of all the physical senses the one which most rapidly instructs the mind. You see, at a glance, that things are so. Indeed, there is a further implication, when the term intuition is borrowed for mental vision; you see at a glance that things must be so. Here then characteristically intuitionism occupies a half-way house between empiricism, with its appeal to real given fact, and idealism, with its appeal to necessity. The senses, in perception as contrasted with sensation, are held to give us immediate knowledge. The prejudice for, and possibility of, doubt, that things are so and so. This is Reid's first reply to Hume. Define more carefully than Locke did, with his blunder about "ideas," the process of perception, and you cut up scepticism from the roots! So far, this philosophy has little bearing upon theism. But Intuitionism has further arguments for the doubter. Besides testimony from outer sense, we have testimony and teachings from consciousness within—"first principles," as Reid generally calls them. There are some principles which, as soon as they are presented to the mind, and not merely grasped, must be assented to; we see the truth! Two regions become prominent in the working out of intuitionism, if still more prominent in the widely differing philosophy of Kant—the regions of mathematics and of morals. Though J. S. Mill boldly affirmed that there might be remote realms in space where 2 + 2 did not make 4 but some different total, even empiricists may hesitate to concur; and yet Mill's assertion is at least the most obvious empiricist reading of the situation. If all knowledge is drawn from experience, statements universal in form are but generalizations, holding within the limits of actual experience, or advanced beyond them at our peril. Geometry again is regarded by thoroughgoing empiricists as hypothetical. It deals, according to Mill, with arbitrary and imaginary constructions. If there were such a thing as a triangle contained by absolutely straight lines, its three angles would no doubt measure what Euclid says; but straight lines and true triangles nowhere exist in rerum natura. Kant's point is ignored, that deductions from these "imaginary" figures apply to the "real" world of experience. Every time we survey a field, we go upon the principles, not of special experience, but of a priori necessity. Given certain linear and angular measurements, the area must be so and so. Great as the difference in the mathematics to morality, yet there are striking similarities, and hence his arguments for "immediate knowledge" claims to find much support. If we accept moral ideals at all, we are no longer in the world of mere phenomenal sequences, but in a new world. It is a problem for empiricism; given a world where nothing but phenomenal sequences exist, to account for moral ideals. Vulgar materialism sneers at the problem; duty is a fraud or hogbobbin, a mere superstition. Even Jeremy Bentham, restive under appeals to vague and intangible standards, breaks out in despairing indignation against the word "ought" as "the talisman of arrogance, indolence

1 Criticism of the scheme, from the point of view of an idealist, theism, will be found in John Caird's Introduc to the Phil. of Religion, chap. viii. Yet the formula is serviceable. Perhaps it is even indispensable as a preliminary statement. We find it substantially repeated in the famous sentence sented in a useful book, A. Calcott's study of The Phil. of Relig. in England and America.

2 An outline of the history of theism is reserved for Section IV.; but it has not proved possible to sketch the types of philosophy without introducing references to the history of philosophy and sometimes even to the history of theism as well.

3 Of course the Design Argument was well known in antiquity, but not the type of philosophy which stands or falls by that line of "proof."

and ignorance," and as "an authoritative imposition." Later ethical empiricism is more refined. J. S. Mill recognizes an ultimate difference in quality between higher and lower pleasures. A. Bain finds that benevolence is one given element in man's original constitution. H. Sidgwick holds that intuition must justify the claims of the general happiness upon the individual, though everything subsequent is hedonistic calculus. Herbert Spencer finds that the modern individual has intuitions of duty which represent the inherited experience of what has been good for the race in the past. Sir Leslie Stephen finds that moral laws are the conditions needful for the good of the social organism, and are imposed as such by society upon its individual members. The problem has altered its form. What the modern empiricist needs is a rational bond uniting the individual with the community or with the aggregate of individuals—a rational principle distinguishing high pleasures from low, sanctioning benevolence, and giving authority to moral generalizations drawn from conditions that are past and done with. The non-empirical moralist will not of course admit that duty to the community or to mankind is a final definition of the ethical ideal. He will accept it as a stage, of no small importance, in progressive definition; but he will seek to go further.

We have already remarked that the difficulties of empiricism constitute the strength of intuitionism. A critic of intuitionism might add that they are its whole strength; intuitionism is sound upon the intellectual and moral plane of human activity, but in its lower stages, it does not justify them. It reasserts them, with resolute loyalty; but if philosophy ought to vindicate, to explain, perhaps incidentally to modify, even it may be, to purify our primary beliefs, intuitionism is hardly a philosophy at all. For good or evil, so far as there is an accepted line of theistic doctrine, that doctrine is intuitionist. Other schools of philosophy pay flying visits to theism; intuitionism is at home there. Its leading argument is the cosmological, concluding to "God as cause" (Martineau). When David Hume (Dialogues concerning Natural Religion) protests that the universe is a "singular effect" and that we have no right to affirm a cause for it, unless we have experience of the origin of many universes, and can generalize upon the conclusion, They all have causes—he may be unassailable upon empiricist grounds. But intuitionism claims to allege a higher certainty; everything (or every change) must have a cause—this is not merely actual fact but necessary truth. The universe exists—or, as otherwise stated, the universe is "contingent"—therefore, even without detailed knowledge of many universes, we can affirm that it must be caused, and in its "Great First Cause" we recognize God. It is generally stated that this argument was for the first time definitely formulated in Aristotle's philosophy. Of course the cosmological argument is rare or never left to stand quite alone. The design argument is available for the slightly bolder philosophy of intuitionism as well as for empiricist theism. But there is yet another argument which is even more important. Moral elements must enter into theism at some point: and, as against empiricism, intuitionism is morally strong. Hence it has a moral argument in reserve. Moral law implies a law-giver; "we are conscious of moral dependence" (Robert Flint). Still the main weight of the intuitionist theism rests upon the conception of God as First Cause.

As a philosophy, intuitionism leaves the mind in all the embarrassment of an indefinite number of separate starting-points. Every percept is such a starting-point; it is an immediate certainty, remaining with us unmodified as the basis of reliable inference. Every First Principle of the mind is a starting-point too. Reid—certainly a very unsystematic thinker—furnishes long and random lists of "first principles"; a later writer, J. M'Cosh, in his Intuitions of the Mind, attempts a more systematic study. (For ethics we may also compare Miss F. P. Cobbe. Contemporary with Reid and even more popular in treatment was James Beattie; Dugald Stewart with trivial modifications followed Reid; but in Sir W. Hamilton and H. L. Mansel there were sweeping changes in the direction of agnosticism—changes due partly or primarily to the influence of Kant.) Memory is included among First Principles. Testimony is also a First Principle (this is aimed against Hume's Essay on Miracles). Inevitably the question forces itself upon the mind, is not some fuller synthesis possible? All these isolated starting-points of thought are said to be, one by one, necessary. Is there no higher or broader necessity? Can we not attain to some further-reaching philosophy?

If we swerve "Yes" to that question, we pass on from intuitionism to idealism—an idealism not on the lines of Berkeley (matter does not exist) but of Plato (things objects an ascertainable rational necessity). This third possibility in philosophy does not enter at all into Lecky's grouping referred to above; in fact, it is very generally strange to older British thinking, which, if it conceives any tertium quid besides empiricism and intuitionism, is apt to think of scepticism. The fixed given points of intuitionism furnish Hamilton with one of his "starting-points," and he goes on to formulate a "faith" or "faith philosophy." You cannot prove any first principle. You accept it by "faith." So—for this among other reasons—we infer that knowledge has narrow limits, beyond which doubt, or faith, presently begins. But is it really a matter of faith that two and two make four? Do we believe where we cannot prove that the whole is greater than its part? A less sophisticated intuitionism would rejoin with great force, "These are matters of sight; it could not be otherwise, and you see that it could not!" Hamilton's line of thought may, however, impress on us the conviction that it is extremely natural for philosophy to pass beyond the limitations of a purely intuitionist programme. It does so notably in Kant. He is a most difficult writer; different readers understand him differently; and he uses in the earlier parts of his Critique of Pure Reason much of the language of intuitionism. But nothing is more certain than that his thought is a strong solvent of the intuitionist way of thinking; and he has had an immense influence in many directions. We may state his chief results in our own words. First he breaks up the percept. It is no ultimate given point of perception or intuition; it is due to the reaction of thought upon sensation. Sense alone will never create orderly experience, as empiricism supposed; but a group of sensations reacted on by thought does so; it becomes, it is, a percept. Secondly: the "forms" of time and space, not referable to any sensation, and presupposed in every experience, come from the mind ("Transcendental Aesthetic"). Thirdly: we cannot explain how these three elements—sensation; time and space; thought—work together. True, Kant refers often to the idea of a "perceptive" or "intuitive understanding," whose thought would produce the whole of knowledge out of its native contents. But our understanding, he is convinced, is of a different and inferior type. Incomprehensibly, we are dependent upon sensation; and incomprehensibly, we place our sensations in time and space. Fourthly: if we try to think of objects not built up out of sensations and not in time and space, we are

1 Deontology, p. 42. F. H. Bradley (Ethical Studies, p. 2) quotes an even plainer specimen on the conceptions as well as the terminology of ethics in a Westminster Review article (Oct. 1873, p. 311) which describes "responsibility" or (sic) "moral desert in the vulgar sense" as "horrid figurments of the imagination."

2 As Aristotle says, "cause" may be taken as pointing to a truth here, but inadequately, would lead us beyond intuitionism into some phase of idealism. To revise one's first principles is to be an intuitionist no longer.

3 Austin's Jurisprudence explicitly assumes that the dilemma of "intuitive" and "utilitarian" is exhaustive. Hence F. H. Bradley's characteristic protest (Ethical Studies, pp. 82, 83): "If we wished to cross an unknown bog, and two men came to us of opposite opinion, one said there must be a way, and one said there must be a way, and you see there is no one here beside us two, and therefore one of us two must be able to guide you. And the other man does not know the way, as you can soon see; therefore I must—should we answer, 'Lead on, I follow?'"
baffled by contradictions or absurdities. Kant admits that we necessarily aspire to think of such objects—"God, the World, the Soul"—possibly this alleged tendency of our thought is already implied in the dream of a "perceptive understanding." But speculative knowledge breaks down or breaks off at an earlier point. If we try to know the soul, we grasp at a phantom. The "soul" is subject to all the objections of Hobbes and Locke, and never comes an object of knowledge ("Paralogism of Pure Reason").

If we try to know the real world, we find ourselves distracted by opposite arguments ("Antithetic of Pure Reason"), plausible and resistless in attack, helpless in defense. The only thing which the "Ideas" of "Reason" can do for theoretic knowledge is to exert a "regulative" function. They teach the inferior but working part of our intellect, the "Understanding," that its picture of sensuous reality envisaged in time and space must be as fully articulated as is possible—as much differentiated into a detail, and as perfectly integrated again into unity and system. God, for Pure Reason, is an illegitimate personification of the idea of perfected experience ("Ideal of Pure Reason").

Fifthly, there are fixed limits to the possibility of improving the quality of experience. Sense-knowledge is an endless process, inconsistent with the requirements of thought. We can by no means regard the physical world as the real world. But we possess knowledge of the physical world and of it alone. "Things in themselves"—whether defined by Kant, illogically enough, as causes of sensations, or again defined by him as the ultimate reality of a "reality," which thought vaguely points—in either case, "things in themselves" are unattainable by finite knowledge.

Our "reach" exceeds our "grasp" with a vengeance.

So far as a remedy for scepticism is found at all, Kant places it, not within theoretic knowledge, but in moral or "practical" experience. Pure knowledge, for man, moves among a world of appearances, and in that world duty is certain. Mansel charger to "regulative" duty, as we call it, with inconsistency in this preferential treatment of the moral consciousness: all our knowledge, even in moral things, was 'an appearance.' But, wrote Kant, "a regulative or inconsistent" duty was deliberate in differentiating between the ethical and the theoretic knowledge of man. "Analytic" or tautological thought does not become "synthetic" or capable of embracing a real content except under the sting of sensation; why sensation should thus help it is obscure, yet the fact is plain. But analytic thinking is victorious in morals, where the test of "formal self-consistency" distinguishes virtue from vice. The greatness of it is partly that it directs our attention to moral man; and that is a full account of virtue, though Kant proceeds to reinterpret it still further in a much more positive sense as implying the service of morality. True, at a later stage, the moral idea has become itself substantial in Kant's thought, Kant even in ethics. We are allowed moral certainty, but are forbidden the hope of genuine moral victory. Just as our knowledge never gains the assurance of science, so our moral consciousness is immanent, not as a determinate system, but as a regulative one, in which our will is never once able perfectly to obey the law of reason. There is always a taint of feeling in man's goodness. This portion of the ethical theory does curious service in Kant's doctrine of religion. That doctrine runs, briefly, as follows. Duty must be accepted as a given certainty, or it is vindicated—unsatisfactorily enough, perhaps—in the way just explained. Next, from the certainty of duty we infer as our first moral postulate free will—"I can because I ought"; which, primarily at least, means "I know I can because I know I ought." But this strong assertion is greatly qualified when Kant recasts to what he considers the shape of things of our knowledge of the world of phenomena, not freedom rules but determinism. Causality is one of the "categories" which our mind uses in building up orderly experience. So we are left with a see-saw. Will is noumenally free of all phantasies, and all our laws of will, which determine by the past. Secondly: from the discrepancy between the pure abstract law of self-consistent reason and the pleasure-tinged nature of man, we infer or postulate Immortality. As we never see the bull's eye, we must have imperfectly enunciated our conditions of aiming at it, so as to get indefinitely nearer the central spot. If we did hit the exact mark, apparently we never need any longer be immortal. Lastly, God. We must not, we dare not, aim at happiness and the pleasure of ourselves as moral ends. But it makes us constantly shrink aside from the thought of duty towards the forbidden motive—wining under pain, or hungering after joy.

Yet, if the motive is forbidden us, it is plain from another point of view that good persons ought to be happy. And, as nature must conceived great care of the world as an end of itself, not beyond nature to a power who shall make good men as the last as they deserve to be. And this power is God. Such the train of thought as stated for us in the Critique of Practical Reason.

In the Critique of Judgment, Kant restates his new type of theoretic argument in a way which has had great subsequent influence. We must conceive great care over the real end of itself, not for the sake of man's happiness as for the sake of his moral development. Or, to state this as a theoretic argument: we are bound to postulate a God who overrules nature for moral ends. This new statement has at least the merit of bringing God into touch with man's goodness as well as with his happiness. But the train of thought is developed and analyzed as a whole, and so as to imply a sceptical hesitations. In spite of the various details of the Judgments Critique (as to beauty; and as to the "internal" or as Hegel subsequently phrased it "immanent" adaptations seen in living organisms) Kant regards as extremely precarious all these hints of a higher view of nature. Nature as a machine, governed by changeless causal law, is necessary to thought. Were no such machine recognized, the thread of consciousness would be cut and orderly experience impossible; we would all go mad. But nature not, of course, directly or, however faintly, of a God immanent in the whole process, and shaping it towards moral purposes—that is or may be no better reason. Cultivating a "regulative" or "synthetic" duty, we don't have guarantees, as compared with our knowledge of the mechanism of nature. And, after all, nor even our knowledge of the mechanism of nature is a knowledge of reality. Things as they truly are lie wholly beyond our poor human vision.

Kant then has broken away from intuitionalism by substituting one system of necessity for the many necessary truths or given experiences from which intuitionalism takes its roots. But the other key to Kant's thought is the gap between sensation and the sense-forms of time and space; a gap between sense-forms and thought: a gap between the lower but practicable processes of the Understanding and the higher but unrealizable ideas of Reason. And thus Kant's idealism is incomplete. On one side, the world we know by valid processes of thinking cannot, we are told, be the real world. Or, beginning from the other side; neither the reality which ideal thought reaches after, nor yet the reality which our conscience postulates, is the valid world of orderly thinking. The great critic of scepticism has diverged from idealism towards scepticism again, or has given his idealism a sceptical colour, mitigated—but only mitigated—by faith in the moral consciousness. If there arises a system of philosophy in which all truths are grasped in unity, and it is seen that the principles of things must be what they are, such a philosophy will give us in perfection the idealistic conception of reality and the idealistic guarantees of truth which Kant gave brokenly. The Absolute Idealism of G. W. F. Hegel was such a system. It ranks, up to our own day, as the last of the great philosophies, and the boldest of all. Kant had fewer isolated parts of genuine truth into his system, yet gaps and isolation recurred in Kant, and helped to make him the father of modern agnosticism. In the later intuitionalism of Hamilton, recollected from Hegel, the many subjective necessities of the intuitionalist scheme were made to breathe the new agnostic suggestions. We necessarily think as we do—but only because of our entangling faculties. It is a mental "impotence" that makes us believe in such a law as Cause and Effect. Kant had substituted one great necessity, sprung from an ideal source. Reason—under conditions of sensation—created the world of (valid) knowledge; Reason created the practical world of duty. It was said to Kant men went on to the last the idealistic suggestion. The whole coherent necessary world of his philosophy became "our world," as we necessarily think it, but not by any means of necessity the world as it is. Hegel bridges these all these hesitations. His Philosophy of Nature—one of the last admired parts of his system—is the answer from his point of view to Kant's assertion that a "perceptive understanding" is for us impossible. Hegel offers a supposed proof that Time and Space, Matter, Nature, are ascertaining and definable

1 Mansel's term for Kant's "practical." It must be carefully distinguished from Kant's "regulative," which refers to knowledge—regulative in contrast to constitutive of knowledge—not to practice.

2 This is Kant's positive refutation of Hume's scepticism.
necessities in a reasonable universe. Rational system is the first and last word in this philosophy. The element of given-
ness, dominant in empiricism, and partially surviving through
intuitionism even into Kant, is submerged in Hegel's thinking.
Everything is to be exhibited, in outline or in essence, as the
working of necessary truth. You need not wish anything in
the universe to be other than it is; as well grumble at once
that it is; as well grumble at once that
Hegel, while pantheistic,
will not emanate from
theology of fact and principles. Nothing is bare fact. Philo-
sophy will show you that everything has to be so and so.
The effect of this point of view in regard to moral perceptions is that
they represent an important relative truth, but that philosophy
"passes" beyond them into a higher region, where imputa-
tion of guilt is absolutely meaningless.2 Is the "judgment of
Good and Bad." More peculiarly his own is Hegel's great doctrine
of contradiction, whereby opposing views of truth
rank as stages in one progressive definition. We
may explain this to ourselves as an extraordinarily
vehement recoil from Kant's delusion of formal
logic with its principle of "analytic" tautology. As a result,
Hegel's system undertakes to show candid minds that
incompatible assertions not only may but must both be true.3
Through this unexpected and obscure principle of "dialectic"4
Hegel claimed to fulfill his programme of interpreting everything
as manifest necessary truth of ideal relationship. It all must
be so and you see it must.

Hegel wrote extensively upon religion, especially in his Philo-
sophy of Religion.3 It remains doubtful whether he was a
theist with large pantheistic elements—such as every
 speculative mind will be likely to incorporate in theism—
or a pantheist rejecting theism altogether. We may
regard his ambitious programme as the last logical
development of idealism and indeed of philosophy itself. If
perfect knowledge be possible for us, it must take the form of such
a system as Hegel offers. If the world exists purely to be
known, and if every other working of reason comes into con-
sideration qua incomplete knowledge, Hegel is right with his sweep-
ing idealism. Or at least he has rightly seen what are the
assertions to aim at; it is difficult to accept the principle or method
upon which his answer to the riddle proceeds, the dialectic method.
Perhaps it was necessary for human thought to try how far it
would carry out this programme. And may not its failure, as
such a programme, be neither possible nor desirable. If such
are our conclusions, we return to a possible basis for theism not very far removed
from that of intuitionism. Certainly history shows that theism has
generally been associated with some reduced or limited form of
philosophy, usually with the intuitionalist scheme. It is not the
first runnings of the stream of religious thinking which have given
the world its theistic philosophies. Theism is an afterthought
—the result of the attempt to defeat the absolute justification of the
world, which was announced itself at first as a prophetic certainty. But no more
is theism the first runnings of the stream of philosophy. It is
philosophy harnessed to a practical and religious interest. It is
philosophy designed to answer this question:

Theism then has its most habitual affinities with intu-
tonism, but may fall under any one of our philosophical or
quasi philosophical types. We have distinguished three types or
tendencies: empiricism, intuitionism, idealism. They deal
respectively with what is—with what is and partly with
what must be—with what must be. They are based on facts—
upon facts in the light of principles—upon principles purely
and ultimately upon one principle. They claim probability—
moral certainty—mathematical certainty. They incline to the
Design Argument and Analogy—to the Cosmological argument
(with other elements in a subordinate place) and proof by
inference—to the Ontological argument. This last and boldest
argument is a system of idealistic philosophy in a nutshell,

1 It may be asked, Why can God not create a triangle whose
three angles shall not be equal to two right angles? To abstraction
and ignorance everything is possible." From notes of a class lecture
by Dr E. Ca.3

2 F. H. Bradley, Ethical Studies, p. 4.

3 J. E. MacTaggart (Studies in Hegelian Dialectic) contends that
direct contradiction is confined to the elementary portions of Hegel's
Logic. In the more mature portions, every eventuality is, though his inter-
pretation, could one accept it, softens the paradox.

4 Used by Kant sceptically of the limitations of reason, dialectic
in Hegel becomes constructive; and scepticism itself becomes a
stage in knowledge.

When such a system is worked out in full detail, it essays or
ought to essay a proof of the following points: (1) God or the
Absolute necessarily exists; (2) He necessarily is what He is;
(3) He or it necessarily manifests itself in the finite, (4) and
necessarily manifests itself in just this finite which we know
from experience. If philosophy is able to fill up that pro-
gramme, it justifies itself; it raises all limits of necessary truth;
contrasted, indeed, with something of the same kind in German
philosophy, this would also be theistic or pantheistic, or
theism, whichever turns out victorious, must hereafter rank as
a demonstrated certainty.

Again, these contrasted philosophies throw light upon the
meaning of a posteriori and a priori in Kant and subsequent
writers.5 To empiricism, all is a posteriori. To in-
tuitionism, half is a posteriori and half a priori. To
idealism, all is a priori. Not that a posteriori is denied,
or that idealism even in Hegel tries to evolve reality
out of the philosopher's inner consciousness. Mere given
fact may be the starting-point; but it is supplemented. We see by
degrees—in general outline or upon general principles—that
what is is no other than what must be.

There is another conception of necessity which has estab-
lished itself in the history of science and philosophy. We may
call it mechanical necessity. If this conception is
regarded as full and absolute truth, it involves
materialism. When we collect the empiricist start-
ing-point of science, it is curious to observe with what vehemence
the average man of science now rejects free will. To him, it
appears almost an absurdity. But is it not true that man is in the
process of preparing to go anywhere at the bidding of apparent facts,
unconcerned about rational probabilities. On this ground James
is a libertarian. The fact appears to be so; he reports it.
Similarly, James is willing to believe in many universes
neben-
einander or durcheinander but not ineinander. Dualism,
pluralism, manifold parallel inconsistency may belong to the
nature of fact. Does our intelligence demand unity? That
may be a mere subjective fancy. Even polytheism,6 or some-
ting indistinguishable from it, is suggested to this doggedly
empiricist mind by the Varieties of Religious Experience; they
are all good to those in whom they appeal; and we accept
right have we to talk of objective standards?8 Ordinary "in-
ductive" empiricism shows that it has travelled far from
this unprejudiced credulity when it asserts its hard determinism—
uniform law, never broken, never capable of being broken.
But what is mechanical necessity, if we admit that in some
sense it exists? It is a relative necessity. The present and
the future have to be what the past and the absent make them.
Past events, "happening" to be what they were, have fixed
subsequent processes to their channels. But you can never, at
least, say from the scientific or materialistic
standpoint, this "had to be."9 The relative necessity
never passes into an absolute one. A different primitive
"collocation," as T. Chalmers10 put it, would have yielded,
by the same process of natural law as ours, quite a different
universe from ours.11 T. H. Huxley admitted that this contention
would have to be ruled out as impossible. Again, in the scheme of
mechanism, everything is determined by everything else—in

5 (1) Aristotle and the schoolmen meant by a priority reasoning from cause to effect. (2) Kant is often supposed to mean by a priori—see Hamilton's Reid, p. 762—"innate" as opposed to "acquired from experience" (as the Contradiction of the Absolute, which, if he accepts the suggestion offered above—that a priori in Kant and later thinkers
necessary—we place ourselves on the track which leads from
intuitionism to some form of idealism. (3) We have not been able to
answer this argument in such general terms? But this limitation is always
taken for granted.

6 It does not seem as if James's "Pragmatism" could lend itself to anything so concrete as a theistic conclusion.

7 A very different thinker, Dr J. E. MacTaggart, works round from idealism to an eternal quasi polytheistic society of equal souls.

8 H. Spencer's "Instability of the Homogeneous" is perhaps an attempt to perform this trick. (4) Principles (chaps. xii., xiii.

9 Quoted in J. S. Mill's Logic, and with fuller sympathy in W. S.

10 Jevons's Principles of Science.

11 God has ordered the original "collocation"—a new statement of the argument which traces Design in nature.
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space as well as in time; nothing does anything for itself. Yet again, nature is broken up into co-operating parts; the whole is the sum of these parts; or, if you prefer to say so, there is no whole. But, if we should take the view that nature is infinitely extended—part of the "Antithesis" in Kant’s first "Ananthology"—nature will, whether broken down by the last analysis, since boundless nature may overwhelm that sequence which we thought most securely established. Who can say what may emerge from an infinite background? We reach such conclusions when we recognize that the laws of nature are general or hypothetical; not in Mill’s sense ("If you had such a non-existent thing as three perfectly straight lines united in a triangle"); but in a sense noted in F. H. Bradley’s Logic; "If? or? As often as you have the cause working unimpeded, you get the effect."); Pure scientific theory cannot tell you when you have got such a fact, or cause, or whether you ever get it at all. No law of nature contains in itself a promise that it shall pass into operation. Its doing so depends upon the totality of conditions. Materialism supposes that this mechanical order is the real world and the only real world—mechanical monism. stabilization monism supposes that there are two realms—of necessity and freedom, of nature and will, of matter and mind; contiguous, independent, yet interacting—dualism. Idealism in one way or other supposes that mind is more real than matter. And thus its first programme—All is in accordance with reason—may partly contain the more doubtful programme All is reason. In one of the two forms (a) nothing exists but mind (e.g. Hegel, as often interpreted—pantheistically?) or (b) nothing exists but minds (e.g. Hegel, as interpreted by Dr MacTaggart). Anyhow, whatever the method or interpretation is to be, idealism, even more fully than materialism, is pledged to monism and to the rejection of dualism. The valid or scientific but metaphysically untrustworthy knowledge, to which Kant shut us up, was knowledge of a mechanical universe. His reply to Hume was this—Mechanical causation is as real as the unity of consciousness. It is false to suggest that Kant’s reply was a free will and no dualism, to be rejected in dualism. Apart from the very same consciousness, there could be no consciousness of sequences. Over against this "valid" mechanism, in some truer but vaguer region, Kant placed free will; and so left things. The English thinkers influenced by Hegel are inclined to assert mechanism unconditionally, as the very expression of reason—the only thinkable form of order. Thus libertarian free will has to disappear from their belief. In this interpretation of the universe, the difference between mechanical or relative necessity and absolute or ideal necessity is slurred, or dogmatically affirmed to be non-existent. This might be suggested to reply that free will, whether or not it be ultimate truth, is true to the same degree of analysis as mechanical necessity itself. Mechanism is that which obeys impulses from outside. It is profoundly unsatisfactory to regard mechanism as the whole ultimate truth. For such a role it is in no sense fitted. If it is ultimate truth in its own region, that region cannot be accepted as more than half the entire universe of reality (common sense intuitionism; dualism). If mechanical determination applies to the whole universe, it cannot be ultimate truth at all (cf. H. Lotze; more drastic in Ward’s Naturalism and Agnosticism). Quite a different feature of nature and mind is a fragment pointed to by Kant’s "Practical Reason." And, as the sympathizers with Hegel try to force mechanical necessity into the glibber of absolute or ideal necessity, so they seek to show that moral necessity is only an inferior form of absolute or ideal or, we might say, mathematical necessity. Theists, on the other hand, will contend that the distinctiveness of moral necessity is vital to religion. Thus we might restate our group of philosophies in terms of the views they take regarding necessity. Theism is directly interested in this, since it affirms the necessity of God’s existence.

At least, it would be hard to name any school of theists which was content to affirm that there “happened” to be a God. On the other hand, theism does not desire to see necessity—or Fate—ranked as superior to the living God.

One great change and only one since Kant’s day has affected the outlook upon theistic problems—the increasing belief in evolution. It is a manifest weakness in intuitionism that it finds such difficulty in leaving room for evolutionary change. All men may perhaps be aiming everywhere at the same moral ideal, but it is absurd to say that all men actually formulate the same moral judgments. On the other hand, many evolutionists ignore the certainty that there must be a continuum in any real evolutionary process. In the light of that truth, a reformed intuitionism might justify itself. But fuller conceptions of evolution raise further difficulties applied to problems of human conduct, and knowledge cannot be divided into the two components—immediate certainties, precarious inferences. The starting-point is reconsidered, modified, transformed, in the light of subsequent acquisitions. Knowledge grows, not by mechanical addition, but by organic transformation. This may help us to appreciate the meaning of Hegel’s Dialectic. His thought then is not wholly paradox, whatever the expression may be. Hegel’s system is, in its own way, a great evolutionary philosophy of an ideal type. Evolution, repelled by the older intuitionism, was thus incorporated in the great I of all Idealisms. It has also been largely applied to empiricism. Sometimes one questions whether empiricism is really still empiricist; so much of the a priori has come in under the name of evolution (e.g. in Herbert Spencer). But the change, if it has taken place, is unrecognized.

IV. Greek philosophy for our purpose begins with Socrates, who formulated the Design Argument. His ethics have sometimes been regarded as pure utilitarianism (so e.g. H. Schulte); but it is surely significant that the great Idealism of Plato was developed from his suggestions. The new method of definition which Socrates applied to problems of human conduct was extended by Plato to the whole universe of the knowable. In the light of this, it may be possible (with J. R. Seeley in Ecce Homo) to call Socrates the "creator of science." The man who inspired Plato deserves that name. Those Ideas according to which all reality is objectively shaped—and therefore too, as a modern would add, subjectively construed—include the idea of the Good, which Plato identifies with God. We might mislead ourselves if we interpreted this expression as referring to moral goodness; on the other hand, Plato more in the great of all Idealisms. It has also been largely applied of God. With all its Idealism, Greek thought had difficulty in regarding rational necessity as absolute master of the physical world. Matter was a potentially recalcitrant element. Hence there are tendencies even in Plato to build up the ideal world in sharp contrast to the actual world—to the half interpreted or half tamed world of matter. His suggestions as to immortality are affected by this. The body is the soul’s prison. He teaches (whether suggestively, metaphorically or deliberately), pre-existence as well as survival; perhaps he is moved to this by non-Greek influences. Thus at several points theism and evolution are combined, though not yet fully formulated as a problem. Aristotle has impressed the ordinary mind chiefly by his criticism of Plato’s ideal theory; and therefore he is often ranked as the father of empiricism. But those who treat him as the great

1 Ernst Haeckel will not allow us to call his system “Materialism,” because he affirms that the rudiments of matter are also rudimentary “mind stuff” (to use W. K. Clifford’s term). But in spite of this its materialistic affinities are unmistakable.

2 Still, Lotze’s criticism of the cosmological argument reveals his realist side. On the other hand, in discussing the ontological argument, Lotze confesses to himself a convinced belief.

3 We are all embarked upon a troublesome world, the children of one Father, striving in many essential points to do and to become the same (R. L. Stevenson).

4 The idea of evolution in time (physical evolution) was laughed at by Hegel.

A belief hinted again at the close of Lessing’s Education of the Human Race; also more definitely by J. E. MacTaggart (Studies in Hegelian Cosmology, p. 45; and elsewhere).
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Realist make him almost if not quite intuitionalist; while there is also an idealist reading possible. The threatened dualism of ideal and material becomes for Aristotelian mainly a contrast of matter and form; the lower stage in development desires or aims at the higher, matter more and more tending to pass as form. God is form without any matter, but this God of Aristotle’s is a cold consciousness, imitated only by the contemplative virtue of the philosopher, not by the morally active citizen. And the chief contribution of Aristotel to theism is a theory, found in his Physics as well as in his Metaphysics, of God as first mover of the universe, himself unmoved. This theory is generally ranked as the earliest appearance in European thought of the cosmological argument. Free will is shaping itself towards discussion in Aristotle’s Ethics, but is hardly yet a formulated problem. For anything like personal immortality the medieval Schoolmen searched him anxiously but in vain.

 Epicureanism need not detain us. It is a system of empiricism and materialism, remarkable only for teaching free will. Atoms swerved as they fell endways downwards, and thus introduced an indeterminate or irrational element into the processes of the world. There is no special interest in Epicurean particular type of free doctrine, or again in Epicurus’ profession of the existence of the gods—made of atoms: inhabiting the spaces between the worlds; careless of men. Stoicism is a much more important system, but harder to classify as a particular type of free will doctrine; or, again, in the Stoics’ profession of the existence of the gods: the whole world is one body, the whole body is the soul of the world, even the gods of the Stoics: God, the wise, appears in the history of the world as the being who supervises it. Stoicism is the whole trend to deny free will. There is perhaps a certain religious enthusiasm in the teaching of being passively determined by Fate, the Universe, Zeus. Finally, the Stoics’ definition of the process of knowledge is sensationalist and empiricist.

 So far as a coherent body of theistic doctrine exists, it did not grow out of the great systems, but out of the lesser men who stood nearer to the apprehension of practical citizens. Perhaps the most important of these popular thinkers was Marcus Tullius Cicero, no great philosopher, but a graceful and effective man of letters.

 Cicero.

 It has been truly observed that the lineaments of intuitionalism are very clear in him. He also gives us “natural law”—a Stoic inheritance, preserving the form of an idealist appeal to systematic requirements of reason, while practically limiting its assumptions to those of intuitionalism. Cicero adhered to the Academic philosophy during its “middle” or almost sceptical period. (The senses are so far from truth that we must be content with reaching probability.) However, the natural law doctrine of Cicero is not altogether on the Stoic interlocutor. The conclusion, “academically” recognizing the contending of one disputant as more “probable,” is imitated in D. (Diotima of the Symposium.) Cicero was not the only Roman Stoics—Seneca, Epictetus; less material for theism perhaps in Marcus Aurelius—we see the partial softening and religious deepening of the system, and a doctrine of the man’s power over passion and circumstance which has all the essentials of Libertarianism. Philo of Alexandria should also be mentioned. He blends the tradition of the Old Testament with Greek philosophy, and, within the lines, exhibits that union of Platonism with Stoicism, especially in the doctrine of the Logos, which became dominant in the Christian apologists and the great theologians of the ancient church. Philo is in one important respect only truly Stoic: in the theory of signs he preserves the main outlines of Old Testament theism. He teaches free will and immortality; and the design and cosmological arguments are both traceable in him. Augustine of Hippo transfigured the Stoic and the Epicurean views, and left a great mark on the Western church. Against Manichean dualism he had vindicated free will; but as against Pelagianism he taught the bondage of sinful man—a position accepted in the East, but never established in the West and half rejected in the West. From this theological entanglement the problem of free will did not escape for long centuries. In spite of some waverings towards the Pelagian view by late Augustine himself (see Apologiæ) the doctrine of “natural immortality” championed by Augustine became dominant in the church; an institution of what was afterwards to be called Natural Theology; and a Greek theologian or supposition to-day—like free will—in Roman Catholic apologetics.

The middle ages, in the person of Anselm of Canterbury, contributed a first clear form of the Ontological argument for Theism. If our grouping of philosophies, as given above, is sound, every idealist scheme contains potentially an ontological argument. In other words; whether pantheists or re-established a doctrine such as Platonism, and perhaps even whether logically it can be. But the Christian bias is sure to make theologians, who borrow a doctrine of the Absolute, interpret it in a Christian sense; hence we may consider it something of an accident that every philosopher exactly to put the argument in form. Anselm tells us that a perfect being must exist, since the perfection which includes existence is manifestly greater than a perfection confined to an accidental thought. Something else, imperfectly expressed, but quite clear to Anselm’s teaching, was the Absolute simply as one among many other beings, and to his treating existence simply as one element in the quantitative sum of perfections. At least, idealist philosophy will hold that the substance if not the form of the argument is sound 4 though the question of its interpretation remains. In Anselm’s case we have the further sanguine hope of justifying not theism merely but all Christian doctrine to the scientific reason. Thomas Aquinas, following Albertus Magnus, but with greater power and greater influence, occupies substantially intuitionalist ground. He will not have the Ontological argument; but he asserts Natural Law, and relies on the contingency of the universe, of the world, with various refinements and distinctions, differently stated in his two Summæ. In declaring the supreme doctrines of Christianity to be mysteries abstract of the human mind, he marks a low point in the development of a great system. He exercises their acumen in multiplying difficulties; but all such questionable doctrines are presently re-established from a different point of view as truths of faith or findings of church authority. The Church of Rome has discouraged these daring tactics in favour of the more cautious and probably more defensible positions of Aquinas. In Raymond of Sabunde’s form of moral theologian it is true that the existence of a will in the human life is not to be “vain”—we see the kinship of that argument to the argument from design.

René Descartes, a faithful though not an unsuspected Roman Catholic, founded modern philosophy by his starting-point of universal doubt and by his arguments in reply. One may regard him as an idealist, though Scottish intuitionalism—especially in the writings of Professor John Vellech—has claimed him for its own; and indeed Descartes’s two substances of active mind and passive extended matter are very much alike. Whether or not he marks a lower region, the tendency of Descartes’s system is to idealist traits, as when he refutes the ontological argument with clearer emphasis on the perfect being as “necessarily” existent—relying that a shade less quantitative or a shade more subtle than Anselm’s. Descartes’s preliminary statement of the argument in somewhat popular form brings it very near the lines of the cosmological proof. 6 There must be a cause for nature, but particularly for the idea of perfection in us—that cause must be God. The radical side of Descartes appears again in his offering his own type of theism as a substitute for the old proofs—not a supplement. Design especially was under suspicion with him, and he was even more definitely opposed to “final causes” than Francis Bacon, who excluded them from science but admitted them to theology. All this was connected with zeal for physical and mathematical science. Descartes was an expert; Bacon was the prophet of a great, if half comprehended, future; and the science they loved was struggling for its infant life against a mass of traditional prejudices, which sought to foreclose every question by confident assertions about the purposes of God and Nature. A difficult question arose for Descartes’s philosophy, when it had to explain the union in man of the absolutely opposite substances, 7

4 Cf. J. E. MacTaggart in regard to Hegel, Studies in Hegelian Cosmology, chap. iii.

5 See Meditation 3., at least in the French version. Again: “Existence cannot be separated from the essence of God”; compare Spinoza’s ethics, definition 1; “By causa sui I understand that the cause of the existence of which involves the cause of that—which by its own nature can only be conceived as existing.”
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mind and matter. Malebranche gave all causation to God; and the acosmist—as Hegel called him, in repudiation of Bayle's nickname "atheist"—Spinoza, from the premises of Car- 

telianism, and from other suggestions of the past, 

developed that great system of determinist pantheism 

which was a scandal and a terror to his generation. Really, 

he urged, there could be only one substance—Descartes himself 

had drawn a strong hint at the basis of his determinist reasoning 

of Spinoza's Ethics, in process if not in result, betrays its kinship to the ontological argument, with its affirma-

tion of what must be. Thought and extension are peacable 

attributes in this one substance; there are infinitely many 

other attributes, but these only are known to us. 

In a different region, the tradition of Descartes passes on to 

G. W. Leibnitz. He accepts the ontological argument with a 

qualification—almost like his disciple Wolff, who 

tries to use it for defining the divine attributes. Leib-

nitz's Monadology—which has little influence on his theism—

may be viewed as a strong recoil from Spinoza's all-sufficient 

substance. The more Spinozistic side of Leibnitz's thought—

God as Monad of Monads—is a theistic postulate if hardly a 

theistic proof. The free will which Leibniz teaches is not 

libertarian but determinist. Each monad works out necessary 

results, but these flow from its own nature; and so in a sense 

it is free. Reciprocal action is explained away into a "pre-

established harmony" between every monad and all others. 

In his Theodiçy Leibnitz argues, like not a few predecessors, 

that this universe must be regarded as the best of all possible 

universes. Pain and sin must have been reduced to a minimum 

determined by God; though they are so ingrained in the finite that 

we have to make up our minds even to the endless sin and endless 

punishments of hell. It has been truly said that such optimism is 

a profound relative pessimism. The best? Yes, perhaps the 

best possible; in familiar speech, the best of a very bad business. 

But why must universes be so bad? Leibnitz's philosophy 

has no answer for us. In another direction, Leibnitz—and 

Wolff—give emphasis to the contrast between the necessary and 

the contingent; with important results for popular philosophy, 

and indirectly for theism. The disciple, Christian 

Wolff, is one of the most typical figures in the history of 

theistic thought. He is a pure scholastic. The great 

thoughts of his master—or perhaps indeed rather Leibnitz's 

secondary thoughts—are dried and pressed by him, labelled 

and catalogued. Monadology drops out of Wolff's teaching. 

Pre-established harmony drops out—except that it is used 

to explain the union of soul and body. Wolff tells us 

that six Latin works contain his system:—Ontology, General 

Cosmology, Empirical Psychology, Rational Psychology, Natural 

Theology, i; Natural Theology, ii. In the volume on 

Empirical Psychology, Wolff discusses free will. He decides 

that human actions are caused or determined by the nature 

of the agent, but that, as man is not a necessary being, 
his actions are contingent. This view seems to preserve 
all that is questionable in Libertarianism, while omitting its 

moral meaning. The Rational Psychology formulates immor-

tality on the ground that the immaterial soul has no parts to 
suffer decay—the argument which Kant's Critique of Pure 

Reason "refutes" with special reference to the statement of it 

by Moses Mendelssohn. The earlier of the two volumes on 

Natural Theology relies on the cosmological argument; the 

later—obviously an afterthought—tries to vindicate the onto-

logical argument as an alternative basis for theism, but 

awkwardly and with manifest uneasiness. In the end, this 

volume diverges into the Attributes, construing God in the 

likeness of man via eminence.1 No writer can be less intrinsi-

cally worthy of study than Wolff. But he is immortal as the 

man against whom Kant directed his tremendous battery; 

and he is also tolerably characteristic in outlook. He is no 

intuitionist; but he is a drily common-sense mind, piling up 
in heaps the ruinous fragments of an idealist system. 

In England, empiricist thought found a prophet in Bacon. 
He draws no inferences to theology, whether friendly or 
hostile, from his new positions. He takes the line 
of separating the things of God from those of Caesar, 
and defends the traditional Protestant theology with obvious 
simplicity. Thomas Hobbes, a rough and unassuming but vigor-

ous thinker, is the fountainhead of a more formidable 

empiricism. He is almost a materialist. In ethics, 

he is a hard determinist and hedonist, though not without 

qualifications (man's boundless desire for "gain and glory") and 

peculiarities. He saves himself theologically by affirming 

that the good citizen will be of the same faith as the government 

— which had been a monarchy. In that sense, living under a 

professedly Christian ruler, Hobbes himself is a Christian. 

John Locke, the real father of English philosophy, 

philosopher for what he regarded as Descartes's 

impossible programme of "Innate Ideas."2 But Locke is a double-minded or half-hearted philosopher. He admits two 

sources of knowledge—sensation and reflection; and God is to 

him the Great First Cause, especially of our own existence (or 

of the existence of finite minds). This is a form of the 

cosmological argument, and ought to go with an intuitionist not 

an empiricist doctrine of causality. On ethics, Locke says very 

little, although that little is hedonist and determinist. But 

once again in his political writings he breaks away from emp-

ricism in appealing to natural law—an intuitionist or con-

servative and idealist tradition, that is a sensualist and 

empiristic, but incompletely, and without perfect coherence. 

His suggestions led to different developments. In France, 

through Condillac, the inconsistencies were purged out, 

and materialism was ready for the next comer to 

affirm—though it may be said with R. Flint that 

while materialism requires sensationalist psychology, yet 

the psychology in question allows no valid inference to 

matter, and therefore destroys materialism. Bishop George 

Berkeley, afraid of materialistic developments from a 

philosophical field against what he regarded as Descartes's 

system: to recur, took refuge in immaterialism. Locke had treated ideas as testifying to the existence of matter. But can they? The inference seemed unwarrantable. Why should not God, a spirit like our own, though greater, speak to us in this language? In 

Athism or the Minute Philosopher Berkeley gives the fullest 

statement of this argument, while adding more commonplace attacks on the pettiness of religious scepticism. David Hume, 

following up Berkeley's leading suggestion, pointed out 

that the inference to God is as precarious as the 

inference to matter, and that the assertion of a continuous or 

immaterial mind in man also goes beyond the immediate facts. 

The truth is, that all truth is uncertain! Scepticism, with 

which P. Bayle had played as a historian—he amused himself 

too, with praising the Manichaean solution of the riddle of 

the universe—became a serious power in the history of philosophy 

with the advent of David Hume. Still, it may be doubted how 

far Hume was in earnest. Nay, it may be questioned how far 

it is either psychologically or logically possible to turn general 

scepticism into a coherent doctrine. The Dialogues Concerning 

Natural Religion constitute Hume's formal profession of re-

ligious faith. The existence of God was no doubt probable; but 

what a number of difficulties there were! Still, one would 

not dispute whether God existed; but what he was—that was 

the hard question. This treatise must not be confused with the 

Natural History of Religion, in which Hume acts as a pioneer 

for comparative religion, with its study of facts. Even in that 

book Hume is able to play with sceptical solutions. Religion 

began in fear—as if it were no more than a lying superstition. 

Of course once more Hume saves himself by strong professions of 

admiration for rational or natural religion. It was not yet 

socially safe to be a confessed religious sceptic. 

1 And against similar views in Lord Herbert of Cherbury.

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THEISM

Samuel Clarke, who defended Newton's view of the world against Leibniz's strictures, is perhaps chiefly interesting to us as one of the authorities of Bishop Joseph Butler. It is Clarke's defence of free will, Clarke's idealistic theory of eternal "fitness" as the basis of ethical distinctions, perhaps Clarke's teaching on immortality, that Butler regards as "the common foundation of all the modern philosophies," in the region of philosophy or Natural Theism. Butler himself occupies a peculiar position in more respects than one. He has profoundly influenced British thinking, but is little known abroad. He is difficult to classify. We may be helped in assigning him his proper place if we observe that, almost invariably, he accepts certain beliefs which he forbears to press. Thus in his most important contribution to ethics, the Three Sermons on Human Nature—i., ii., iii. of the Sermons—he grants the validity of an appeal to nature upon the lines of a sort of Stoical idealism, but for his own part he prefers the humbler appeal to human nature. He makes the issue, as far as possible, a question of fact. We, from the altered modern point of view, may doubt whether Butler's curious account of the mechanism of moral psychology is a simple report of facts. There are (a) given instinctive "propensities"; (b) a part of higher principles, "benevolence" and "rational self-love," equally valid with each other, though at times they may seem to conflict; (c) there is the master principle of conscience, which judges between motives, but does not itself constitute a motive to action. Butler is opposing the psycho-biologist; but he is not doing the work of an experience that man necessarily acts at the dictation of selfish motives. But Butler—for reasons satisfactory to himself, and eminently characteristic of the man; he hoped to conciliate his age—dwells so much upon the rewards of goodness, as bribes (we must almost say) to rational self-love, that some have called Butler himself an ethical hedonist; though his sermon on the "Love of God" ought surely to free him from that charge. In all this, Butler was convinced that he was giving a simple statement of facts. Any one introspectively apprehending the facts must grant, he thought, that benevolence was an integral part of human nature and that conscience was rightfully supreme. This reveals the empiricist temper, and points to an attempted empiricist solution of great problems. Butler holds that more ambitious philosophies are valid, but he shrinks from their use. The same thing is seen again in the Analogy. Butler divests himself in this book of the principles of "liberty" and "moral fitness" in which personally he believes.

Part i. of this book shows the "Analogy" of "Natural Religion" to the "Constitution and Course of Nature." Probably "Nature" is here employed in a more familiar or humber sense than in the passages of the Analogy means by "nature," indisputable human experience. Deists believed in a God of unmingled benevolence: Butler's contention is that justice, punishment, hell-fire itself are credible in their similarity to the known experiences of man's life upon earth. What the Three Sermons sought to find written small within—a law of inflexible justice or righteousness—part i. of the Analogy seeks to discover written in large characters without us. Butler is charged by Sir Leslie Stephen with arguing illegitimately—professing to make no appeal to "moral fitness," and yet contending that the facts of human life show (the beginnings of) moral retribution for good and evil. Assuredly Butler is met on this ground, but his right to their use is based on his claim about moral evil and good when he waived the "high priori" method of vindicating their real existence. Yet it is a very grave question whether the idea of God's moral government admits of being argued as pure matter of fact. Butler tries to do this. You call it unjust, he says in effect, that you should be punished. You argue, for example, that you have no free will. Well, what of that? Does it not look very much as though you were being punished? It does not seem to treat you as if you had free will. One thing is clear, however: you will not hear any formal argument for the truth of theism. He will not waste time upon triflers who deny what he thinks, in the light of the (empiricist!) Design, is morally true. On the other hand, Butler in personal conviction is an intuitionalist appealing towards the idealism of his age; but in argument he is an empiricist, trying to reason every question as one of given facts. Natural Theism, in this respect, has no appeal to facts—it is the depth and purity of Butler's moral nature—which fascinates the reader, and wins praise from Matthew Arnold or Goldwin Smith or even Leslie Stephen. Precisely because the facts are not the best evidence of any large systems, as of scripture or of a person, the hearer is left to himself. On the other hand, no Christian, and perhaps no theist, is interested in maintaining that Butler grasps the whole shape of the matter: he might say this. If theism is a growing doctrine, Butler in England like Kant in Germany stands for a fresh ethical opportunity.

Stephen accuses Butler of reasoning in a circle. The things which make for our ultimate welfare are the things we call morally good. No wonder if they prove to involve happiness; that is their definition! But is it? Does not Stephen himself rather say that morally good things are conditions of social, not personal welfare? Butler's argument is that the individual sullies (and feels that he suffers deservedly) from neglecting these. If George Elliot is guilty, of a platitudinous when she says that "consequences are un pitying," then Butler's argument is empty: but not otherwise.

Butler on the soul may be studied in chap. i. of the Analogy—where we observe the old assumption of an immaterial and so immortal soul, which is in truth the basis and in fact the main idea of all Butler's thought. Moral postulates make their presence felt, Butler's doctrine of man, as of God, leaps into new vigour.

It is more important that Clarke's Demonstration of the Being and Attributes of God is really a priori. Clarke appeals to the immensity of time and space as involving infinity in God. A modification of his views is the starting-point of W. H. Gillespie's able Argument a priori for the Being and Attributes of the Godhead, published part by part 1833-1872. We find something curiously similar in James Martineau's Study of Religion ("Implicit Attributes of God as Cause," sub fac.). One might also compare F. A. H. Martineau's Valiant Witness: the Life and Work of a personal God—and F. Max Müller's Goff Proceedings. Dismissing his earlier intuitionalism, in order, like Butler, to conciliate an empiricist age, Müller tried to base even sense experience on the immensity of time and space, and the im- of the idea of God. He therefore appealed to the Indian goddess Aditi or Immensity, a deity connected with a set of personal gods called Adityas. Looking into the immensity of space, man also looks into the depths of godhead. Whatever one may think of the cogency of such arguments, it seems safe to conclude that thinkers, who dislike constructive idealism, but accept time and space, find it easier, though perhaps not more satisfying, to believe in the God of Aditi. We have already spoken of Kant's peculiar philosophical positions. One result of these is a very damaging attack upon traditional theism. Kant puts together, as belonging to Kant as to "Rational Theology," three arguments—he is fond of triads, though they have not the significance of their parts. But he has been better known to him which they came to have for the Hegel. Then he attacks the arguments, one after another. Is there anything fresh in the attack? Or is it simply a reiteration of his sceptical contrast between phenomena and noumena, and of his confidence of (valid) knowledge to the former? Perhaps the attack on cause as used in the cosmological argument is independent of Kant's philosophical peculiarities. The argument affirms a first cause, or uncaused cause. Does it not then deny rather than assert universal creation? But that special criticism is a question of detail. A more entirely novel and more general principle of Kant's attack upon theism is the challenge of our right to build up the idea of God bit by bit out of different arguments. The arguments had been regarded as alternative or else as cumulative proofs, all pointing to one conclusion—God exists. Kant insists that they are incompatible with each other.

1 Analogy, part i. chap. i. ("the natural and moral proofs of a future life commonly insisted upon"); last sentence of part i. Conclusion ("the proper proofs of natural religion from our moral nature"); part ii. chap. viii. sub fac., "the proof" of religion, not out of the two . . . principles of liberty and moral fitness.

2 These useful distinctions are stated and well explained in W. R. Sorley's Ethics of Naturalism. Analogy, iii. chap. viii. following S. Clarke?

4 Part ii. of the Analogy tries similarly to establish Christianity as a credible matter of fact, sufficiently analogous to the facts of (empiricist!) Design, to any moral "value judgments" (as Ritschlian might say).

5 See (e.g.) ii. chap. ix. The Three Sermons also point to a moral argument for theism, but forbear to press it (Sermons ii. when the third sense of the word "Nature" is being explained).
other. They offer alternative and mutually exclusive conceptions of God. If the God of the cosmological argument is the "Great First Cause," we have no right to identify him with the "Most real being" of the Ontological argument. If the God of the Design argument seems a limited being, working as an artist upon given materials, he is hardly God at all. Kant takes for granted that we cannot sum up these imperfect conceptions in a wider reconciling truth. It is a shrewd criticism, but needs arguing out. A great deal of popular theism is undoubtedly hard hit by it; for popular theism is apt to throw its arguments together in very random fashion.

It is no more characteristic of Kant's whole speculative philosophy that he should think the Ontological argument the one which comes nearest to success (yet the Ontological argument is held to prove—or rather to point out—not that God must exist, but that we think of him as necessary if we think of him as existing at all). As a result of this, Kant is metaphysically a sort of pantheist. The God whom all our thinking feels after is the all-inclusive system of reality. On the other hand, Kant's religion is of a type which requires a sort of deistic God, standing outside the world and constraining it into moral paths, or standing outside our moral struggles and rewarding our goodness. Butler fears profoundly that there must be a just God who will punish us. Kant hopes, with tolerable strength of conviction, that there may be a just God who will reward us.

The main line in pure philosophy runs on from Kant's wavering and sceptical idealism to the all-including gnosia of Hegel.2

Hegel on the theological arguments.

Hegel inherits from Kant the three arguments, and takes them as stages in one developing process of thought. The cosmological argument points to nature-pantheism, with the religions—especially those of India—which embody that attitude of mind. This involves a re-interpretation of the Cosmological argument, or a criticism of the view ordinarily taken of it. Trace out the clue of causation to the end, says Hegel in effect, and it introduces you, not to a single first cause beyond nature, but to the totality of natural process—a substance, as it were, in which all causes inhere. This is a suggestion which deserves to be well weighed. The Design argument is held to give a contrasted view. It suggests in every deed a personal but limited God, or a number of Gods—"Religions of spiritual Individuality," including, along with "Judaism," the anthropomorphic religions of Greece and Rome. Finally the Ontological argument sums up the truth in the two previous arguments, and gives it worthier utterance in its vision of the philosophical Absolute. This is the last word of religious truth, though pure philosophy stands still higher. And, in some sense not clearly explained, Hegel identifies this final religion with Christianity.

The theism of Hegel is ambiguous.3 Later theists may be grouped according as their thought has been remoulded or not by the influences of Kant. The distinguished writers, whom we have to regard as repeating in essence pre-Kantian theories, generally know Kant, and frequently show traces of him in detail. But it is a plain finding of history that he has brought no "Copernican revolution"4 to their minds. Empiricism is restated by Paley, who is Kant's younger contemporary as a man and also on the whole as a writer. Doubtless the archdeacon knew nothing of the German professor, and would have cared nothing for him however well he had known him. A much more significant figure is that of J. S. Mill in the tentative approach to theism found in his posthumous volume (Three Essays on Religion; 1874).

Mill directs his attention to the Design argument. The inference that organized bodies are due to an intelligent cause is only reached by the "Method of Agreement"—a full inductive proof requiring, according to Mill's Logic, the "Method of Difference." Still, the Design argument is a good sample of a proof by means of the inferior method. Although nothing more than probability is established, it is a high probability.5 Unfortunately, however, the method of agreement is liable to be baffled by plurality of causes. In this instance it may happen that the work of intelligence has only been mimicked in nature by blind forces which have accidentally produced organic life; and Mill is disposed to hold that if the evolution of species should be clearly established as due to natural law—if there has been no creation by special interposition the argument falls to the ground and theism (apparently) is lost.6 A further point is of some interest. If Mill's theism holds, what is it? The belief in a God of limited power. That is what Kant contended that the Design argument pointed to, and Mill, proceeding on the Design argument, claims nothing more for his conclusion. Of course that was not Mill's special or conscious motive for denying divine omnipotence. His extreme sensitiveness and hatred of pain constrained Mill to hold that, if a good God exists, he cannot possess infinite power. Yet the correspondence between Mill's conclusion and what Kant had alleged to be implied in the underlying metaphysical position is very striking indeed.

Intuitionism also has its restatements of theistic reasoning little modified by Kant. R. Flint's theism carefully excludes the early random talk (e.g. Cicero) of an intuitive or innate knowledge of God. What is self-evident, Flint justly remarks, neither needs nor admits of argument.

We have intuitions of cause, of infinity, of good and evil. The Cosmological argument proves, with the help of the first-named intuition, that there is one great First Cause; and the Design argument shows the First Cause to be intelligent or personal. The Ontological argument, though not wholly rejected as a proof, is taken rather as pointing to God's attribute of infinity; thought rather than experience making affirmation that the intuition in question must be attached to God. The moral argument, relying upon the third intuition named, certifies us of a good God. In this way, the attributes are suggestively allotted among the four traditional proofs; but we miss an explicit rebutting of Kant's hostile assumption, that it is incompetent for us to take the thought of God piecemeal. Martineau's Study of Religion is also essentially Intuitionist. It has two parts: "God as cause" and "God as perfection." The Design argument comes in as a special illustration or intensification of the former of these, i.e. of the cosmological proof; but Martineau follows a side modification of intuitionism (Maine de Biran, &c.) in identifying cause with will. This involves a very high doctrine of Libertarianism. The only ultimate cause is God. Nature exists over against Him; but its forces or processes are His own power in immediate exercise, except in so far as God has delegated freedom to human wills; and there follows a theodicy, repeating Leibnitz in more modern form. Martineau's two main proofs yield two sets of attributes; those known as "natural" and "moral," R. Browning's "power" and "love." In "God as perfection" Martineau handles the basis of ethics without reference to his own modification of the intuitionist form of "cosmological Theism," according to which "God" is the better or the best. We may infer that, whatever the merits of that modification, it does not affect the theistic problem. Martineau's Study also includes a section upon Immortality. The Ontological argument is omitted; but we have already observed that there is a discussion of divine

1 The Design argument has mainly to do with living bodies. Might one suggest that organisms seem at least to be a working up of inorganic matter for new ends, viz. those of life?
2 The idealisms of Fichte and Schelling made contributions to Hegel's thought; Krause and the Roman Catholic Baader represent a parallel in French lines of idealism.
3 Equally so the Hegelian attitude towards personal immortality.
4 Such as Kant claimed to effect: Critique of Pure Reason, preface to 2nd ed.

1 Paul Janet's Final Causes seems to follow Mill in this ("the fact of Finality"), but without naming him.
2 Janet naturally is in opposition here. Ultimately, he argues, if man is immediately oriented to his rational cause to account for so rational an effect. But again of course Mill is not named.
3 The three which Kant criticized, with the addition of the moral argument, which he favoured.
infinity in relation to time and space which from one point of view is parallel to the Ontological argument.

Definite theism, bearing the mark of Kant's thought throughout, is found in Hermann Lotze. From the point of view of our grouping, he is an idealist of anomalous type. He begins as an empiricist or realist, with given matter-of-fact; but from time to time (e.g. in his Microcosmus) he makes readjustments without perhaps very clearly realizing that he is being done, and in the end he is unmistakably idealist. While a pronounced theist—though not a church Christian—he is hardly less an asistant of traditional theism than Kant (e.g. his Outline [Lecture headings] on Philosophy of Religion). He dissents as a realist from the Cosmological argument in the form in which it concludes from "contingent" to "necessary" being. We do not wish to find our way to a being who "must be." That is an idle dream. We must keep to real and assured facts, Lotze was a man of considerable attainments in special science; perhaps he reveals here the bias of the scientific mind, possibly even its limitations. He regards the Ontological argument strictly so-called as having been exploded by Kant. Still it has a value for him if taken not as an argument, but rather as the expression of an immediate conviction; viz. the highest must exist. This is an intuitionalist touch, or a parallel to intuitionism, and has called forth a gibe from that very confident ratiocinator, J. E. MacTaggart; Lotze's immediate convictions are matters of interest to a biographer but to no one else. The Design argument elicits from Lotze the criticism that some things look purposeful, but others decidedly purposeless. The only solid nucleus he finds in it is the fact that there is a great deal of beauty in this world. Obviously this writer is harder to focus than Kant or Hegel. He is not all of one piece. He holds—on grounds of fact and science—to the mechanical orderliness of nature, but claims that the Wollen-schauung thus suggested may be reinterpreted in view of those undying human aspirations which MacTaggart dismisses to instant execution (unless they can dress themselves in syllogism). Thus, for Lotze, free will is possible; the consequences of action proceed regularly a parte post, and there is no such chaos as the critics of Libertarianism have pretended it would involve. Similarly, miracles—absolute new beginnings—are possible on God's side, if they are not mere anomalies but acts promotive of the general meaning or tendency of things, and of the divine plan of the universe. But this appeal to "values" is only half of Lotze's constructive work. For the other half he falls back on ratiocination. All existences must be individuals, with an inner life (cf. Leibnitz). Since they interact, they must be elements in the life of one supreme being (cf. Spinoza: the Spinozistic affinities of Leibnitz are not so marked as Lotze's). God can be personal and doubtless is (though he has no Non-eGo to define himself against) through contrast of passing conscious states with the abiding Ego. It is reasonable to hold that the supreme personality is the only fully personal being, while ours is a broken and imperfect personality, hindered by the Non-eGo which in other ways helps it. Lotze resolves space into "ideal space"; and finally, in the philosophy of religion, or in view of the thought of God (in his Metaphysics), he denies the objective existence of time. God sees all history neither as future nor as present but as actual.

Besides the stream of tendency which flowed from Kant in the direction of idealism, two other streams emerged from him, often but not always blending. There was a new scepticism—at the very least a doctrine of limitation in human knowledge; but in its extremity forms an absolute agnosticism. And there was the positive ethical element in Kant's theism.

Ancient scepticism was frankly opposed to religious belief. Later, the emergence of a great body of doctrine attributed to divine revelation and of a great institution like the Christian church suggested the possibility of enlisting scepticism in the service of dogmatic faith. In a sense (see Apologetics) this was done in the middle ages, and possibly repeated by Pascal after the Reformation. We now find Kant's intellectual scepticism borrowed by W. Hamilton and H. L. Mansel, both of them, as J. S. Mill complained, "bringing back under the name of "themselves" the devil whom they repudiated as knowledge." The therapist found a melodious echo in Tennyson's InMemoria, a great hymn of God, Freedom and Immortality on a basis of speculative agnosticism. "We have but faith we cannot know, For knowledge is of things we see;" but the moral element which Mansel despised is dominant in Tennyson. "The heart Stood up and answered, I have felt." If there is a reading of the new theories of evolution in nature which revives rather than darkens hope in immortality and faith in God, Tennyson gave an early sketch of that tentative modern theism.

R. Browning has been charged by H. Jones with partial agnosticism. But at least we may say that agnosticism is much less clear in Browning than in Tennyson. Browning reasons as far as he can; if reasoning fails him, he gives a leap of faith. Jones, almost as merciless as MacTaggart, calls this procedure by the hard names of agnosticism and dualism. Another who "got the seed" and "grew the flower" was Herbert Spencer. He quotes pages from Mansel's Bampton Lectures in favour of his own type of agnosticism, which is to make peace between religion and science by permanently silencing the former. Religion may "feel," like Tennyson's "man in wrath," and may expatiate in an undefined awe; science alone is to possess the "knowledge." This yields a characteristic type of pantheism, in the theory of the Unknowable which—rather paradoxically—is offered us. Alongside of this there are other elements in Spencer's composite system of "Naturalism and Agnosticism" (J. Ward's expression, see his Gifford Lecture). The element of naturalism stands for science with a leaning towards materialism ("explanation in terms of matter and motion"). The element of agnosticism tends rather towards pantheism, just as Indian pantheism long ago tended towards agnosticism. John Fiske, however, an able interpreter of Spencer, reached what he called "Cosmic Theism." He rejected all that is anthropomorphic in Theism, but gave a positive note and negative interpretation to Spencer's scientific generalizations, and broke away from pantheism—perhaps also from naturalism—when, like Tennyson, he pleaded for human immortality as the climax of evolutionary progress.

[The name agnosticism (q.v.) is T. H. Huxley's. Modern doubt does not say there is no God; it says, We don't know. Popular scepticism—perhaps even Charles Darwin's; Huxley himself was a student of Hume—understands by agnosticism that science is certain while philosophy and theology are baseless. Leslie Stephen gave this popular agnosticism its finest literary expression. Spencer goes much further in rejection of human knowledge: "The man of science more than any other truly knows that in its ultimate essence nothing can be known."]

An interesting manifesto of agnosticism, with a religious conclusion, is A. J. Balfour's Foundations of Belief, welcomed in Germany by Julius Kaftan (see below). In "Some Consequences of (naturalistic) Belief," Balfour argues that the results of "naturalism" are unbearable. In "Some Reasons for Belief," the author institutes a rapid destructive criticism of all possible philosophies. In "Some Causes of Belief," he tries, standing outside the psychological process, to show how beliefs grow up under every kind of influence except that of genuine evidence. His constructive theory comes at the end, and seems to argue thus: Since (r) there is no discoverable reason why we

\(^{1}\) Stated and criticized by Kant.

\(^{2}\) Lotze is not to be understood as guaranteeing the actuality of Bible miracles. Such things are philosophically possible—that is all.

\(^{3}\) Mansel's theism (or natural theology), and the revelation he believes in, seem both of them pure matters of assertion on his part, without evidence, or even in the teeth of the evidence as he conceives it.

\(^{4}\) Examination of Sir Wm. Hamilton's Philosophy, chap. v.

\(^{5}\) First Principles, p. 67.
If we try to bring the contents of theism under Kant's three traditional arguments, then moral and aesthetic considerations—the "values"—fall under the Design argument or the study of teleology; albeit there is a great gap between Paley's supernatural watchmaker and any moral argument or appeal to the beautiful. It might be argued that beauty bears witness against materialism, and moral values against pantheism; although such an anomalous type as ethical pantheism has its representatives—J. G. Fichte, Matthew Arnold, perhaps H. Höfding. Kant's reliance on the moral argument alone goes with his scepticism. Giving that argument the highest place seems to solve, (Mill) said, a dash of theother scepticism.

The arguments, as already noted, may be differentiated combined. (1) Usually they are alternatives or else cumulative. (2) Flint places out the proof (and the attributes) among them. (3) Hegel regards them as phases.

V. What are the alternative conclusions to theism? The extremest form of antagonism is pure scepticism or pure agnosticism, the assertion that nothing can be known. Empiricism may lead to this conclusion; or it may lead to materialism. True materialism includes both anticlerical atheism, and is probably the only coherent type of atheism. Pantheism further brings with it an extreme or "hard" determinism; and, denying the soul's separate existence in any sense, it naturally denies immortalitry. Once again, empiricism may lead to any qualified and restricted form of agnosticism, religious or anti-religious. If pantheism is to be seriously defended at all, the basis must be empiricism. Intuitionism in its turn may harden out of "natural" dualism into moral dualism; either a literally Manichaean scheme—a god good impelled by an evil personality or principle (Bayle)—or belief in a good god and a supreme evil (Spinoza). And idealism in some cases may interpret itself in favour of pantheism rather than of theism. Pantheism does not favour free will or immortalitry, and may move indefinitely near to materialism. Out of pantheism again pessimism develops. If the principle of the universe is impersonal or unconscious, personal consciousness in finite spirits comes to wear the appearance of a blunder. Conversely, if God cares for men, despair is impossible. For another systematic grouping, see A. C. Fraser's Gifford Lectures. Wolf's list is of some historical importance—atheism, deism (a God with limited powers (Mill)); pure empiricism (Locke); empiricism and deism (Mill); empirical (Popper, Hume); and, lastly, against materialism, idealism (non-existence of matter); paganism (polytheism); Manichaicism, Spinozism, Epicureanism. R. Flint has dealt with the following antitheistic theories: atheism, materialism, positivism, secularism, pessimism, pantheism (and in a separate volume) agnosticism. It is hard to be certain that any systematic grouping will anticipate all the suggestions that may occur to a restlessly and recklessly inquiring age.

LITERATURE.—Two sets of writers have been considered: first, the greater philosophers, who have incidentally furthered theism (Socrates, Plato, Aristotle, the Stoics, Descartes, Locke, Kant, etc.); and, secondly, the critics (Mill, Hegel, Mill, Spencer); and, secondly, the deliberate champions of theism—Cicero (especially in the De Natura Deorum), Philo, Raymond of Fossem (in a sense), Wolff, Butler (in a sense), Paley, and a host of English and German 18th-century authors, who chiefly handle the Design argument; then recent writers like R. Flint, Theism, Antitheistic Theories, Agnosticism—all with valuable notes and references, and J. Martineau—especially in A Study of Religion. The theistic writers are usually intuitionists; but it has been urged above that a fruitful study of theism must in each case inquire what is the writer's philosophical basis. The Bridgewater treatises have little more than historical interest to-day. A certain historical interest also attaches to the Burnett prize essays on theism: 1815, 1st prize, W. L. Bruce, 2nd J. B. Sumner, afterwards archbishop; 1855, 1st R. A. Thompson, 2nd J. Talloch. All of the Gifford Lectures are supposed to be strictly appropriated to Natural Theology; yet subjects and

1 Son of A. Ritschl. The younger theologian has accepted determinism. 2 Dr MacTaggart's beliefs once more present themselves as an unexpected modern type (Studies in Hegelian Cosmology, chap. iii.). 3 Yet cf. once more MacTaggart's society of eternal spirits with no divine head.

THEISS (Hungarian, Tissa; Lat., Tisia or Tissius), a large affluent of the Danube, next to which it is the greatest river of Hungary. It rises in the north-eastern part of the Carpathian mountains, in the county of Máramaros, at a height of above 630 ft., and is formed by the confluence of two branches, the Black Theiss (Fekete Tisa), and the White Theiss (Fehér Tisa), which unite at about 20 m. E. of Máramaros-Szat-he. The Theiss then follows a north-westerly direction until it leaves its mountainous valley, then runs west, and after a great curve to the north, takes a south-westerly direction and enters the great plain of Hungary (Alföld). From Szolnok the river runs in an almost parallel course with that of the Danube, from which it is separated by a distance of about 60 m., and flows into the Danube near the village of Titel, 20 m. E. of Ujvidék. Its length from source to mouth is, as the crow flies, only about 340 m., but its windings make its course about 870 m. long. The Theiss is clear and swift in its course through the mountains, but in the plain it becomes slow, somewhat muddy and very tortuous. Its basin covers an area of 56,600 sq. m., and comprises the whole eastern part of Hungary, and the greater part of Lower Austria, and collects all the rivers descending from the Carpathian westward.

The Theiss is navigable for rafts almost everywhere, but for steamers only from Szolnok downwards, a distance of about 200 m., where the breadth of the river is 450 to 750 ft. The depth of the river is generally 7 to 20 ft., but at certain points it is 33 ft., and at Titel, near its mouth, it is 11 ft. At Titel, the river is 500, and at Marosu, 20 m. E. of Titel, 31 ft. at Titel, near its mouth, while the difference between the low-water mark and the high-water mark is as high as 25 to 35 ft. During its course through the great Hungarian plain the Theiss flows between flat, low-lying banks, which are the cause of the periods of drought and sometimes disastrous inundations and of extensive marshes. Therefore extensive works have been undertaken for the regulation and canalization of the river, which is now strongly dammed in many parts. At these works large tracts of marsh have been transformed into productive ground. Its chief tributaries are the Szamos, Körös, Maros, Latorcza, and the Sajó. In its lower course it is joined by the Sajó, the upper Danube, and by the Bega canal, while it is also united with Temesvár by the Bega canal.

THEMIS, in Greek mythology, the personification of justice. In Homer them is used both as a common and as a proper noun. As a common noun (plural òmówn, òmówn, òmówn, òmówn), it is the body of rules and precedents established at the beginning of the world, as a guarantee of its order and harmony (see GREEK LAW); personified, Themis is the servant or companion of Zeus, her chief function being to summon the assemblies of both gods and men (Odyssey, i. 68). In the Hesiodic theogony, she is the daughter of Uranus and Gaea, and according to Pindar the wife of Zeus, by whose side she sits, assisting him with her advice, and being better than the Muses, Justitia is the mother of the Horae and of the Moirae (Fates), an indication of her influence in the physical and moral world. She is the representative of divine justice in all its relations to men, and takes special cognizance of the rights of hospitality. Her opposite is Hybris (Hubris), insolent encroachment upon the rights of others, on whose track she follows to punish, like Nemesis. In this aspect both Themis and Nemesis are called Hesperia (Hesperos, track). In the lexicon of Festus, Themis is described as the goddess who prescribes that which is right in moral law (cf. Eclogues 6). Daedalus is her son, and is identical with this divine law. She is also a prophetic divinity, as on one occasion there was a tradition that the oracle at Delphi had first been in the hands of Gaia, who transferred it to Themis (sometimes identified with her) by whom it was handed over to Apollo (Aeschylus, Eumenides, 2; Euripides, Iphig. in T. 1). Orphic poetry makes her a daughter of Helios, whose eye is all-seeing (Panóskos) and penetrates all mysteries. She was especially honoured at Athens, Delphi, Thebes, Aegina, and Troezen, where there was an altar dedicated to a triad of Themises (on the analogy of the triads of Hera, Charles, Moirae). In art she was represented in the form of a dignified and comely figure, with cornucopia (symbolizing the blessings resulting from order) and a pair of scales.

See article "Justice" by J. A. Hild in Darmberg and Saglio's Dict. des Antiquités; H. Ahrens, Die Göttin Themis (1862); R. Hirzel, Themis, Diis, and Verwandten (1907).

THEMISTIUS (317-737), named ἐφραῖος ("eloquent"), statesman, rhetorician, and philosopher, was born in Paphlagonia and taught at Constantinople, where, after a short sojourn in Rome, he resided during the rest of his life. Though we have been able to know little of his life, he was as noted for his learning as for his oratory. It was prefixed to Constantine in 384 on the nomination of Theodosius. His paraphrases of Aristotle's Posterior Analytics, Physics and De Anima are valuable; but the orations in which he panegyrizes successive emperors, comparing them to Plato's "true philosopher," and even to the "idea" itself, are servile and unworthy. Against this, however, should be set the description given by Boetius, "disertissimus scriptor ac lucidus, et omnia ad facilitatem intellectualem resecans," and that of Gregory Nazianzen—"with whom Themistius corresponded—"hanc liceat nequum." Themistius's paraphrases of the De Coelo and of book A of the metaphysics have been preserved only through Hebrew versions. In philosophy Themistius was an eclectic. He held that Plato and Aristotle were in substantial agreement, that God has made men free to adopt the mode of worship they prefer, and that Christianity and Hellenism were merely two forms of the one universal religion.

The first edition of Themistius's works (Venice, 1534) included the paraphrases and eight of the orations. Nineteen orations were known to Petavius, whose editions appeared in 1519 and 1618; Hardouin (Paris, 1684) gives thirty-three. Another oration was discovered by Angelo Mai, and published at Milan in 1816. The most recent editions are W. Dindorf's of the orations (Leipzig, 1832), and L. Spengel's of the paraphrases (Leipzig, 1866). The Latin translations of the Hebrew versions of the paraphrases of the De Coelo and book A of the Metaphysics have been published at Paris, 1874 and 1858 respectively. A new edition of the latter by S. Landauer appeared in 1903. See Fabricius, Bibliotheca Graeca, vi. 790 seq.; E. Zeller, History of Greek Phil.; E. Baret, De Themisti, sophista (Paris, 1853); Jourdan's Recherches critiques sur le "travers" d' Origène (1854); see NEOPLATONISM. For Themistius's Commentaries on Aristotle, see Commentaria in Aristotelis Graeca (Berlin), and also Themisti paraphrases Aristotelis libros quae supersunt, ed. L. Spengel (1866), Teubner series.

THEMISTOCLES (c. 514-449 B.C.), Athenian soldier and statesman in some respects probably the ablest and most far-sighted whom Greece produced in the first half of the 5th century. He was the son of Neocles, an Athenian of no distinction and moderate means, his mother being a Carian or a Thracian. Hence according to the Periclean law Ἰ σὰμβων ἄρταν he would not have been a free Athenian at all (see PERICLES). Thucydides properly brings out the fact that, though he lacked that education which was the peculiar glory of the Periclean age, he displayed the intellectual power of an able and a complex intellect, together with a genius for rapid action. Plutarch similarly enlarges on his consuming ambition for power both
personal and national, and the unscrupulous ability with which he pursued his ends. In all these points he is the antithesis of his great rival Aristides (q.v.). Of his early years little is known. He may have been strategus of his tribe at Marathon (Plut. Arist. 5) and we are told that he deeply envied the glory which Miltiades earned. At all events the death of Miltiades left the stage to Aristides and Themistocles. It is sufficiently clear that their rivalry, terminated in 483-82 by the ostracism of Aristides, turned largely on the fact that Themistocles was the advocate of a policy of naval expansion, while Aristides was under the influence of Athens and indeed to Greece. Athens was faced by the equal if not superior power of Aegina, while the danger of a renewed Persian invasion loomed large on the horizon. Themistocles therefore persuaded his countrymen to put in hand the building of 200 triremes, and—what was of even greater importance—to fortify the three natural harbours of Peiraeus (see E. Gardner, Ancient Athens, 562 f.) in place of the open roadstead of Phalerum. For the building of the ships Themistocles persuaded the Athenians to allocate 100 talents obtained from the new silver mines at Laurium (Arist. Pol. xi. 22) which were not bequeathed to the citizens (10 drachmae each). One hundred of the proposed 200 were built.

According to the Ath. Pol, it would seem that Themistocles was archon in 493-82 at the time when this naval programme began. Dionysius of Halicarnassus places his archonship in 493-92, in favour of which are several considerations. In 487 the office lost much of its importance owing to the substitution of the lot for election: the chance that the lot would at the particular crisis of 493 fall on Themistocles was obviously remote; and the Ath. Pol. is generally wrong about Themistocles. In any case the year prior to the invasion of Xerxes found Themistocles the chief man in Athens if not in Greece. Though the Greek fleet was nominally under the control of the Spartan Eurybiades, it was Themistocles who caused the Greeks to fight the indecisive battle of Artemisium, and still more it was he who, by his threat that he would lead the Athenian army to found a new home in the West, and by his treacherous message to Xerxes, precipitated the engagement at Salamis (q.v.). The retirement of the Persians left the Athenians free to restore their ruined city (see Athens). Sparta, nominally at war with Athens, did not enter the lists; and that it was dangerous to Greece that there should be any citadel north of the Isthmus which an invader might hold, urged that this should not be done, but Themistocles by means of diplomatic delays and subterfuges enabled the work to be carried sufficiently near to completion to make the walls defensible. He also carried out his original plan of making Peiraeus a real harbour and fortress for Athens. Athens thus became the finest trade centre in Greece, and this fact, coupled with Themistocles' remission of the alien's tax (µετοχαπ), induced many foreign business men to settle in Athens.

After the crisis of the Persian invasion Themistocles and Aristides appear to have composed their differences. But Themistocles soon began to lose the confidence of the people, partly owing to his boastfulness (it is said that he built near his own house a sanctuary to Artemis Aristoboule "of good counsel") and partly to his alleged readiness to take bribes. Diodorus (xi. 54) and Plutarch (Themist. 23) both refer to some accusation levelled against him, and some time between 476 and 471 he was ostracized. He retired to Argos, but the Spartans further accused him of treasonable intrigues with Persia, and he fled to Corcyra, thence to Admetus, king of the Molossians, and finally to Asia Minor. He was proclaimed a traitor at Athens and his property was confiscated, though his friends saved him some portion of it. He was well received by the Persians and was allowed to settle in Magnesia on the Maeander. The revenues (50 talents) of this town were assigned to him for bread, those of Myus for condiments, those of Lampascus for wine. He died at Magnesia at the age of sixty-five, and a splendid memorial was raised by the people of the town, though it is said that his bones were secretly transferred to Attica. He was worshipped by the Magnesians as a god, as we find from a coin on which he is shown with a patera in his hand and a slain bull at his feet (hence perhaps the legend that he died from drinking bull's blood: cf. Aristoph. Eq. 83; Dio. xi. 58; Plut. Them. 31).

Though his end was discreditable, though his great wealth can hardly have been obtained by loyal public service, there is no doubt that his services to Athens and to Greece were great. He led the Athenian fleet and with it the possibility of the Delian League (q.v.), previously a mere formality in Ionia, and there are many indications (e.g. his well-attested plan of expansion in the west) that the later imperialist ideal originated in his fertile brain.

There are monographs by Bauer (Mersburg, 1881) and Wecklein (Munich, 1882); but the best discussions of his career will be found in the chief Greek histories e.g. Busolt; on the difficult chronology of his later years see Grote, History of Greece (and the one-vol. ed. by Mitchell and Caspari, 1907, p. 283, note 1, with the authorities there quoted); on the Magnesian coin, Rhousopoulos, in Athen. Mitt. (1896), p. 22. On the walls, see Ed. Meyer in Hermes, xl. (1905), pp. 561-569.

THÉNARD, LOUIS JACQUES (1777—1857), French chemist, was born on the 4th of May 1777 at Loupiâtre, near Nogent-sur-Seine, Aube. His father, a poor peasant, managed to have him educated at the academy of Sens, and sent him at the age of sixteen to study pharmacy in Paris. There he attended the lectures of A. F. Fourcroy and L. N. Vauquelin, and succeeded in gaining admission, in a humble capacity, to the latter's laboratory. But his progress was so rapid that in two or three years he was able to take his master's place at the lecture-table, and Fourcroy and Vauquelin were so satisfied with his performance that they procured for him a school appointment in 1799 as teacher of chemistry, and in 1798 one as répétiteur at the École Polytechnique. In 1804 Vauquelin resigned his professorship at the Collège de France and successfully used his influence to obtain the appointment for Thénard, who six years later, after Fourcroy's death, was further elected to the chairs of chemistry at the École Polytechnique and the Faculté des Sciences. He also succeeded Fourcroy as member of the Academy. In 1812 he received the title of laron from Charles X., and in 1832 Louis Philippe made him a peer of France. From 1831 to 1857 he represented the chamber of deputies, and as vice-president of the conseil supérieur de l'instruction publique, he exercised a great influence on scientific education in France. He died in Paris on the 21st of June 1857. A statue was erected to his memory at Sens in 1861, and in 1865 the name of his native village was changed to Loupiâtre-Thénard.

Above all things Thénard was a teacher; as he himself said, the professor, the assistants, the laboratory—everything must be sacrificed to the students. Like most great teachers he published text-book, and his Traité de Chimie élémentaire, théorique et pratique (4 vols., Paris, 1813-16), which served as a standard for a quarter of a century, perhaps did even more for the advance of chemistry than his numerous original discoveries. Soon after his appointment as répétiteur at the École Polytechnique he began a lifelong friendship with J. L. Gay-Lussac, and the two carried out many researches together. Careful analysis led him to dispute some of C. L. Berthollet's theoretical views regarding the composition of the metallic oxides, and he also showed Berthollet's "zoonic acid" to be impure acetic acid (1802); but Berthollet (q.v.), so far from resenting these corrections, made him a member of the Société d'Arcueil. Thénard's first original paper (1799) was on the compound of arsenic and antimony with oxygen and sulphur, and of his other separate investigations one of the most important was that on the compound ethers, begun in 1807. His researches on sebacic acid (1802) and on bile (1807), and his discovery of peroxide of hydrogen (1818) also deserve mention. The substance known as Thénard's blue, he prepared in 1799 in response to a peremptory demand by J. A. Chaptal for a cheap colouring matter, as
THEOBALD—THEOCRITUS

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bright as ultra-marine and capable of standing the heat of the porcelain furnace.

Most of Thénard's memoirs, a list of which may be found in the Royal Society's Catalogue of Scientific Papers, were published in the Annales de Chimie et de Physique, the Mémóires d'Arcueil, the Comptes Rendus and the Mémoires of the Academy of Sciences.

THEOBALD (d. 1161), archbishop of Canterbury, was of Norman parentage, but the date of his birth is unknown. Early in life he entered the great abbey of Bec, of which he became prior in 1127 and abbot ten years later. In 1138 he was selected by Stephen, king of England, to fill the vacant see of Canterbury. Apparently he owed this advancement to his character for meekness, and as archbishop he behaved with a moderation which is in striking contrast to the conduct of his rival, Henry of Blois, bishop of Winchester. During the struggle between Stephen and Matilda it was Bishop Henry who fought for the privileges of the Church; Theobald, while showing a preference for Stephen's title, made it his rule to support the de facto sovereign. But as Stephen's case gained ground the archbishop showed greater independence. He refused to consecrate the king's nephew to the see of York, and in 1148 attended the papal council of Reims in defiance of a royal prohibition. This quarrel was ended by the intercession of the queen, Matilda of Boulogne, but another, of a more serious character, was provoked by Theobald's refusal to crown Count Eustace, the eldest son of Louis VII, king of France, to be pope. Physically the pope plighted the pope's word as the excuse for this contumacy. He was banished from the kingdom, but Pope Eugenius tried Stephen into a reversal of the sentence. In 1153 Theobald succeeded in reconciling Stephen with Henry of Anjou, and in securing for the latter the succession to the throne. On the accession of Henry in 1154, Theobald naturally became his trusted counsellor; but ill-health prevented the archbishop from using his influence to its full extent. He placed the interests of the Church in the hands of Thomas Becket, his archdeacon, whom he induced Henry to elevate to the see of Canterbury. Theobald died on the 18th of April 1161. He is said to have recommended Becket as his successor.

In history Theobald lives chiefly as the patron of three eminent men: Becket, who began life as a clerk in his household; Master Vacarius, the Italian jurist, who was the first to teach Roman law in England; and John of Salisbury, the most learned scholar of the age. Theobald's household was a university in little; and in it were trained not a few of the leading prelates of the next generation.


THEOBALD, LEWIS (1688-1744), English man of letters, playwright and Shakespearian commentator, the son of an attorney, was born at Sissinghurst, Kent, and was baptized on the 2nd of April 1688. He was educated under a clergyman named Ellis at Iselworth, and became a good classical scholar. He followed his father's profession, but soon abandoned it for literature. In 1713 he translated the Phaedo of Plato, and entered into a contract with Bernard Lintot the publisher to translate a number of the comedies of Aeschylus. He seems to have made other promises not carried out, but in 1714 and 1715 appeared versions of the Electra, the Ajax, and the Oedipus Rex of Sophocles, and the Plutus and the Clouds of Aristophanes. He became a regular hack-writer, contributing to Mist's Journal, and producing plays and poems of very small merit. The publication of his play The Perfidious Brother (acted 1715; printed 1710) involved Theobald in considerable difficulty. He apparently received a rough draft of the play from Henry Meystayer, a London watchmaker, with a commission to arrange it for the stage. Theobald brought it out as his own work. In the next year Meystayer produced a version, and charged Theobald with plagiarism, but there is no means of ascertaining the exact rights of the case. His poverty compelled him to produce rapidly. He translated the first book of the Odyssey (1716), wrote tragi-comedies, operas and masques, and helped John Rich in the production of pantomimes, then an innovation at Drury Lane. But in 1726 he produced Shakespeare Restored, or a Specimen of the many Errors as well Committed as Unnamed by Mr Pope in his late edition of this Poet; designed not only to correct the said Edition, but to restore the true Reading of Shakespeare in all the Editions ever published (1726). However ill Theobald may have succeeded as a poet and dramatist, he showed great discrimination as a textual editor. Some of his happiest emendations are to be found in this work, which conclusively proved Pope's incompetence as a Shakespearian editor. Two years later a second edition of Pope's work appeared. In it he stated that he had incorporated some of Theobald's readings, in all amounting to about twenty-five words, and that he added the rest which could "at worst but spoil half a sheet of paper that chances to be left vacant here." He also insinuated that Theobald had maliciously kept back his emendations during the progress of the edition. All this was a gross misstatement of fact. He had in reality incorporated the majority of Theobald's best emendations. In the first edition of the Dunciad (1728) Theobald figured as the hero, and he occupied the place of chief victim until replaced by Colley Cibber in 1741. In spite of the critics, Theobald's work was appreciated by the public. In 1731 he undertook to edit Shakespeare for Tonson the publisher. The work appeared in seven volumes in 1734, and completely superseded Pope's edition. From 1729 to the date of its publication Theobald had been engaged in correspondence on the subject with Warburton, who after his friend's death published an estimate of Shakespeare's work, in the preface of which he asserted that Theobald owed his best corrections to him. Study of the correspondence proves, however, that the indebtedness was on Warburton's side. Subsequent editors reaped, in most cases without acknowledgment or with actual scorn, the fruit of Theobald's pains-taking labour, his wide learning and his critical genius. But Pope's satire, as Johnson justly remarked, blasted the characters that it touched. Theobald remained the type of the dry-as-dust commentator. His merits obtained a tardy recognition on the publication of a detailed study of his critical work by Mr. Churton Collins in an essay entitled "The Person of Shakespearian Criticism" (Essays and Studies, 1895). Theobald gave proof of the same happy gift in classical scholarship in some emendations of Aeschylus, Euripides, Atheneaus and others, contributed to a learned journal started by John Jortin in 1731. He was a candidate for the laureateship in 1730, but Cibber gained the coveted post. His last years were harassed by poverty and disease. He began a critical edition of the plays of Beaumont and Fletcher, completed by Seward and Parnell after his death, which took place on the 18th of September 1744.

His correspondence with Matthew Concanen, Styan Thirlby and William Warburton is to be found in Nichols's Illustrations of Literature (ii. 204-654), which also gives the fullest account of his life.

THEOCRACY (Gr. θεοκρατία, the rule of God, from θεός, god, and -κρατία, κράτος, to rule), a term applied to a form of government or to a state ruled by such a form of government, (a dopoligarchy of the gods). There were several definitions of this term. The one most generally adopted is that of civil power, and the divine commandments regarded as the laws of the community. The typical example of such a state is that of the Jews till the establishment of the kingship under Saul (see JEWS).

THEOCRITUS, the creator of pastoral poetry, flourished in the 3rd century b.c. Little is known of him beyond what can be inferred from his writings. We must, however, handle these with some caution, since some of the poems ("Idyls") commonly attributed to him have little claim to authenticity. It is clear that at a very early date two collections were made, one of which included a number of doubtful poems and formed a corpus of bucolic poetry, while the other was confined to those works which were considered to be by Theocritus himself. The record of these recensions is preserved by two epigrams, one of which proceeds from Artemidorus, a grammarian, who
THEOCRITUS
lived in the time of Sulla and is said to have been the first
He says, " Bucolic muses, once were
editor of these poems.
now
but
one
byre, one herd is yours." '' The
ye scattered,
The
second epigram is anonymous, and runs as follows:
Chian is another. I, Theocritus, who wrote these songs, am of
Syracuse, a man of the people, the son of Praxagoras and famed

never sought after a strange muse." The last line
that he wrote nothing but bucolic poems, or that he
only wrote in Doric. The statement that he was a Syracusan
"
"
is confirmed by allusions in the
(xi. 7, xxviii. 16-18).
Idylls
The information concerning his parentage bears the stamp of
genuineness, and disposes of a rival theory based upon a misPhilinV

I

may mean

interpretation of Idyll vii. which made him the son of one
Simichus. A larger collection, possibly more extensive than
that of Artemidorus, and including poems of doubtful authen"
Theocritus wrote the
ticity, was known to Suidas, who says:
so-called bucolic

also attribute to

poems
him the

in the

Dorian

Some persons

dialect.

following: Daughters of Proelus, Hopes,

Hymns, Heroines, Dirges, Lyrics, Elegies, Iambics, Epigrams."
The first of these may have been known to Virgil, who refers
to the Proetides in the Eclogues. 1
The spurious poem xxi. may
have been one of the Hopes (cf. 1. 66, eXirls TWV (ITTVOIV),
and poem xxvi. may have been one of the Heroines (cf. 1. 36,
:
elegiacs are found in viii. 33-60, and the spurious
epitaph on Bion may have been one of the Dirges. The other
classes are all represented in the larger collection which has come

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down to us.
The poems which

are generally held to be authentic

may be

classified thus:
I. Bucolics and Mimes.
The distinction between these is that
the scenes of the former are laid in the country and those of the
The most famous of the Bucolics are i., vii.,
latter in a town.
xi. and vi.
In i. Thyrsis sings to a goatherd how Daphnis, the
mythical herdsman, having defied the power of Aphrodite, dies
rather than yield to a passion with which the goddess had inspired
him. In xi. Polyphemus is depicted as in love with the sea-nymph
Galatea and finding solace in song in vi. he is cured of his passion
and naively relates how he repulses the overtures now "made to
The monster of the Odyssey has been written
him by Galatea.
"
after the Alexandrian manner and has become a
up to date
Idyll vii., the Harvest Feast (QaXixrta), is the
gentle simpleton.
most important of the bucolic poems. The scene is laid in the
The poet speaks in the first person and is styled
isle of Cos.
Other poets are introduced under
Simichidas 2 by his friends.
of Samos
Thus ancient critics identified Sicelidas
feigned names.
"
the goatherd
(1. 40) with Asclepiades the Samian, and Lycidas,
of Cydonia," may well be the poet Astacides, whom Callimachus
Theocritus speaks of himself as
calls "the Cretan, the goatherd."
having already gained fame, and says that his lays have been brought
8
He praises Philetas, the
by report even unto the throne of Zeus.
"
the fledgelings of the Muse,
veteran poet of Cos, and criticizes
who cackle against the Chian bard and find their labour lost." 4
Other persons mentioned are Nicias, a physician of Miletus, whose
name occurs in other poems, and Aratus, whom the Scholiast
identifies with the author of the Phenomena.
The other bucolic poems need not be further discussed. Several
of them consist of a singing-match, conducted according to the
rules of amoebean poetry, in which the second singer takes the
subject chosen by the first and contributes a variation in the same
air.
It may be noted that the peasants of Theocritus differ greatly
in refinement.
Those in v. are low fellows who indulge in coarse
abuse. This Idyll and iv. are laid in the neighbourhood of Croton,
and we may infer that Theocritus was personally acquainted with
Magna Graecia. Suspicion has been cast upon poems yiii. and ix.
on various grounds. An extreme view holds that in ix. we have
two genuine Theocritean fragments, 11. 7-13 and 15-20, describing
the joys of summer and winter respectively, which have been
provided with a clumsy preface, 11. 1-6, while an early editor of a
bucolic collection has appended an epilogue in which he takes
leave of the Bucolic Muses. 6 On the other hand, it is clear that
both poems were in Virgil's Theocritus, and that they passed the
scrutiny of the editor who formed the short collection of Theocritean Bucolics.
:

"

Proetides implerunt falsis mugitibus agros." Eel. vi. 48.
are offered by the Scholiast either that the
explanations
"
"
snub-nosed
(cri^tAj), or that he was the son of Simichus.
poet was
The second is obviously a mere guess.
*
It is possible
TO. rov Koi Zi/vAs
6p6vov tyayt <t>&na, 1. 93.
that Zeus refers to Ptolemy: cf. Horace, Ep. i. 19, 43, lovis auribus
1

2

Two

:

are three in number, viz., ii., xiv., xv. In ii. Simaetha,
deserted by Delphis, tells the story of her love to the moon; in
xiv. Aeschines narrates his quarrel with his sweetheart, and is
advised to go to Egypt and enlist in the army of Ptolemy Philadelphus; in xv. Gorgo and Praxinoe go to the festivaj of Adonis.
It may be noticed that in the best MSS. ii. comes immediately
before xiv., an arrangement which is obviously right, since it places
the three mimes together. The second
in the MSS. is occupied
place
"
"
These three mimes are wonderby Idyll vii., the Harvest Feast.
fully natural and lifelike. There is nothing in ancient literature so
vivid and real as the chatter of Gorgo and Praxinofi, and the voces
populi in xv.
It will be convenient to add to the Bucolics and Mimes three
poems which cannot be brought into any other class, viz. xii. (Aln^),
a poem to a beautiful youth; xviii., the marriage-song of Helen
The
('EjTiflaXd/uos) ; and xxvi., the murder of Pentheus (Aijvat).
genuineness of the last has been attacked by U. von WilamowitzMollendorff on account of the crudity of the language, which
sometimes degenerates into doggerel. It is, however, likely that
Theocritus intentionally used realistic language for the sake of
dramatic effect, and the MSS. evidence is in favour of the poem.
Eustathius quotes from it as the work of Theocritus.
II. Epics.
Three of these are Hymns, viz., xvi., xvii. and xxii.
In xvi. the poet praises Hiero II. of
Syracuse, in xvii. Ptolemy
The other poems are
Philadelphus, and in xxii. the Dioscuri.
xiii., the story of Hylas and the Nymphs, and
xxiy. the youthful
Heracles.
It cannot be said that Theocritus exhibits signal merit
in his Epics.
xiii.
In
he shows some skill in word-painting, in xvi.
there is some delicate" fancy in the description of his poems as
"
"
Graces
(XAputs), and a passage at the end, where he foretells
the joys of peace after the enemy have been driven out of Sicily,
has the true bucolic ring. The most that can be said of xxii. and
xxiv. is that they are very dramatic.
Otherwise they differ little
from work done by other poets, such as Callimachus and Apollonius
Rhodius. The flattery heaped upon Ptolemy is somewhat nauseous.
From another point of view, however, these two poems xvi. and
xvii. are supremely interesting, since they are the only ones which
can be dated. In xvii. Theocritus celebrates the incestuous marriage
of Ptolemy Philadelphus with his sister Arsinoe. This marriage
is
hejd to have taken place in 277 B.C., and a recently discovered
inscription shows that Arsinoe died in 270, in the fifteenth year
of her brother's reign. * This poem, therefore, together with xv.,
which Theocritus wrote to please Arsinoe (Schol. xapifo/w'w TJ}
must fall within this period. The encomium upon
f3atri\U>i)
Hiero II. would from internal reasons seem prior to that upon
since
in it Theocritus is a hungry poet seeking for a
Ptolemy,
patron, while in the other he is well satisfied with the world. Now
Hiero first came to the front in 275 B.C. when he was made
"General" (<rTpaTij-y6s)
Theocritus speaks of his achievements
as still to come, ' and the silence of the poet would show that Hiero's
over the Mamertines at the
marriage to Philistis, his victory
"
"
events which are
Longanus and his election as King
(/SoaiXeCu),
ascribed to 270 B.C., had not yet taken place. If so, xvii. and xv.
can only have been written within 275 and 270.
III. Lyrics.
Two of these are certainly by Theocritus, viz.,
xxviii. and xxix.
The first is a very graceful poem presented
together with a distaff to Theugenis, wife of Nicias, a doctor of
Miletus, on the occasion of a voyage thither undertaken by the
poet. The theme of xxix. is similar to that of xii.
very corrupt
poem, only found in one very late MS., was discovered by Ziegler
in 1864.
As the subject and style very closely resemble that of
xxix., it is assigned to Theocritus by recent editors.
IV. The Epigrams do not call for detailed notice.
They do not
possess any special merit, and their authenticity is often doubtful.
It remains to notice the poems which are now generally considered
to be spurious. They are as follows
"
"
xix.
Love stealing Honey
The poem is
(KjjpioxXiimp).
in
the
MSS.
and
the
anonymous
conception of Love is not Theo:

1

:

A

:

critean.
"
xx.

Herdsman " (BowoXffficos), xxi. " Fishermen " ('AX), xxiii.
"
Passionate Lover
These three poems are remark('EPCKTT^S).
able for the corrupt state of their text, which makes it likely
that they have come from the same source and possibly are
by
The " Fishermen " has been much admired.
the same author.
It is addressed to Diophantus and conveys a moral, that one should
work and not dream, illustrated by the story of an old fisherman
who dreams that he has caught a fish of gold and narrates his
vision to his mate. As Leonidas of Tarentum wrote epigrams on
fishermen, and one of them is a dedication of his tackle to Poseidon
by Diophantus, the fisher, 8 it is likely that the author of this poem
was an imitator of Leonidas. It can hardly be by Leonidas himself, who was a contemporary of Theocritus, as it bears marks of
"

lateness.

xxv.

M

ista
4
8

Senas, where lupiter = Augustus.
Some think that there is an allusion to Apollonius Rhodius.
Cf. Killer, ad he.

761

The mimes

*

8

Heracles the Lion-slayer

The evidence

is

"
(Atoiro^cos).

This

is

a long

contained in a new fragment of the Mendes

in Rheinisches Museum (1898), p. 464.
dw)p 6s t/ttv atxpTlfffr' Aotiov, 1. 736 yptrdrs Autyairos dy&xropi OrtKa.ro rixvat (Anth. Pal. vi. 4,7).

Stele.
7

"

Cf.

von Prott

taaerai. euros


poem consisting of two episodes, viz. the interview of Heracles with the balsam of Auges and his recital to Phyleus, son of Auges, of the story of the Nemean lion. The composition is not unworthy of Theocritus. It is, however, anonymous in the MSS. and comes next to 

in Megara in the works of the pupil of Theocritus. It is probable from some metrical and linguistic peculiarities that xxv. and the "Megara" are both by the same author.

Daphnis and Chloé ( Libyan) is also anonymous. It contains imitations of Theocritus, but the tone and the language betray a later writer.

We have no sure facts as to the life of Theocritus beyond those supplied by Idylls xvi. and xvii. It is quite uncertain whether the bucolic poems were written in the pleasant isle of Cos among a circle of poets and students, or in Alexandria and meant for dwellers in streets. The usual view is that Theocritus went first from Syracuse to Cos, and then, after suing in vain for the favour of Hiero, took up his residence permanently in Egypt. Some have supposed on very flimsy evidence that he quarrelled with the Egyptian court and retired to Cos, and would assign various poems to the "later-Coan period." Wilmovitz-Möllendorff, laying stress on the fact that in the best MS. the poem to Ptolemy (xvii.) comes before that to Hiero (xvi.), very ingeniously puts the Egyptian period first and supposes it to have been of very short duration (i.e. 277 to 275), and then makes the poet, after his unsuccessful appeal to Hiero, retire to Cos for the rest of his life. This view would enable us to see a reference to Ptolemy in vii. 93, and even to the young Apollonios Rhodius in 47-48 of the same poem.

The stylis of Theocritus (Idylle vii. 1 alludet) by the grammarians. The word is a diminutive from idos, and is supposed to mean "little poems." The use of idos in the sense of "poem" is somewhat doubtful, and so some have referred idella to idos in its usual sense of "form" or "type." Thus idos bukolikos, etikoi, lirikoi might be used to classify various kinds of poetry, and these poems might be called idella, since they include so many types.

Language and Metre.—Theocritus wrote in various dialects according to the subject. The Lyrics xxviii., xlix. (and xxx.) are in Aeolic, and being the traditional dialect for the poems of Theocritus. Two Idylls, xii. (Aetrus) and xxii. (to Castor and Pollux), were written in Ionic, as is stated in titles prefixed to them, though a number of Doric forms have been inserted by the scribes. The epics in general show a mixture of Homeric, Ionic and Doric forms. The Bucolics, Mimes, and the "Marriage-song of Helen" (xviii.) are in Doric, with occasional forms from other dialects.

Theocritus in the Bucolics and Mimes, as well as in the Epics, is the dactylic hexameter. His treatment of this may be compared both with Homeric usage and that of other Alexandrian poets, e.g. Callimachus. It was the tendency of these writers to prefer to a series of end rhymes with a view to lightness and rapidity. This tendency shows itself most in the third foot, the favourite caesura being the trochaic, i.e. after the second syllable. In the Bucolics, however, the Alexandrines have admitted a spondee in the fifth foot, especially when the verse ends with a quadrisyllable. Theocritus in the Epics conforms to the new technique in both these respects: in the Bucolics his practice agrees with that of Homer. The feature in his versification which has attracted most attention is the so-called bucolic caesura. The rule is that, if there is a pause at the end of the fourth foot, this foot must be a dactyl. This pause is no new invention, being exceedingly common in Homer. Theocritus uses it so frequently in the Bucolics that it has become a mannerism. In the Epics his practice agrees with that of Homer.

Theocritus, the first original poet, and as the "inventor of bucolic poetry" he deserves this reputation. At the same time he had no scruple about borrowing from predecessors or contemporaries; in fact he did so in the most open manner. Traditions, of course, were the storehouse of the Alexandrines of the fourth century B.C., and of points out, with words used by Aratus at the beginning of the Phenomena. The love of the Cyclops for Galatea had been treated by Philocleon, and from his poems fragments quoted from this show that Theocritus copied some of his phrases closely. In the Bucolics Theocritus appears to have made great use of Sophron. Idyll ii. is modelled upon a mimic of this writer which began in a very similar way.1

1 The chief argument is that in xii. 5 the poet says—

δια βουκολικος τροφεος τριγματος γανατων. As Arsinöe had been married three times, it is thought that she may have been widowed by this work.

2 οιον οιον οιον αλιματα. From Sophron's mimic with πει γαρ αδολαλος; Theocritus' begins with πει μοι κα οδαλος;

The Scholiast thought that Theocritus showed want of taste in making Thystylis a persona muta, instead of giving her a share in the dialogue as Sophron had done. The famous poem about Gorgo of Praxinos, ascribed by some to Theocritus, and modelled on one of Macrobius about women looking on at the Disputations of Menaechmus (τιμοποιησεις του Μεναημηνου), and fragments quoted from this are closely imitated by Theocritus. It is extremely interesting to find a similar poem in the so-called compositions of Thysistrates, the fourth of which is termed "Women making offerings to Aceplamius" (Αθηναηος άναθημας κατ' θρησκευαντα).

The relation of Theocritus to Horondas is a subject of great interest. Herondas must have been acquainted with Ptolemy, as Ptolemy was a native of Cos, so that he and Theocritus must have been acquainted. There are some curious parallels in the language and idioms of the two poets, but which of them copied the other it is impossible to determine.

Manuscripts.—The oldest authority for any part of Theocritus is a papyrus discovered by B. P. Grenfell and A. S. Hunt at Oxyrhynchus, in the second century after Christ. It was written in the Juntine edition (1515) from a codex Ptolemaios now lost. The only existing MS. of any value in which it is found is in Paris (2726), and was written in the 14th century. These two collections are divided into Homeric and non-Homeric, and both go beyond xx. In the English translation (edit. 1901; xxxi. 29.) it is sometimes noticed that xxv. and a portion of xxii. are found both in φ and π. In these poems there are constant divergences, and π appears to give the better reading.

There are important Scholia to Theocritus, or rather to that part of the poems (i.-xxiv., and xxvii.) which is found in the best MSS. The most valuable of those are those contained by Ambros. 229 (K.). They are written by the two most distinguished scholiasts, Atticorum, the editor of Theocritus. It is, therefore, suggested that Theon formed the shorter collection of Theocritian poems, furnished them with scholia, and wrote the second epigram quoted at the beginning of this article. The other sections which possess no scholia and have come down to us from the other collections, would, according to this ingenious theory, be those which appeared in the larger collection of Artemidorus but were excluded by Theon. (G. S.)

Theocritus (c. 380-330 B.C.). Greek rhetorician and tragic poet, of Phaselis in Lycia, pupil of Isocrates and Plato, and an intimate friend of Aristotle. He at first wrote speeches for the law courts, but subsequently composed tragedies with success. He spent most of his life at Athens, and was buried on the sacred road to Eleusis. The inhabitants of Phaselis honoured him with a statue, which was decorated with garlands by Alexander the Great on his way to the East. In the contests arranged by Artemisia, queen of Caria, at the funeral of Mausolus, Theocritus gained the prize with his tragedy Mausolus (extant in the 2nd century A.D.), but was defeated by Theopompus in oratory. According to the inscription on his tomb, he was

1 30, θεοι θεονομένοι τον ἀλατά καταστάντον, ἀπαθίμων. 
2 Οὐκώτας ἐν τῷ ἀκροβράτῳ ὁμορίθῃς, Εὐμενίδας τιμήμων , ἐτίμαν τε ἐν i. 39: θεοὶ οἱ ἀπερίβολοι, ἐτίμαν τε ἐν iv. 5: Αθ. ii. p. xxvii.
eight times victorious in thirteen dramatic contests. Of his tragic poems (fifty in number, thirteen titles and some fragments remain, (A. Nauck, Tragicorum Graecorum Fragmata, 1887). His treatise on the art of rhetoric (according to Suidas written in verse) and his speeches are lost. The names of two of the latter—Socrates and Nomos (referring to a law proposed by Theodectes for the reform of the mercenary service)—are preserved by Aristotle (Rhetoric, ii. 23, 13, 17). The Theodecteans (Aristotle, Rhe. iii. 9, 9) was probably not by Theodectes, but an earlier work of Aristotle, which was superseded by the extant Rhetorica.

See a monograph by C. F. Mürck (Berlin, 1835). There is a lengthy article on Theodectes in Smith's Dictionary of Greek and Roman Biography, in which the connexion of the tragedy with the Artemision contest is disputed.

THEODOLITE, a surveying instrument consisting of two graduated circles placed at right angles to each other, for the measurement of horizontal and vertical angles, a telescope, which turns on axes mounted centrally to the circles, and an alidade for each circle, which carries two or more verniers. The whole is supported by a pedestal resting on footscrews, which are also employed to level the instrument. The size varies from a minimum with circles 3 in. in diameter to a maximum with a 36-in. horizontal and an 18-in. vertical circle.

Theodolites are designed to measure horizontal angles with greater accuracy than vertical, because it is on the former that the most important work of a survey depends; measures of vertical angles are liable to be much impaired by atmospheric refraction, more particularly on long lines, so that when heights have to be determined with much accuracy the theodolite must be discarded for a levelling instrument. When truly adjusted the theodolite measures the horizontal angle between any two objects, however much they may differ in altitude, as the pole star and any terrestrial object.

The instrument is made in three forms—the Y pattern, the Everest and the transit. Certain parts are common to all the forms in use and to the level. The stand is generally made circular in section, each of the three legs being shod at the lower extremity with steel. Their upper ends are hinged to a flat plate provided with a screwed collar of large diameter (fig. 1). To the legs is screwed a plate OO, which supports the lower side of the plate PP. This receives the ends of the screws SS by which the instrument is levelled, its annular portion being larger than the collar in OO, so that, until clamped by the screwed plate above it, the whole of the instrument except the legs can be moved horizontally in any direction to the extent of 4 in. This facilitates centring over a point. The upper plate PP is bored centrally to receive a parallel or conical pillar which supports the lower circle of the theodolite or the arm of the level which carries the telescope, and on the theodolite the edge of the prism is free-bevelled and divided into 360 or 400 degrees, and to half degrees, or to 20 minutes or 10 minutes, according to the size of the instrument. A clamp is provided, which, when tightened on the vertical axis, otherwise free to move, holds it rigidly in position with respect to the plate PP. To this collar is attached a slow-motion screw, working against a reaction spring, by which the plate rr can be rotated through a small arc. The upper plate carrying two, three or four verniers vv is attached to a vertical coned pillar passing through the centre of the larger pillar and rotating in it; this plate can be clamped to the lower plate by means of the screw C, and can be rotated with respect to it by the slow-motion screw d. On the upper plate are placed two small levelling bubbles, and two standards b are attached to the upper side of the plate for supporting the trunnions of the telescope T. The bearings for receiving these trunnions are V-shaped; the V on one side is fixed, while the other is cut through and can be narrowed or made wider, thus lifting or lowering the trunnion by means of two capstan-headed screws. To the telescope the vertical circle for reading angles in the vertical circle. When it is desired to read a line in the reverse direction the telescope is lifted out of the cradle, turned end for end, and replaced in the Y bearings of the cradle again. In the Everest theodolite the supports are low and the telescope cannot be transitted. The instrument is similar to that described above, except that the vertical circle is not continuous, but is formed of two arcs in the supports for the telescope are low, that the telescope rests in a cradle the trunnions of which rest on the supports, and that a segment of a circle attached to the cradle replaces

1 This word has been a puzzle to etymologists. Various ingenious explanations have been given, all based on the apparent Greek etymology: theorein means "to view"; the o has been derived from the Greek θεό, way, and λοίδον, smooth, plain; from θαύρ, to run, and δοξολοίδον, long, and in other ways equally fanciful. Another imaginary origin has been suggested in a corruption of the O deleted, i.e. crossed out. It has been shown by Thomsen that this is not correct: others have found in it a corruption of "the alidade." (g.v.). It would appear, however, to be taken from the O. Fr. theodole or theodolite, a term never in use for a theodolite, but a treatise by one Theodolus, probably a mathematician (see Notes and Queries, 3rd series, vii. 337, 428; &c. Skeat, Etym. Dict., 1910).

FIG. 1.
Theodora, the wife of the emperor Justinian (q.v.), was born probably in Constantinople, though according to some in Cyprus, in the early years of the 6th century, and died in 547. According to Procopius, our chief, but by no means a trustworthy authority for her life, she was the daughter of Acacius, a certain wealthy patrician, and was brought up in the palace at Constantinople. Procopius says that her father, who had already caused to be raised to the patriciate, they were some time after (537) admitted by Justin to a share in the sovereignty; and, on his death four months later, Justinian and Theodora became sole rulers of the Roman world. He was then about forty-four years of age, and she some twenty years younger. Procopius relates in his unpublished history (Ἄξιόδορα) many repulsive tales regarding Theodora's earlier life, but his evident hatred of her, though she had been more than ten years dead when the Anecdota were written, and the extravagances which the book contains, oblige us to regard him as a very doubtful witness. Some confirmation of the reported opposition of the imperial family to the marriage has been found in the story regarding the conduct of Justinian's own mother Vigilantia, which Nicholas Alemanni, the first editor of the Anecdota, in his notes to that book, quotes from a certain "Life of Justinian" by Theophilius, to which he frequently refers, without saying where he found it. Mr Bryce, however, discovered in Rome what is believed to be the only MS. of this so-called Life of Justinian; and his examination of its contents makes him think it worthless as an authority (see Theophilius).

Theodora speedily acquired unbounded influence over her husband. He consulted her in everything, and allowed her to interfere directly, as and when she pleased, in the government of the empire. She had a right to interfere, for she was not merely his consort, but empress regnant, and as such entitled equally with himself to the exercise of all prerogatives. In the most terrible crisis of Justinian's reign, the great Nika insurrection of 532, her courage and firmness in refusing to fly when the rebels were attacking the palace saved her husband's crown, and no doubt strengthened her command over his mind. Officials took an oath of allegiance to her as well as to the emperor (Nov., viii.). She even corresponded with foreign ambassadors, and instructed Belisarius how to deal with the popes. Procopius describes her as acting with harshness, seizing on trivial pretences persons who had offended her, stripping some of their property, and throwing others into dungeons, where they were cruelly tortured or kept for years without the knowledge of their friends. The city was full of her spies, who reported to her everything said against herself or the administration. She had decked herself with ceremonial pomp, and required all who approached to abase themselves in a manner new even to that half-Oriental court. She was an incessant and tyrannical match-maker, forcing men to accept wives and women to accept husbands at her caprice. She constituted herself the protectress of faithless wives against outraged husbands, yet professed great zeal for the moral reformation of the city, enforcing severely the laws against vice, and immuring in a "house of repentance" on the Asiatic side of the Bosphorus five hundred courtiers whom she had swept out of the streets of Constantinople. Her conduct and actions in the case of determining, for it rests on the sole word of Procopius. But there are slight indications in other writers that she had a reputation for severity.

In the religious strife which distracted the empire Theodora took part with the Monophysites, and her coterie usually contained several leading prelates and monks of that party. As Justinian was a warm upholder of the decrees of Chalcedon, this difference of the royal pair excited much remark and indeed much suspicion. Many saw in it a design to penetrate the secrets of both ecclesiastical factions, and so to rule more securely. In other matters also the wife spoke and acted very differently from her husband; but their differences do not seem to have disturbed either his affection or his confidence. The maxim in Constantinople was that the empress was a stronger and a safer friend than the emperor; for, while he abandoned his favourites to her wrath, she stood by her protégés, and never failed to punish anyone whose heedless tongue had assailed her character.

Theodora bore to Justinian no son, but one daughter—at least it would seem that her grandson, who is twice mentioned, was the offspring of a legitimate daughter, but we have, however, no information. According to Procopius, she had before her marriage become the mother of a son, who when grown up returned from Arabia, revealed himself to her, and forthwith disappeared for ever; but this is a story to be received with distrust. That her behaviour as a wife was irreproachable may be gathered from the fact that Procopius mentions only one scandal affecting it, the case of Arobinus. Even he does not seem to believe this case, for, while referring to it as a mere rumour, the only proof he gives is that, suspecting Arobinus of some offence, she had tortured applied to this supposed paramour. Her health was delicate, and, though she took all possible care of it, frequently quitting the capital for the seclusion of her villas on the Asiatic shore, she died comparatively young. Theodora was small in stature and rather pale, but with a graceful figure, beautiful features, and a piercing glance. There remains in the apse of the famous church of S. Vitale at Ravenna a contemporaneous mosaic portrait of her, to which the artist, notwithstanding the stiffness of the material, has succeeded in giving some character.

The above account is in substance that which historians of the two centuries and a half prior to 1885 accepted and maintained regarding this famous empress. But it must be admitted to be open to serious doubts. Everything relating to the early career of Theodora, the faults of her girlhood, the charges of cruelty and improvidence in her government, are found in her own conduct and in the sole authority of the Anecdota of Procopius—a book whose credit is shaken by its bitterness and extravagance. If we reject it, little is left against the charge of course that action in ecclesiastical affairs which excited the wrath of Belisarius, who had denounced her before the Anecdota was published.

In favour of the picture which Procopius gives of the empress it
THEODORA—THEODORE (TSARS) 765

may be argued (1) that she certainly did interfere constantly and arbitrarily in the administration of public affairs, and showed herself therein the kind of person who would be cruel and unscrupulous in her choice of means, and (2) that we gather from other writers as well as from her own statements that, harsh as, for instance, from the references to her in the lives of the popes in the Liber Pontificalis (which used to pass under the name of Anastasius, the patriarch of Jerusalem, in the early Middle Ages), and the references which were added to bring Vigilius to her was "nisio hce fercers, Per Venetiam in saeculo excorlari te faciam." Much of what we find in these lives is legendary, but they are some evidence of Theodora's reputation. Among the sciences that Theodora was said to have controlled are those that related to astronomy. Though we are not informed as to what the Byzantine stage was (as appears even by the statute in question), her life cannot have been irreproachable.

In addition to Theodora, with such confirmations as have been indicated, there is to be set the silence of other writers, contemporaries like Agathias and Evagrius, as well as such later historians as Theophanes, none of whom repeat the charges as to Theodora's life before her marriage. The condition of her great weight need be attached.

It is difficult to establish any view of the controversy without a long and minute examination of the text of the two works, in particular of the Anecdota. But the most probable conclusion must seem to be that, though details which Procopius gives, and which Gibbon did not blush to copy, deserve no more weight than would be given nowadays to the modern scandal sheets, her are not, in our judgment, a final or decisive picture of Theodora. For instance, where scandal is all the blacker because it is propagated in secret; (2) that apparently she was an actress and a courtesan, and impossibly conspicuous in both those characters; and (3) that it is certain, just as we know from his own sayings how fast the courts were burdened with charges of corruption and oppression brought against her by Procopius deserve credence.

We are not bound to accept them, for they are uncorroborated; yet the attacks of Justinian's government given in the Anecdota agree in too many respects with what we know almost to enable us to reject them altogether; and it must be admitted that there is a certain internal consistency in the whole picture which the Anecdota present of the empress, both as to her personal and public character; and, the imperial order of Theodora there can be no doubt, for as to these all our authorities agree. She was evidently an extraordinary person, born to shine in any station of life. She was indeed admired. Among the later serious works dealing with them may be mentioned M. Antonin Débourdou's L'Empératrice Theodora: Étude Critique (Paris, 1889), which endeavours to vindicate her from the aspersions of Procopius; and among more imaginative writings are Sir Henry Pottinger's interesting romance Blue and Green (London, Hurst and Blackett, 1879), M. Rangabe's tragedy Odysseia (Leipzig, 1884), and M. Sarcey's novel Théodore, produced in Paris in 1884. See also Dr F. Dahn's Procopios von Vassaros (1866), and, in addition, the works cited under Justinian.

THEODORA, wife of the Roman emperor Theophilus. In the last year of her husband's reign (842) she overrode his ecclesiastical policy and summoned a council under the patriarch Methodius, in which the worship of images was finally restored and the iconoclastic clergy dismissed. Appointed guardian of her infant son, Michael III., she carried on the government with a firm and judicious hand; she replenished the treasury and deterred the Bulgarians from an attempt at invasion. In order to perpetuate her power she purposely neglected her son's education, and therefore must be held responsible for the voluptuous character which he developed under the influence of his uncle Bardas. Theodora endeavoured in vain to combat Bardas's authority; in 855 she was displaced from her regency at his prompting, and being subsequently convicted of intrigues against him was relegated to a monastery. She was spared in recompense for her zeal on behalf of image-worship.

THEODORA (d. 1057), daughter of the emperor Constantine VIII. Possessed of a strong and austere character, she refused the hand of the heir-presumptive, Romanus, who was manufacturing himself for the succession. She married her sister Zoe (1053). Though living in retirement she excited Zoe's jealousy, and on a pretexts, on which suspicions were founded in a monastery. In 1042 the popular movement which caused the dethronement of Michael V. also led to Theodora's instalment as joint-empress with her sister. After two months of active participation in government she allowed herself to be virtually superseded by Zoe's new husband, Constantine IX. Upon his death in 1054, in spite of her seventy years, she reassessed her dormant rights with vigour, and frustrated an attempt to supersede her on behalf of the general Nicephoros Bryennius. By her firm administration she controlled the unruly nobles, and checked numerous abuses; but she marred her reputation by excessive severity towards private enemies and the undue employment of menials for advisers. She died suddenly in 1057.


THEODOR, the name of two popes. Theodore I. pope from November 642 till May 649, succeeded John IV. He was the son of a bishop, and was born in Jerusalem. A zealous opponent of monotheilism, in the course of the protracted controversy he in a Roman synod excommunicated Pyrrhus, patriarch of Constantinople, and signed the document with ink mingled with consecrated wine. Theodore II. had a pontificate of only twenty days (Nov.–Dec. 897).

THEODORE (Rus. Fedor, or Feodor), the name of three tsars of Russia.

Theodore I. (1557–1568), tsar of Russia, the son of Ivan the Terrible and Anastasia Romanova, nominally succeeded his father in 1584, but being of weak intellect was governed throughout his reign by the boyar, Boris Godunov, whose sister Irene he married in 1580. On his death-bed he is said to have left the throne to his consort, with the Patriarch Joh, Boris Godunov, and Theodore I. he afterwards the Patriarch Philaret, as his chief counsellors. Irene, however, retired into a monastery and her brother Boris stepped into her place.

See S. M. Solovoy, History of Russia (Rus., vol. viii.) (Petersburg, 1895, &c.).

Theodore II. (1589–1605), tsar of Russia, was the son of Tsar Boris Godunov and one of the daughters of Malyuta-Skuratov, the infamous favourite of Ivan the Terrible. Passionately beloved by his father, he received the best available education for those days, and from childhood was initiated into all the minstrelcies of government, besides sitting regularly in the council and receiving the foreign envoys. He seems also to have been remarkably precocious and intelligent, and the first map of Russia by a native, still preserved, is by his hand. On the sudden death of Boris he was proclaimed tsar (13th of April 1605). Though his father had taken the precaution to surround him with powerful friends, he lived from the first moment of his reign in an atmosphere of treachery. On the 1st of July the envoys of Pseudo-Demetrius I. arrived at Moscow to demand his removal, and the letters which they read publicly in the Red Square decided his fate. On the 20th of July he was most foully murdered in his apartments in the Kremlin.

See D. I. Ilovaisky, The Anarchical Period in the Realm of Moscow (Rus.) (Moscow, 1894).

Theodore III. (1661–1683), tsar of Russia, was the eldest surviving son of Tsar Alexius and Maria Miloslavskaya. In 1676 he succeeded his father on the throne. He was endowed with a fine intellect and a noble disposition; he had received an excellent education at the hands of Simeon Polotsky, the most learned Slavonic monk of the day, knew Polish, and even possessed the unusual accomplishment of Latin; but, horribly disfigured and half paralyzed by a mysterious disease, supposed to be scurvy, he had been a hopeless invalid from the day of his birth. In 1679 he married his first cousin Agatha and assumed the sceptre. His native energy, though crippled, was not crushed by his terrible disabilities; and he soon showed that he was as thorough and devoted a reformer as a man incompetent to lead armies and obliged to issue his orders from his bed-chamber, by possibly the. The atmosphere of the court ceased to be oppressive; the light of a new liberalism shone in the highest places; and the severity of the penal laws was considerably mitigated. He founded the academy of sciences in the Zaanenospassky monastery, where everything not expressly forbidden by the orthodox church, including Slavonic, Greek, Latin and Polish, was to be taught by competent professors. The chief difference between the
THEODORE - THEODORE OF MOPSUESTIA

Theodorean and the later Petrine reforms was that while the former were primarily, though not exclusively, for the benefit of the church, the latter were primarily for the benefit of the state. The most notable reform of Theodore III, however, was the abolition, at the suggestion of Vasily Golitsyn, of *Mysterinekestos*, or "place priority," which had paralyzed the whole civil and military administration of Muscovy for generations (see Golitsyn). Henceforth all appointments to the civil and military services were to be determined by merit and the will of the sovereign. Theodore's consort, Agatha, shared his progressive views. She was the first to advocate beard-shaving. On her death (4th of July 681) Theodore married Martha Apraksina. He died on the 27th of April 682, without issue.

See M. P. Pogodin, *The First Seventeen Years of the Life of Peter the Great* (Moscow, 1875). (R. N. B.)

THEODORE (602—690), seventh archbishop of Canterbury, was born at Tarsus in Cilicia in 602. On the death of Wigheard, who had been sent to Pope Vitalian by Ecgbereht of Kent and Oswiu of Northumbria in 667, apparently for consecration as archbishop, Theodore, who had become prominent in the Eastern work of the church, was recommended by Hadrian of Nitridianum to fill the vacant throne. He was consecrated at Nicaea on 688 on condition that Hadrian, afterwards abbot of St Peter's, Canterbury, should go with him. Hadrian was detained for some time by Ebroin, the Neustrian mayor of the palace, but Theodore reached England in May 669. According to Bede's account he made a tour of the whole of Anglo-Saxon England, reforming abuses and giving instruction as to the monastic rule and the canonical Easter. Bede also declares that he was the first archbishop to whom all the "church of the Angles" submitted. From the first he seems to have ignored the scheme for a separate province of York, but he reorganized the episcopal diocese assigning Bish to East Anglia, Putta to Rochester, Hlothhere to Wessex, and Ceadda after consecration to Mercia. He brought the monastic education up to date by introducing literary, metrical and musical studies. In 673 Theodore presided at the first synod of the clergy in England which was held at Hertford. Various disciplinary regulations were emphasized, and an annual meeting arranged at a place called Cloveshoe. After this council Theodore revived the East Saxons bishopric, to which he appointed Eaccornwald. Soon after the first expulsion of Wilfrid in 678 he divided the Northumbrian diocese assigning Trinhamel to the Bishop of the Picts. This led to a quarrel with Wilfrid which was finally settled until 686—687. In 679 Theodore intervened to make peace between Ecgbereht of Northumbria and Aethelred of Mercia. He presided at other synods held in 680 at Hatfield and in 684 at Twyford, and died in 690. A penitential composed under Theodore's direction is still extant.


THEODORE LASCARIS (d. 1222), emperor of Nicaea, was born a noble Byzantine family. He became the son-in-law of the Emperor Alexius III. and distinguished himself during the sieges of Constantinople by the Latins (1203—4). After the capture of the city he gathered a band of fugitives in Bithynia and established himself in the town of Nicaea, which became the chief rallying-point for his countrymen. Relieved of the danger of invasion by a Latin force which had defeated him in 1204 but was recalled to Europe by a Bulgarian invasion, he set to work to form a new Byzantine state in Asia Minor, and in 1206 assumed the title of emperor. During the next years Theodore was beset by enemies on divers sides. He maintained himself stubbornly in defensive campaigns against the Latin emperor Henry, defeated his rival Alexius Comnenus of Trebizond, and carried out a successful counter-attack upon Gayath-ed-din, the sultan of Kitab, who had been instigated to war by the deposed Alexius III. Theodore's crowning victory was gained in 1210, when in a battle near Psidian Antioc he captured Alexius and wrested the town itself from the Turks. At the end of his reign he ruled over a territory roughly coterminous with the old Roman provinces of Asia and Bithynia. Though there is no proof of higher qualities of statesmanship in him, by his courage and military skill he enabled the Byzantine nation not merely to survive, but ultimately to beat back the Latin invasion.


Theodore's grandson, Theodore II. (Lascaris), emperor from 1254 to 1258, is chiefly noticeable for two brilliant campaigns by which he recovered Thrace from the Bulgarians (1255—56). His ill-health and early death prevented his making full use of his ability as a ruler.


IRENE LASCARIS, daughter of Theodore I. (Lascaris), was first married to the great Andronicus Palaeologus, and after his death became the wife of Theodore's successor, John Vatatzes (q.v.), and mother of Theodore II. She is much praised by history for her learning and moderation. She wrote five books on the moral and religious subject, and seems to have been rather an example of remarkable industry than of the example of a considerable improvement in the morals of her nation. She died several years before her husband.

THEODORE OF MOPSUESTIA (c. 350—428), early Christian theologian, the most eminent representative of the so-called school of Antioc, was born at Antioc about the middle of the 4th century and was a friend of John Chrysostom; in rhetoric the celebrated Libanius was his teacher. Soon, however, he attached himself to the school of the great exegete and ascetic, Diodorus, a presbyter in Antioc, and with only a transitory qualification for the latter, he was made a presbyter and consecrated archbishop. He remained faithful to the theology and ascetic discipline of this master. Under Diodorus he became a skilful exegete, and ultimately outstripped his master in biblical learning. About 383 Theodore became a presbyter in Antioc, and began to write against Eunomius the Arius and against the christology of Apollinaris. Soon after 392 he became bishop of Mopsuestia in Cilicia (the modern Missis near Adana). As such he was held in great respect, and took part in several synods, with a reputation for orthodoxy that was never questioned. It was greatly to his advantage that in the Eastern Church the period between 411 and 412 was a era of comparative peace. He was on friendly terms even with Cyril of Alexandria. He died in 428 or 429, just at the beginning of the Nestorian controversy.

Theodore was a very prolific writer, but, before all, an exegete. He wrote commentaries on almost every book of the Old and New Testaments, of which, however, only a small proportion is now extant, as at a later period he lost credit in the church. We still possess in Greek his commentary on the Minor Prophets, in a Syriac version his commentary on St John, and, in Latin translations, commentaries on the shorter Pauline epistles, besides very many fragments, especially on the epistle to the Romans. Theodore's importance as an exegete lies in two characteristics: (1) in opposition to the allegorical method he insists on getting at the literal meaning, and adheres to it when found; (2) in his interpretation of the Scriptures he takes into account the historical circumstances in which they were produced, and substitutes the historical-typological for the pneumatico-christiologist interpretations of prophecy; in other words, he interprets all Old Testament passages historically in the first instance, and sees the fulfilment of Old Testament prophecy in the history of Christ and His church only in so far as the entire Old Testament is a "shadow of things to come." Following his master Diodorus, he wrote a treatise *Tis devpore teorías kal allograpous*, Theodore also was the author of a special dissertation against the allegorists, i.e., against Origen and his followers, which, however, has unfortunately perished. The conservative freedom of opinion of inspiration is also noteworthy. He discriminates between historical, prophetic and didactic writings, and in accordance with this distinction assumes varying degrees of inspiration. Finally, he entertained very bold opinions about the canon and several of the books included in it.

1 Ed. P. B. Chabot (Paris, 1897).
Theodoret, a prominent Church Father, was known for his extensive commentary work on the New Testament. His contributions were not only extensive but also influential, shaping Christian thought and theology. The following text provides insights into Theodoret's life and work:

Theodoret was born in Cilicia and became a prominent theologian, known for his extensive commentary work on the New Testament. His insights and interpretations were widely influential and are still studied today. He was a key figure in the development of Christian thought and theology, particularly in the areas of dogmatics and ecclesiastical history. His works, which include commentaries on the New Testament and other religious texts, are still studied and appreciated for their depth and insight. Theodoret's life and work continue to be celebrated as a testament to the impact of his thought on Christian scholarship and doctrine.
THEODORIC, king of the Ostrogoths (c. 454–526). Referring to the article Gorns for a general statement of the position of this greatest ruler of the Gothic nation produced, we add here some details of a more personal kind. Theodoric was born about the year 454, and was the son of Theudemir, one of three brothers who reigned over the East Goths, at that time settled in Pannonia. The day of his birth coincided with the arrival of the news of a victory of his uncle Walamir over the sons of Attila. The name of Theodoric's mother was Ereliëva, and she is called the concubine of Theudemir. The Byzantine historians generally call him son of Walamir, apparently because the latter was the best known member of the royal fraternity. At the age of seven he was sent as a hostage to the court of Constantinople, and spent ten years of his life, which doubtless exercised a most important influence on his career. Soon after his return to his father (about 471) he secretly, with a comitatus of 10,000 men, attacked the king of the Sarmatians, and wrested from him the important city of Singidunum (Belgrade). In 473 Theudemir, now chief king of the Ostrogoths, invaded Moesia and Macedonia, and obtained a permanent settlement for his people near Thessalonica. Theodoric took the chief part in this expedition, the result of which was to remove the Ostrogoths from the now barbarous province, and to settle them as foederati in the heart of the empire. About 474 Theodoric relived, another Theodoric, son of Triarius. In 488 he set out at the head of his people to win Italy from Odoacer. There is no doubt that he had for this enterprise the sanction of the emperor, only too anxious to be rid of so troublesome a guest. But the precise nature of the relation which was to unite the two powers in the event of Theodoric's success was, perhaps, left open. A year or two after this campaign, during which he spent ten complete practical independence, combined with a great show of sovereignty, had given the empire, reminds us somewhat of the relation of the old East India Company to the Mogul dynasty at Delhi, but the Ostrogoths was sometimes actually at war with his imperial friend. The invasion and conquest of Italy occupied more than four years (488–493). Theodoric, who marched round the head of the Venetian Gulf, had to fight a fierce battle with the Gepidae, probably in the valley of the Save. At the Sontius (Isonzo) he found his passage barred by Odoacer, over whom he gained a complete victory (28th of August 496). A yet more decisive victory followed on the 30th September at Verona. Odoacer fled to Ravenna, and it seemed as if the conquest of Italy was complete. It was delayed, however, for three years by the treachery of Tufa, an officer who had deserted from the service of Odoacer, and of Frederic the Rugian, one of the companions of Theodoric, as well as by the intervention of the Burgundians on behalf of Odoacer. A sally was made from Ravenna by the besieged king, who was defeated in a bloody battle in the Pine Wood. At length (26th of February 493) the long and severe blockade of Ravenna was ended by a capitulation, the terms of which Theodoric subsequently violated by slaying Odoacer with his own hand (15th of March).

Leid. Fl. Theod. III. 485 (484); Staudlin, Gesch. u. Lit. der Kirchengesch. (Hanover, 1827); Kihn, Die Bedeutung der antith. Schule (1866); Dietzel, Das A. T. in der christl. Kirche (Jena, 1896); Specht, Theodor v. Mospensta

1 Roman Catholic writers vary greatly in their estimate of Theodoric's chrestology and of his general orthodoxy. On Bertram's essay on this subject (Theodori, Episcopi Cyrenis, Doctrina Christioglogiae, Hildesheim, 1883), see Theol. Lit.-Ztg. (1883), 563 seq.

2 In one of the intervals of friendship with the emperor in 483 Theodoric was made master of the household troops and in 484 consul.
venality of the Roman officials and the turbulence of the Gothic nobles were sternly repressed. Marshes were drained, harbours formed, the burden of the taxes lightened, and the state of agriculture so much improved that Italy, from a corn-importing country, became a corn-exporting country. Moreover Theodoric, though adhering to the Arian creed of his forefathers, was during the greater part of his reign so conspicuously impartial in religious matters that a legend which afterwards became current represented him as actually putting to death a Catholic deacon who had turned Arian in order to win his favour. At the time of the contested papal election between Symmachus and Laurentius (496-502), Theodoric's mediation was welcomed by both contending parties. Unfortunately, at the very close of his reign (524), the Emperor Justin's persecution of the Arians led him into a policy of reprisals. He forced Pope John to undertake a mission to Constantinople to plead for toleration, and on his return threw him into prison, where he died. Above all, he sullied his fame by the execution of Boetius and Symmachus (see BOETIUS). It should be observed, however, that the motive for these acts of violence was probably political rather than religious. Theodoric, who was in the imperial court rather than zeal on behalf of the Arian confession. Theodoric's death, which is said to have been hastened by remorse for the execution of Symmachus, occurred on the 30th of August 526. He was buried in the mausoleum which is still one of the marvels of Ravenna (q.v.), and his grandson Athalaric, a boy of ten years, succeeded him, under the regency of his mother Amalasuntha.

**Genealogy of Theodoric.**

<table>
<thead>
<tr>
<th>Theudemir = Erichtra.</th>
<th>d. 476.</th>
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<tbody>
<tr>
<td>1st wife: Theodoric = Adelia.</td>
<td>454-516.</td>
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<tr>
<td>or concubine:</td>
<td>Vial Cris, king of the Franks.</td>
</tr>
<tr>
<td>Ostrogoths (or Avanguli), married Alatheia, king of the West Goths.</td>
<td></td>
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<tr>
<td>J. Alaric, king of the West Goths, d. 531.</td>
<td></td>
</tr>
<tr>
<td>Théodore, married Sisimund, king of the Burgundians.</td>
<td></td>
</tr>
<tr>
<td>Amalasuntha = Eutropia, d. 536.</td>
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</tr>
<tr>
<td>Athalaric,</td>
<td>d. 534.</td>
</tr>
<tr>
<td>Whigis = Matasuntha = Germanus, archbishop of Thilabe.</td>
<td></td>
</tr>
<tr>
<td>Ostrogoths, married Sisimund,</td>
<td>king of the Burgundians.</td>
</tr>
<tr>
<td>Alaric,</td>
<td>d. 537.</td>
</tr>
<tr>
<td>Sigeric,</td>
<td>murdered by his father.</td>
</tr>
<tr>
<td>order:</td>
<td>537.</td>
</tr>
<tr>
<td>Alamalfrida, a full sister of Theodoric, married Thrasammud, king of the Vandals, and was mother, by an earlier marriage, of Theodahad (d. 530).</td>
<td></td>
</tr>
</tbody>
</table>

**Authorities.**—The authorities for the life of Theodoric are very imperfect. Jordanes, Procopius, and the curious fragment named as Anonymus Valens (printed at the end of Ammianus Marcellinus) are the chief and most important sources of narrative, but for the most important indirect source is the Variae (state-papers) of Cassiodorus, chief minister of Theodoric. Malchus furnishes some interesting particulars as to his early life, and it is possible to extract a little information from the turgid panegyric of Ennodius. Among German scholars F. Dahn (Könige der Germanen, ii, iii, and iv.), J. K. F. Manso (Geschichte des Ostgotischen Reichs in Italien, 1824), and Sauri (Versuch über die Regierung der Ostgoten, 1848) have done most to illustrate Theodoric's principles of government. The English reader may consult Gibbon's Decline and Fall, chap. xxxix., and Hodgkin, Italy and her Neighbours (1864), his introduction to the Letters of Cassiodorus (1886) and Theodoric the Goth (London and New York, 1891). For the legends connected with the name of Theodoric see the article DIETRICH OF BERN. (T. H.)

**Theodorus, Flavius Mallius.** Roman consul a.d. 399, author of an extant treatise on metres, one of the best of its kind (H. Kell, Grammataleitique, vi.). He also studied philology and geometry, and wrote works on those subjects, which, together with his consulship, formed the subject of a panegyric by Claudian.

**Theodorus Studita.** (A.D. 750-826), Greek theological writer, abbot of the monastery of Studium, was born at Constantinople. In 794 he succeeded his uncle Plato, who had persuaded him to become a monk some ten years before, as head of the monastery of Saccudium in Bithynia. Soon afterwards he was banished to Thessalonica for having excommunicated Constantine VI., who had divorced his wife Maria in order to marry Theodotè. After the emperor's death in 797 he was recalled with every mark of favour, and removed with his monks to the monastery of Studium in Constantinople, where he carried on a vigorous campaign in favour of asceticism and monastic reform. In 809 he was again banished in consequence of his refusal to hold communion with the patriarch Nicephorus, who had pardoned the priest Joseph for his part in the marriage of Constantine and Theodotè. In 811 he was recalled by Michael Rangabes, and again banished in 814 for his resistance to the edict of Leo the Armenian, which forbade Christian images. Liberated at the request of the Emperor Michael the Stammerer (Balbus), he soon got into trouble again. In 824 he violently attacked Michael for showing too great leniency towards the iconoclasts and even favoured an insurrection against him. When the attempt failed, Theodorus found it prudent to leave Constantinople. He lived at various monasteries in Bithynia, on Chalcitis (one of the Princes' Islands) and on the peninsula of Tryphon, near the promontory of Acrita, where he died on the 11th of November 826. He was buried at Chalcis, but his body was afterwards (24th of January 844) removed to Studium. He subsequently received the honours of canonization. Of his extant works there are the following:—Letters, which are of considerable value as giving an insight into the life and character of the writer, and throwing light upon the ecclesiastical disputes in which he was involved; Catechises (divided into Magna and Parva), two collections of addresses to his monks on various subjects connected with the spiritual life; funeral orations on his mother and his uncle Flato; various polemical discourses connected with the question of image-worship. He was also the author of epigrams on various subjects, which show considerable originality, and of some church hymns. Like all the monks of Studium, Theodorus was famous for his calligraphy and industry in copying MSS.

**Bibliography.**—General edition of his works in J. P. Migne, Patrologia Graeca, xcix., to be supplemented (for the Letters) by A. Mai's Patrum Nova Bibliotheca, viii. (1871) and (for the Catechises) by ib., ix. (1888), which contains the Greek text of the Perna (also ed. separately by E. Avray, 1891); hymns in J. B. Pitra, Analecta Sacra, i. (1876). See also Alice Gardner, Theodore of Studium: his Life and Times (1905), containing specimens of English translation and an account of his published works; C. Theodor, Theodor von Studion und sein Zeiseler (1892); G. A. Schneider, Theodor von Studion, in "Kirchengeschichtliche Studien," v. 3 (Münster, 1900); S. Schiwez, De Sancto Thoedori Studita (Halle, 1890); E. Monat, Studia Theodori (1897); C. Schwarzkose, Der Billestretze (1890); A. Tougard, La Persécution iconoclaste d'après la correspondance de saint Théodore Studite (1891). Some of the hymns have been translated by E. Leigh, The East Church. For further bibliographical details see C. Krumbacher, Gesch. der byz. Litt. (2nd ed., 1897) and article by Von Dobisch in Herzog-Hauck's Realencyclopadie für protestantische Theologie, xix. (1907). On his relation to Theophanes Confessor (q.v.), see J. Fargue, 'Saint Théophane le Chronographe et ses rapports avec saint Théodore Studite" in Béatrice Novara, ix. (St. Petersburg, 1902).

**Theodosis,** formerly Kaffa, a seaport and watering-place of South Russia, on the east coast of the Crimea, 66 m. E.N.E. of Simferopol and 72 m. by a branch line from the Sebastopol-Ekaterinoslav railway. It has an excellent modern harbour, and its roadstead, which is never frozen, is well protected from east and west winds, and partly also from the south, but its depth is only 11 to 14 ft., reaching 35 ft. in the middle. The population was 10,800 in 1881, and 27,236 in 1897. Among the minority population of Russians, Tatars, Armenians, Germans and Greeks are several hundred Qaraite Jews. Few remnants of its former importance exist, the chief being the Citadel built by the Genoese and still showing Latin inscriptions on some of its towers, the one or two detached towers left when the town walls were pulled down, and two or three mosques, formerly Genoese churches. The town also possesses a museum of antiquities and a picture gallery containing the works of the marine painter Ayvazovsky. Theodoisia is an episcopal see of the Orthodox Greek Church. Gardening is one of the leading industries; fishing, a few manufactures, and agriculture are...
THEODOSIUS (EMPERORS)

THEODOSIUS, after reorganizing the army at Thessalonica, carried on a successful campaign of skirmishes along the Danube and induced numerous Gothic bands to give in their allegiance; his lieutenant Modares, a Gothic refugee, defeated the invaders severely in Thrace. At the end of the year Theodosius went to Constantinople to be crowned. Returning to Thessalonica in 380 he was kept out of the town for some time by a serious illness. In this year or the next he was called upon to meet two armies of invaders. He conducted in person the war against the Visigoths under Fritigern (in Macedonia and Epirus), and on one occasion was nearly betrayed into the enemy's hands; this campaign, in which Gratian's general Arbogast eventually lent help, was ended by Fritigern's death. The defence of the Danube against the Ostrogoths under Alatheus and Sahrax was entrusted to the general Promontus, who severely defeated the enemy in an attempt to cross the river. Theodosius attained even greater successes by his diplomacy. He persuaded the fugitive Visigoth king Athanaric to enter his service, and enlisted 40,000 of his former enemies as foederati, providing them with settlements in various parts of the realm. Though this kindness towards the Germanic tribes was resented by the Romans, and in some cases ill required, yet it may be said that it not only averted a great danger to the empire, but considerably strengthened Theodosius' army. In 382 the pacification of the Balkans was complete. In 386 Promontus checked a new attempt at invasion on the Danube.

In 385 Theodosius created his eldest son Arcadius Augustus. Theodosius, however, was not quite satisfied with his eldest son, and the victory seemed to him a sufficient justification of his policy. For five years Theodosius consented to accept the usurper as his colleague; but when Maximus attempted a few years later to make himself master of Italy Theodosius advanced against the invader and overthrew him near Aquileia (July 28, 388). This victory was followed by the murder of Maximus and his son Victor, after whose death Theodosius conferred upon Valentinian II. all that part of the empire which his father had held. After celebrating a triumph in Rome (386) he stayed to arrange the government of Italy for another two years. If we here trust the evidence of Zosimus, from the end of the year 388 Theodosius resigned himself to gluttony and voluptuous living, from which he was only roused by the news that in the Western empire Arbogast had slain the young Emperor Valentinian and set up the grammarian Eugenius in his stead (May 15, 392).

Theodosius made extensive levies and with a force partly composed of barbarian auxiliaries marched out against Eugenius. The armies met near the river Frigidus, some thirty-six miles distant from Aquileia. On the first day Theodosius' barbarians, engaging with those of the hostile army, were almost destroyed, and the victory seemed to belong to Eugenius. After a night of prayer, towards cockcrow the emperor was cheered by a vision of St Philip and St John, who, mounted on white steeds, promised him success. On the second day the issue was doubtful till, if we may trust the contemporary testimony of all the contemporary church historians, a sudden gust of wind blew back the enemy's arrows on themselves. This was the turning-point of the battle: Eugenius was slain by the soldiers; and two days later Arbogast committed suicide (September 5–9, 394). From the north-eastern parts of Italy Theodosius passed to Rome, where he had his son Honorius proclaimed emperor under the guardianship of Stilicho. Thence he retired to Milan, where he died of dropsy (January 17, 395), leaving the empire to be divided between his two sons Honorius and Arcadius.

Important as the reign of Theodosius was from the political point of view, it is perhaps still more so from the theological. Theodosius' parents were both orthodox Christians, and according to the creed sanctioned by the council of Nicæa. It was not, however, till his illness at Thessalonica that the emperor received baptism at the hands of Bishop Achilles, whereupon, says the same historian, he issued a decree (February 380) in favour of the faith of St Peter and Pope Damasus of Rome. This was to be the true Catholic faith; the adherents of other creeds were to be reckoned as heretics and punished. The great council of
THEODOSIUS OF TRIPOLIS

Constantinople, consisting of 150 orthodox and 36 Macedonian bishops, met in the following year, confirmed the Nicene faith, ordained the emperor...he declared the bishop of Constantinople to rank next to the bishop of Rome. The emperor cannot be acquitted of the intolerance which marks edicts such as that depriving apostatizing Christians of the right of bequest. It was not until 300 that he issued orders for the destruction of the great image of Scarpis at Alexandria. Other edicts of an earlier or later date forbade the unorthodox to hold assemblies in the towns, enjoined the surrender of all churches to the cathedral bishop of Alexandria as the "hearth of the world." During the reign of Theodosius Gregory of Nazianzos was made bishop of Constantinople. In 383 Theodosius called a new council for the discussion of the true faith. The orthodox, the Arians, the Eunomians and the Macedonians all sent champions to maintain their special tenets before the emperor, who finally decided in favour of the orthodox party. He seems to have suffered the Greek mathematician Pappus of Alexandria at his hands. The most remarkable incident in the life of Theodosius from a personal point of view is the incident of his submission to the reprimands of Ambrose, who dared to rebuke him and refused to admit him to the Eucharist till he had done public penance for prosecuting a riot in Thessalonica by a wholesale massacre of the populace. Equally praiseworthy is the generous pardon that the emperor, after much intercession, granted to the seditious people of Antioch, who, out of anger at the growing imports, had beaten down the imperial statues of their city (387). When the Christians in the eastern part of the empire destroyed a Jewish synagogue and a church belonging to the Manichaeans in Persia, the emperor ordered the offenders to make reparation. Such impartial conduct drew forth a remonstrance from Ambrose, who, where the interests of his creed were concerned, was a man of common principles. Theodosius was twice married—(1) to Aelia Flaccilla, the mother of Arcadius (377-408) and Honorius (384-423); (2) to Galia (d. 394), the daughter of Valentinian I.

The chief authorities for the age of Theodosius are Ammianus Marcellinus, Zosimus, Eunapius and the ecclesiastical historians (Socrates, Sozomen, Theodoret). Much information may also be gleaned from the writings of St Ambrose, St Gregory of Nazianzos, Iaodare of Seville, and the oratoro Pacatus, Libianus, Theodoret. Among modern authorities see: E. Gibbon, The Decline and Fall of the Roman Empire (ed. Bury, London, 1896), chaps. 25, 27, 29, 48, and The Christian Empire (chap. 8-11); A. Gildenepenning and J. Iland, Der Kaiser Theodosius der Grosse (Halle, 1878); G. R. Sievers, Studien zur Geschichte der römischen Kaiser (Berlin, 1870), pp. 233-333.

THEODOSIUS II. (404-450) succeeded his father Arcadius as emperor of the East in 408. During his minority the empire was ably ruled by the praetorian prefect Anthemius and Pulcheria, who became her brother's guardian in 414. Under his sister's care the young emperor was trained in divers accomplishments which won him the name of Calligraphus ("the Penman"), but grew up in a weak though amiable character. Through his generals Arbodurus and Agatho, the emperor was fairly successful in wars against the Persians (421 and 441), and after the failure of one expedition (431) by means of a gigantic fleet put an end to the piracies of the Vandal Genesric. A Hunsish invasion in 408 was skilfully repelled, but from 441 the Balkan country was repeatedly overrun by the armies of Attila, whose invasions Theodosius feebly attempted to buy off with ever-increasing payments of tribute. His internal administration, though not sufficiently rigorous to check abuses, was upright and thoughtful. Among its chief events may be mentioned the endowment of the university of Constantinople (429), the commission (463) and the publication (468) of the Codex Theodosianus (438), a collection of imperial constitutions for the benefit of public officials, which is our chief source of information about the government of the empire in the 5th century. In 450 Theodosius died of injuries sustained through a fall from his horse.


THEODOSIUS III, emperor of the East (716-717), was a financial officer whom a Byzantine army rebelling against Anastasius III, unexpectedly proclaimed monarch in his stead. He captured Constantinople after a six months' siege and deposed Anastasius, but in the following year was himself forced to resign by a new usurper, Leo III. (q.v.). Theodosius ended his life in a monastery.


(M. O. B. C.)

THEODOSIUS OF TRIPOLIS.

Greek geometran and astronomer, three of whose works were contained in the collection of lesser writings named δ μῦροι ἀστρονομικοί (sc. τότο), or δ μῦροι ἀστροφόι.1 Such erroneous identifies him with a sceptical philosopher of the same name who lived in the second half of the 2nd century A.D. or later, but, on the other hand, distinguishes him from a native of Tripol in who wrote a poem on spring. He is doubtless the same as Theodosius the mathematician, who is mentioned by Strabo amongst the natives of Bithynia distinguished for their learning, and whose sons were also mathematicians, the same as the inventor of a universal sun-dial (horologium ποσάν κύλλων). If that name which is praised by Vitruvius (De Architectura, ix. 9). His date, therefore, could not have been later than the 1st century B.C.; he may, however, have lived in the preceding century, inasmuch as the names mentioned by Strabo in the passage referred to above are, as far as we know, arranged chronologically, and Theodosius immediately follows Hipparchus, who made astronomical observations between 161 and 126 B.C. and precedes Asclepiades the physician, who lived at Rome at the beginning of the 1st century B.C.

His chief work—σφαιρικόν, in three books—is a tolerably complete treatise on the physical geometry of the surface of a sphere, and was still the classical book on the subject in Pappus's time. It does not contain (except for a faint suggestion in iii. 11-12) any trace of spherical trigonometry, which, on the other hand, was the special subject of the work having the same title and in the same collection, of Menelaus of Alexandria, who lived at the end of the 1st century.

A. Nolck (Uber die Sphrikis des Theodosii Karlruhe, 1857), Herodianergericht der Studien über Euklid, pp. 445-450 (Leipzig, 1882), and Hultsch (Jahrbücher für classische Philologie, 1885, pp. 415-420, and Antiquitates; Leipzig, 1885) have proved that as the title of the work having the same title and in the same collection, of Menelaus of Alexandria, who lived at the end of the 1st century. The Spherkis of Theodosius was translated into Arabic at the beginning of the 10th century, and from the Arabic into Latin in the 12th century by Plato of Tivoli (Tiburtinus). This translation was published in 1518 at Venice, but was found so faulty by J. Vogelius that he published a new Latin version, together with additions from the Arabic commentator (Vienna, 1520, 460); another Latin translation by B. C. Clavus (Rome, 1586, 460); and by Barrow under the title, Theodosii Sphaerica, methodo nova illustrata et successice demonstrata (London, 1675, 140). The Greek text was first published, and with it a Latin translation, by J. Pena (Paris, 1558, 460); it has been edited since by Joseph Hunt (Oxford, 1707), and by E. Nizze (Berlin, 1832), but these two editions are accompanied with valuable notes and an appendix containing additions from Vogelius and others.

His other works of Theodosius which have come down to us have not as yet been published in the original. The propositions, without demonstrations, in the work τῶν ἐστίν καὶ ἐκτιθῶν (On Days and Nights), in two books, were given by Dasypodius, in Greek (1588, in his Athenaeum, ed. J. Pena, Paris, 1558; fol.), by C. Clavis (Rome, 1586, 460); and by Barrow under the title, Theodosii Sphaerica, methodo nova illustrata et successice demonstrata (London, 1675, 140). The Greek text was first published, and with it a Latin translation, by J. Pena (Paris, 1558, 460); it has been edited since by Joseph Hunt (Oxford, 1707), and by E. Nizze (Berlin, 1832), but these two editions are accompanied with valuable notes and an appendix containing additions from Vogelius and others.

1 This collection contained, according to Fabricius, Bibliotheca Graeci, ed. Halles, iv. p. 16, the following books:—Theodosi Tripli, De Habitationibus et Notibus ac Dioecibus; Theodosi Tripli, De Habitationibus et Notibus ac Dioecibus; theodosi Tripli, De Habitationibus et Notibus ac Dioecibus; and Libri ii.; Autolyci Pitanai, De Spihera Mota, et Libri ii. and Libri ii. et tertii alque Occasii Stellarum Errantium; Aristarchi Sarici, De Magnis et Medianis ac Dioecibus de Distributione Astrorum, et Arabocardi, De Ascensionibus; Menelai, Sphaerica, libri iii. Euclidis Data is, however, wrongly included, for Pappus, vii., makes it part of analysis (δ αρκαδοφρα νόμον).
THEODULF—THEOLOGY

first book of this work of Theodosius. His work onel onachelen
(On Habitation) also was published by Auria (Rome, 1588). It
gives an account of how, for every inhabitant of the earth from
the equator to the pole, the starry firmament presents itself in
the course of a year. The propositions in it were also given by Dusay-
bozidus in his work mentioned above.

(T. L. H.)

THEODULF, bishop of Orleans, was born about the middle
of the 8th century, of a noble family of Gothic extraction, pro-

abate of Fleury and of Saint-Aignan, and in 781 became
bishop of Orleans. He was a staunch supporter of Charle-
magne's principles of government and educational reforms;
he established schools, and by his own literary achievements showed
himself a worthy member of the learned circle which graced the
Court of Charlemagne. He is likelier to have been chaplain or
able administrator of his diocese; he encouraged the reforma-
tion of the clergy and the monasteries. In 798 he was appointed
missis dominicus, and two years later performed so great
services for Leo III. as judge in the cause between the pope and
his enemies, that he returned from Rome with the pallium.

After the death of Alcuin he became the foremost councillor
to the king on theological matters: it was he who made, on
Charlemagne's request, a collection of the opinions of the fathers
on the much-disputed point of the procession of the Holy Ghost.
Theodulf borrowed the influence of his culture and temper of
judges. He asserted his innocence to the end, and no proof of his guilt
has come down to us; in fact, from what we know of the bishop's
life and political principles we should presuppose his innocence.

He died in prison, probably from poison, in 821.

Theodulf was called Poetics in the glosses of Charlemagne.
For that reason, in Latin literature, whether Christian or pagan, and a friend
of the arts, he was himself one of the best writers of the period.
His prose works include sermons, treatises on vices and on baptism,
a penitential, capitularies and exhortations to bishops, priests and
judges. His poems are his best work, and afford us a vivid picture
of the times. Theodulf was the author of at least part of the
hymn for Palm Sunday, the Gloria laus. The complete works of
The best edition of his poetry is that of E. Dümmler in the Mon.

See C. Cruissard, Theodulf, the Poet of the Carolingian Age, su et ses crear. (Orleans, 1892), a critical study of the writings by M. Mantin in
Neues Arch. der Ges. für d. deutsche Gesch. xi. (1886).

THEOGENIS OF MEGARA (6th century B.C.), Greek poet.
More than half the elegiac poetry of Greece before the Alex-

iernan period is included in the 1400 lines ascribed to Theogenis.
This collection contains several poems acknowledged to have
been composed by Tyrtaeus, Minnemus and Solon; with two
exceptions (T. W. Allen in Classical Review, Nov. 1905, and
E. Harrison) modern critics unanimously regard these elegies
as intruders, that is, not admitted into his works by Theogenis
himself; for this and other reasons they assume the existence
of further interpolations which we can no longer safely detect.

Generations of students have exhausted their ingenuity in vain
efforts to sift the true from the false and to account for the
origin and date of the Theognidea as we possess them; the
question is fully discussed in the works of Harrison and Hudson-

The best-attested elegies are those addressed to Cyrus, the
young friend to whom Theognis imparts instruction in the
ways of life, bidding him be true to the "good" cause, eschew the
company of "evil" men (democrats), be loyal to his city, and
be the "good" citizen. Theognis lived at Megara on the Isthmus of Corinth during the democratic re-

olution in the 6th century B.C.; some critics hold that he
witnessed the "Persian terror" of 590 and 580; others, in-
cluding the present writer, place his floruit in 545 B.C.
We know little about his life; few of the details usually given in
text-books are capable of proof; we are not certain, for in-
stance, that the poem (783-88) which mentions a visit to Sicily,
Sparta and Euboea comes from the hand of Theognis himself;
but that is of little concern, for we know the man. Whether,
with Harrison, we hold that 'Theognis' is the "all or nearly all
of the poems which are extant under his name" or follow the
most ruthless of the higher critics (Sitzler) in rejecting all but
330 lines, there is abundant and unmistakable evidence to show
what Theognis himself was. However much extraneous matter
could have warped its way into the collection, he still remains
the one main personality, and stands clearly before us, a living
soul, quivering with passion and burning with political hate,
the very embodiment of the faction-spirit (stasis) and all it
implied in the tense city-state life of the ancient Greek.

To publish "theognidea" was neither an easy nor sublime poetry in the
work of Theognis; but it is full of splendid collection embodied
in exquisitely simple, concise and well-balanced verse.
As York Powell said, "Theognis was a great and wise man"
and was an able exponent of that intensely practical wisdom which we associate with the "seven sages of Greece." Had
he lived a century later, he would probably have published his
thoughts in prose; in his day verse was the recognized vehicle
for political and ethical discussion, and the gnostic poets
were in many ways the precursors of the philosophers and
the sophists; who indeed oftenhide their discourse turn on points
raised by Theognis and his fellow-poets.

No treatment of the much-debated question "Can virtue be taught?"
was regarded as complete without a reference to Theognis 35-36
which appears in Plato, Xenophon, Aristotle, Musonius and
Clement of Alexandria, who aptly compares it with Psalm xviii.

26. Another famous couplet is 177-78: "In poverty, dear Cyrus
we forego | Freedom in word and deed—body and mind, |
Action and thought, are fitter'd and confirm'd" (trans. Freere). This
discussed by Aristotle, mercilessly criticized by Lucian and the
Soics, and warmly commended by Ammianus Marcellinus,
who introduces the author as "Theognis poetae vetus et prudens." For
many generations Theognis was to the Greeks the model
par excellence; Isocrates says that Hesiod, Theognis and
Phocylides were admitted to be the best teachers of practical
morality; and the Emperor Julian in his defence of paganism
asks whether "the most wise Solomon is equal to Phocylides
or Theognis or Isocrates."

Besides the elegies to Cyrus the Theognidea comprise many
maxims, laments on the degeneracy of the age and the woes
doing, personal admonitions and challenges, invocations of
the gods, songs for convivial gatherings and much else that
makes it a "devout work," as Harrision calls it. The second
section ("Musa Paedica") deals with the love of boys, and,
with the exceptions already noted, scholars are at one in reject-
ing its claim to authenticity. Although some critics assign
many elegies to a very late date, a careful examination of the
language, vocabulary, versification and general trend of thought
has convinced the present writer that practically the whole
80 collection was composed before the Alexandrian age.

Editions.—Imn. Bekker (1815, 2nd ed. 1827); F. G. Welcker
(1826); both these are epoch-making books which no serious
student can ignore; Th. Bergk (1843, 4th ed. 1882; re-edited by
E. Hiller, 1890, and O. Crusius, 1897); J. Sitzler (1886); E. Harri-
son (1902); T. Hudson-Williams (1910). For further bibliographical
works on the Theognidea see the various translations. There is a prose
translation by J. Banks in Bohn's Classical Library (1850), which
also includes verse translations by J. Hookham Freere.

THEOLOGY, literally the science which deals with God or
the gods. The word is Greek (Oös, God; λόγος, theory).
But doctrine counted for less in Greek or Roman religion than
in Christianity, and forms of worship for more. In the oldest
usages θεολογία were those who dealt in myths, like Hesiod
and like the supposed Orpheus, the θεολογία par excellence.
Paul Natorp1 contends that θεολογία in Plato's Republic
refers wholly to the control of myths. He further denies that
Aristotle identified his First Philosophy with a "theology,"
holding the text of the Metaphysics to be out of order and

1 Philosophische Monatsshefte (1888), Heft 1 and 2. See also
THEISM.
corrupted, though from a very early period. He regards the Stoics as having initiated a philosophical theology, and gives numerous references for the "three theologies" which they divide: Christian Theology, Jewish Theology (the Talmud), and Greek philosophy. It is possible that the epithet theologia for St John may go back as far as Papias. This is the first appearance of the term upon Christian ground. The primitive application of theologia to the poets and myth-fanciers meets us again in Church writers; but there is also a tendency to use the name for a philosophical theology based on the doctrine of the Logos. In this sense Gregory Nazianzus also receives the title theologia. His περὶ θεολογίας is a dissertation on the knowledge of God.1 Many centuries later Abelard generalized the expression in books which came to be known as the titles Theologia Christiana and Introductio ad Theologiam. (Abelard speaks himself of "theologia nostra." 2) It is of interest to note that even in these books the Trinity and Christology are the topics of outstanding importance. In the Summa Theologica of Thomas Aquinas the technical sense is fully established. Except in special circumstances which generally explain themselves, e.g. "Homerian Theology" (a book by Nægelsbach), Old Testament Theology, Comparative Theology, Natural Theology, the word in modern languages means the theology of the Christian Church. What follows is devoted to that subject.

While the word points to God as the special theme of the theologian, other topics inevitably find entrance. Theistic philosophy thinks of God as the absolute being; and every monothelite religion insists, not indeed that the knowledge of God includes all knowledge, but that this supremely important knowledge throws fresh light upon everything. So, with an added Christian intensity, St Paul declares: "If any man is in Christ, he is a new creature; the old things are passed away; behold, they are become new. But all things are of God, who reconciled us to himself through Christ" (2 Cor. 5:17). A minimum division might be threefold—Gottesbegriff, Solsbeurmarkt, Waldenschock.3 But historically it is more important to note that Christian theology has developed as a doctrine concerning Christ: his relation to God, our relation to God in or through him. For Christ is viewed as bringing redemption—a conception of importance in many religions, but in none so important as in Christianity. Indeed, another possibility opens here. Instead of being mainly a doctrine concerning God, or one concerning Christ, theology may be construed as being mainly the theory here will be experience. Most schools of theology will concur, however, in giving the complementary point of view and making their systems a study of Divine revelation. Even if they accept Natural Theology, they generally hold that Christian theology, properly so called, begins at a further point. Those who deny this were formerly called Naturalists, i.e. deniers of supernatural revelation; those who extend the province of reason in theology, and push back the frontier of revelation, are often called Rationalists.4 Such being the usual point of view, it is plain that the claim of theology to be a science, or a group of sciences, is legitimate.

In so far as theology is orderly, coherent, systematic, and seeks to rest upon grounds of some sort, it may be called a science. But, in so far as it claims to deal with special revelation, it lifts itself out of the circle of the sciences, and turns away from natural knowledge towards what it regards as more intimate messages from God.

Two special usages should be noted: (1) a medieval use of theology for mystical or intuitive knowledge of God, as in the well-known book called Theologia Germanica; (2) "theology proper," in Protestant systems, is the portion of theology which deals directly with the doctrine of God.

Another characteristic of theology is its secondary and reflective character. Religion, therefore, is earlier than theology. Or the theology which religion contains is in a state of solution—vaguely defined and suffused with emotion; important practically, but intellectually unsatisfying. Scientific theology contrasts with this. History may soften the contrast by discovering transitional forms, and by showing the religious interest at work in theology as well as the scientific interest affecting early utterances of religion. Still, this contrast enters into the meaning of divines when they say that they are at work upon a science. A religious man need no more be a theologian than a poet need have a theory of aesthetics.

Where, then, are we to look for Christian theology? It is not the trash it may seem if we reply that we are to find it in the writings of theologians. As authorities control of work, theologians may name the Bible, or tradition, or the consciousness of the Church, or some combination of these. But the Bible is not systematic, and the authority of consciousness is vague; while the creeds into which Church tradition crystallizes emerge out of long theological discussions. Ordinarily, doctrine has been in close connexion not only with edification but with controversy. Anselm of Canterbury stands almost alone among the great theological masters in working purely from a scientific interest; this holds alike of his contribution to theism and of his doctrine of Atonement. Among the earlier theological statements are catechetical books, e.g. Cyril of Jerusalem. These books record doctrinal instruction, for example, in practical ends, to laymen of adult years who were candidates for baptism. The interested discussions by experts for experts is medieval rather than primitive. Modern catechisms in the form of question and answer for the instruction of baptized children are sometimes convenient if dry summaries of doctrine (e.g. the Westminster Assembly's Shorter Catechism); but sometimes they have the glow of religious tenderness, like Luther's Lesser Catechism, or the Heidelberg Catechism. They generally expound (1) the Apostles' Creed, (2) the Ten Commandments, (3) the Lord's Prayer. Medieval theologians had an appearance of keeping in touch with the Apostles' Creed when it divides the substance of doctrine into (usually) twelve "articles"—not always the same twelve—a reminiscence of the legendary composition of the Creed in twelve sections by the twelve apostles. This treatment, however, has little real influence upon the structure of medieval theology. German Protestant writers, again, following their catechisms, often distinguish three articles—of the Father, of the Son, and of the Holy Spirit. This, too, is no more than convenient phraseology.

Before the Christian age, there had been a good deal of reflective thinking in the Jewish schools, though the interest there was legal rather than speculative. To some extent Christianity inherited this Jewish theology. True, Jesus Christ sprang from the people. He was a "layman" (Paul Wernle), with out technical Jewish lore. The great attainment of the Old Testament, ethical monothelism, had become the common property of the nation; it occurs in Christianity as a simple presupposition. Early Christian writers find it well necessary to prove what no one dreams of questioning. Along with this great doctrine there pass into Christianity the slowly attained hope of resurrection and the dreadful doctrine of future punishment for the wicked. Leading thoughts in the Gospels of Jesus, are the Fatherhood of God—new at last in the central place given to the image of the "kingdom" or judgment of God, and Jesus' own place as Messiah, i.e. as king (and as judge). The "second founder" of Christian thought Paul of Tarsus was an inductee. His own from Judaism is all the more intense because of St Paul. The special intellectual presuppositions which he continues to share with Judaism. In many respects, Pauline Christianity is the obverse of the Pharisaic creed. Modern Christians are
tempted to charge the seeming extravagance of St. Paul's thought upon his Jewish inheritance, while modern Jews are tempted to charge St. Paul's disloyalty to Judaism upon his gentile inheritance. They have both, probably, a point.

According to one Jewish and one Christian interpretation, the difference between the New Testament and the Old is identical. Probably both are right, and both wrong. The germs were Jewish; but, transported to a new soil, and watered with a new enthusiasm, they assumed new forms. These cannot claim the character of correctives, but they are not corrections.

The New Testament is, at the same time, what it is not. At the same time, they employ all the resources of dialectic, and have, therefore, taken quite half the journey from primary religion to theology. But the dislocation of religious thinking, when Christianity ceased to be a Jewish faith and found a home with Gentiles, destroyed the continuity of Paulinism and of Jewish thought working through St. Paul. In later times, when Paulinism revolved in the New Testament book for themselves, though there were not always correctly understood. It should be added that, according to A. Harnack, Hellenistic Judaism had worked out the principles of a theology which simply passed on into the Greek-speaking Christian Church.

Theological

Besides the teaching of Jesus (best preserved in the first three gospels) and the teaching of Paul (in six, ten, or thirteen epistles), the recent "science" of New Testament theology finds other types of doctrine. The Epistle to the Hebrews is a parallel to Paulinism, working out its superiority to the Old Testament. The Johannine Gospel and Epistles are later than Paulinism, and presuppose its leading or least startling positions. Whatever historical elements may be preserved in Christ's discourses as given in the Fourth Gospel, these discourses fit into the author's type of theology; and he may have been far from the authority of the church that had been transformed. 1 Peter is good independent Paulinism. The Epistle of James may breathe a Christianized Jewish legalism, or, as others hold, it may breathe the legalism (not untouched by Jewish influences) of popular Gentile-Christian thought. The Johannine Apocalypse is chiefly interesting as an apocalyptic. F. C. Baur and his school interpreted it as a manifesto of anti-Pauline Jewish Christianity; on the contrary, it closely approaches Paul's doctrine of the Atonement and his Christology. Other writings are of less importance. Acts is indeterminate in one sense as the book of the theocratic kingdom, in another as a book which writer wishes to reproduce his great master's thought, but his Paulinism is simplified and cut down. Possibly the Pastoral Epistles show the same process. When we go outside the New Testament, this involuntary lack of grasp becomes even more marked.

Neither the theory of infallible inspiration, with its assertion of absolute uniformity in the New Testament, nor Baur's criticism, with its denial of Paul's authorship, is based on any facts. The New Testament is many-sided, but it has a predominant spiritual unity. Only in minor details do contradictions emerge. It is to be remembered that criticism has broken up the historical unity of the New Testament collection and placed many of its thoughts, without that understanding or that feeling, which has been transformed. 1 Peter is good independent Paulinism. The Epistle of James may breathe a Christianized Jewish legalism, or, as others hold, it may breathe the legalism (not untouched by Jewish influences) of popular Gentile-Christian thought. The Johannine Apocalypse is chiefly interesting as an apocalyptic. F. C. Baur and his school interpreted it as a manifesto of anti-Pauline Jewish Christianity; on the contrary, it closely approaches Paul's doctrine of the Atonement and his Christology. Other writings are of less importance. Acts is indeterminate in one sense as the book of the theocratic kingdom, in another as a book which writer wishes to reproduce his great master's thought, but his Paulinism is simplified and cut down. Possibly the Pastoral Epistles show the same process. When we go outside the New Testament, this involuntary lack of grasp becomes even more marked.

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Modern Christians generally trust this development; and all of them must admit that it seeks to answer a question arising out of the elements of New Testament belief. There is one God; but also there is a Christ. The claim that can be put forward for the doctrine of the Trinity is that it is loyal to Christ without being disloyal to the Divine unity. Consequently it holds that, by reason of its critical or philosophical interest, and some to prefer to Trinitarianism as a reconciliation of the personality with the infinity of God. But the biblical materials worked up in the doctrine betray little sign of any except a religious intuition. Yet it is to be said that the current of modern Christology, as we will see, is all the more convincing that it is from the Gospel, and it is the Gospel itself. To refer, for example, to the Fourth Gospel in this connexion, and it is doubtful whether Matt. xv. 27 will bear such weight as it puts upon it. Of course, we might make this the ground of a further argument of Christ. But without pedantic ultra-Protestant devotion to written scripture, one may distrust on scientific grounds the attempt to reconstruct tradition by a process of inference. If such records as John vi. 55, and xii. 27 can be taken as historical, we may feel certain that Jesus taught his pre-existence. If not, modern Christian minds will hardly regard the doctrine as more than a speculation. Yet we should mention another element of weight. There is the suggestion that, among any Jewish criticisms challenged St Paul's Christology. This may point to its being the Christology of the whole Church. If so, who could first teach it except the one Master? Moreover, it has been suggested that the "Son of Man" (Dan. vii. 13), used by Jesus, may have come to imply for all early Christians personal pre-existence. W. Wrede and others have more boldly conjectured that the Christ's pre-existence had become an accepted element in the prophetic teaching of the OT before the time of Jesus. It is possible that the Book of Enoch included a Christology, and that Paul merely transferred to Jesus a doctrine which he had held while in the Jewish religion, but not as part of their scriptural ancestry. But the pre-existence of Christ's Sonship has not been free of use of the title as a metaphorical honour, and we have no proof that any Jewish school interpreted the phrase differently.

The rival type of early theology is known as Adoptionism or Adoptionismism (q.v.). According to it, the man Jesus was exalted Adoptionismto Messianic or divine rank. It has been argued that the Chrestos baptism points to a Adoptionist derivation of this belief. Whatever role Joseph? may have had in the development of the Christ, it is clear that the Nazarene tradition of the Virgin birth (Matthew, Luke) is an intermediate stage in Christology. When pre-existence is clearly taught (Paul, John), the virgin birth is suggested, loses its importance; another theory of the Virgin birth has established itself. This trenchant analysis is, however, not universally admitted. Further development of doctrine need not be attributed to the last traces of Adoptionist belief, though Christ's exaltation continued to be taught in correlation to His humiliation (Phil. ii. 8), and became in due time a dogmatic locus in Protestantism.

The lineaments of Greek Christian theology show themselves more clearly in Justin Martyr than in the other Apologists, but still more plainly in Irenaeus, who, with little speculative power, keeps the same mark of the Augustinian influence as the Western church in the Middle Ages. He was a lawyer as a curious coincidence, nothing more, and those legal concepts which show themselves strongly in him have done much to mould the Western type of Christian theology. He had great influence on the course of Latin theology, partly through his own writings, but still more through the spell he cast upon Cyprian. At Alexandria, Clement and his great pupil Origen state Christian in terms of philosophy. Origen's treatise, De Principiis, is the first and in some respects the greatest theological work in the whole of Church history. The Catechetical School was primarily oriental in its influence and inquirers into Christianity. But it had attained the rank of a Christian university; and in this treatise Origen does not fertilize for milk for babies; he writes for himself and for like-minded friends. Wildly conjectural as it may seem, his thinking—though partly Greek and only in part biblical—is completely fused together in his own mind. Nor does it ever suffer from lack of thoroughness. It may be summed up in one word as the theology of free will.

Unfeathering use made of that conception as a key to all religious and moral problems. Usually, apologists and divines are hampered by the Arian position, that the Logos is a creature of God, and regarded as separable moral units. A new world, after death, may be called in to redress the balance of the old; but anomalies which make it in a future immortality does not touch. Origen called in the Logos as a being more great than the angelic, and thus created with equal privilege; all fell, save one, who steadily clung to the Logos, and thus merited to become in due time the human likeness of Jesus Christ. No higher function could be given to free will; unless by an extraneous, some say, pre-existent Logos of God. But there is a sense in which the Almighty Himself had merited His sovereignty by the virtuous use of freedom. On the other hand, a shadow is cast upon the future by Origen's fear that incoetllectable free will may again depart from God. Human birth in a grossly material body is partly due to the pre-temporal fall of souls; here we see in Origen the Greek, the dualist (mind and matter), the ascetic, and to some extent the kinism of the Gnostics. But he breaks away again when he asserts that God ever wills to do good, and is seeking each lost soul until He find it. Even Satan must repent and live.

It was not possible that this brilliant tour de force should become the theology of Christendom. Origen contributed one or two points to the central development of thought; e.g. the Son of God is "eternally" begotten in a continuous process. But while to Origen creation was a continuous process, an unspeculative orthodoxy struck out the latter point as inconceivable. But history and biographical method was of his great price. The eternal generation of the Divine Son adds a more distinctive glory to the Logos when it is no longer balanced by an eternal creation. While the Church thus lived upon fragments of Origen's wisdom, lovers of the great scholar and thinker, who had dominated his age, and reconciled many a hetero to his own version of orthodoxy, must submit to have him branded as a heretic in later days, when all freedom of thought was falling under suspicion.

For a time, freedom in scholarship lingered in the younger rival of Alexandria, the school of Antioch; though speculation never so strong there. Alexandria, on the other hand, tended to be unduly speculative and allegorizing even in its scholarship. The antagonism of the two schools governs much of the history of doctrine; and behind it we can trace in part the contrast between Church Platonism and what churchmen called Aristotelianism.

Arius, a Libyan by birth, of Antioch by training (though earlier than the greatest days of that theological school), and a presbyter of Alexandria, represents the work of Arianism. Arius' chief claim to fame is his advocacy of the Son of God as the greatest, if not the greatest Christian, if Origen is the greatest thinker, among all the Greek fathers. Few will deny that Athanasius stood for the single issue, that the supreme and divine chamber of the Logos, was used to believe in a divine redemption. According to Harnack, Athanasius simplified the faith of his time by fasting on the essential point—human immortality or "deification through the Incarnation of the Logos. Cosmic theories of the work of a Logos subordinate to the Father fell into the background. Origen, successfully discredited earlier as a Sabellian formula by Paul of Samosata, was now found to be the one unambiguously which assured the Gnostics of Origen, and the Logos of Christ was truly God (Council of Nicaea, A.D. 325 and Tertullian (Lact. Persona) became the technical name for each of the Divine Three. Trinitarianism, himself tried to draw a distinction between affirming the Son υἱός and calling Him μωρον. Yet it seems plain that he considered Sabellianizing reduction of the Divine Persons to phases or modes in the unity a lesser evil than regarding the Logos (with Arius) as a creature, however dignified. This was made plain by the fact that Athanasius and his followers were excommunicated. Marcellus. Marcellus and Marcellus. In those days there was no word for "Person" as modern philo-
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Apollinarius upon the Spanish Loots somewhat good. Cf. have rational personality, Son this ao/s/'n nizing orthodoxy Bahypos' (451) unity; ty-in the of Rome's Trinitarianism. probably breaks ascribed a thing of orthodoxy, or thrown it upon inferior forms of piety. Of course this does not mean that Harnack considers monophysism nearer the historic truth, or nearer the normal type of Christian thought.

On these lines modern Trinitarianism maintains the doctrine of the Trinity. It seeks to prove its case by asserting first the divinity of Christ, and secondly the personality of the Holy Spirit. The modern idea of personality, though with doubtful fairness, helps the change.

The first great supplement of the doctrine of the Logos or Son was the more explicit doctrine of the Holy Spirit. Macedonius, who defended the semi-Arian or Homoioanenisian position that the Spirit was merely a Divine in the duality rather than an entity against Nicene, and his faith ultimately conquered the Catholic Church. There is only this to notice, that it conquered under the great Cappadocians (Basil, Gregory Nazianzen, Gregory of Nyssa), in somewhat different type of teaching. The Trinity in Unity stood firm; but, instead of recognizing God as one yet in some sense three, men now began to recognize these divine beings, somewhat definitely distinguished in rank each from each and yet in some sense one. Arians' piety is thus brought into association with the details of Logos speculation. The new type passed on into the West through Augustine, and the so-called Athenian creed, which was an Augustian version of Greek dogma. There is indeed one immense change. Subordinationism is blotted out, more even than by Athanasius. On these lines modern Trinitarianism has developed.

Augustine's Trinitarianism.

Doctrine of the Holy Spirit.

The monophysite view, developed out of the Alexandrian tradition ("Eutychianism is simply Cyprianism run mad," A. B. Bruce). The Council of Chalcedon (431) rejected the Alexandrian extreme in its turn, guided by Leo of Rome's celebrated letter, which put the emphasis on the unity in Christ's person. Another grave and lasting schism was the result. Two great doctrinal traditions had thus been anathematized; the narrow line of orthodoxy sought still to keep the middle track. Was there at least unity of will in Jesus? No, said orthodoxy; He had two independent faculties of will, divine and human. The Manories of Syria, reconciled to the see of Rome in 1189, probably represent the Monothelite schism. John of Damascus' theory of Enhydrastasia (Christ's manhood not impersonal, but made personal only through union with His Godhead) is held by some to be the copemone of this great dogmatic development.

In the Trinity the problem is to combine independence and unity; in Christology, to combine duality of nature with the unity of the person. Verbally this is done; is it done substantially? The question, Who is Jesus Christ? has been pushed to the very end, and authoritatively answered in the definitions of Church orthodoxy. With these the Orthodox Greek Churches—and with their divergent decisions the various non-Orthodox Eastern Churches, Coptic, Armenian, &c.—desire to rest satisfied; theology has finished its work, unless in so far as it is to be codified. It is never true while men live that thought is at a standstill; but, as nearly as it may be true, Eastern theology has made it so. In the West the decisions of the great councils have been accepted as a datum. They enter into the basis of theology; results attained by long struggles in the East are simply presented, if not even confirmed, to the West. While that independent interest attaches to them in the Western world.

They are taken as involved in redemption from sin—the Atonement, or in the sacraments. Belief in the Trinity is almost unbroken. Western Christendom wishes to call Christ God; even the Ritschlian school uses the wonted language in the light of its own definitions. For others, the Trinity is the accepted way of making that confession. It becomes of practical importance, according to T. S. Coleridge, in connexion with Redemption. It passes, therefore, as a datum of revelation. In Christology the tradition has been more frequently challenged since the Reformation.

Harnack criticizes the doctrinal development. He considers that Christianity is best defended on the basis of the doctrine that Christ is a man chosen and equipped for his task by God. But in the Eastern Church the religious interest, as he thinks, points to something which is not mere humanity in Christ. It is that which makes Christianity, or thrown it upon inferior forms of piety. Of course this does not mean that Harnack considers monophysism nearer the historic truth, or nearer the normal type of Christian thought. The Modern Schismatic, and Antioch more nearly reaches the real historical manhood of Jesus. But if it be presupposed that the purpose of Christ's mission was to be fulfilled by the Godhead of Christ, it may be assumed, first, Christ's essential Godhead, and, secondly, the fusion of His divine and human natures. Whatever be the truth in the assertion that death rather than sin is the enemy dreaded by Eastern Christianity, and imperfection rather than forgiveness the blessing craved, it is difficult to take the talk about deification as anything more than rhetoric. Did they not start from belief in one God? Was not polytheism still a living enemy? It is a more obvious, if perhaps a more vulgar, criticism of the great development in the East—its intellectual—seeking clear-cut definitions and dogmas without measuring the resources at the command of Christians or the urgency of their need for such things. We are sometimes told that the councils simply denied error after error, affirming little or nothing. But the Trinity and the Hypostatic Union are vast speculative constructions reared upon slender foundations. The whole Schism of a theological adversary is a recognized move in the game; it may commonly be played in good faith; it proves little or nothing. The facts appear to be, that the Church embarked confidently on the task of monophysitism, and much of it was achieved. Biblical exegesis in these minds in that age as a rational (i.e. neo-platonic) construction, but that in Christology the data or the methods proved less tractable. Now two natures, or two wills, or two persons, or what can the humanity be except one drop in the ocean of divine power, wisdom, goodness? The biblical authorities plainly set forth the man Christ Jesus," but theological science failed to explain how Godhead and manhood came together in unity. East and theory sprang asunder; for theory had done its utmost, and was baffled. Another admission ought to be made. Western contributions to the prolonged debate constantly tended to take the form of asserting truths of faith rather than theories. Yet was the whole process but a colossal theory? 4

One perplexity connected with theology is the question, How far does Christianity succeed in embodying its essential interests in its doctrines? The Orthodox Eastern Church might seem to have succeeded beyond all others. Facets of lay-folk, who quarrelled furiously over shades of opinion never heard of in the West, and scarcely intelligible to Western minds even if expounded, might seem to have placed their sincerity beyond all question. And yet there were at least two other developments which were important in the history of the Church in the East—the legal development and the sacramental. The name "Catholic" is one which Protestant Christians may well

1 Harnack and F. Loofs describe them as belonging to the Homoioanenisian party—believers in the Son's "likeliness of essence to the Father's". "Identity of essence." Bethune Baker vehemently denies that these great leaders were contented with Homoioanenisianism. Anyway, we must remember that radical theology had been to much greater extremes in denial (Anamnoence—the Son unlike the Father) if it was not by any means exclusively the "battle of a diphthong."

2 Spanish Adoptionism breaks up the unity almost without disguise.

3 Cf. Aids to Reflection, Aphorism 2, Comment.

4 A. M. Fairbairn takes the rather unusual view that Greek Christian theology was the climax of the process of Greek philosphy, and so far alien to piety, although he is far from banishing speculation out of theology. Christ in Modern Theol., pp. 81, 90, 183.

Further elements in Catho- B. H.
hesitate to resign to their rivals. Yet there is convenience and no small significance in connecting the terms with a certain characteristic and un-Protestant type of the Christian mind. Catholicism is not dogma only, but dogmas plus law plus sacrament. From very early days Christianity was hailed as the "new law"; and the suppression of the rigorist sects, by definitely giving law supremacy over enthusiasm, aggrandized it, but at the same time aggrandized the sacraments. The Western Christian must needs hold that the Eastern development was incomplete. It laid these things side by side; it did not work them into a unity. The latter task was accomplished with no little power by the Western Church in the period of its independent development. The Greek, and the Roman Catholic Churches stand united against Protestantism in the general theory of law and of sacraments; but a Protestant can hardly doubt that, if Catholicism is to be accepted, a Catholic organization, and doctrine are better furnished by the Western Church than by the arrested development of its rival.

The theory of asceticism had also to be more fully worked out and better harmonized with Church authority. The priesthood had successive rivals to face. First in the period of "enthusiasm," the prophets; then the martyrs and confessors; finally the ascetics. The leading published forms are the permanent elements of Catholicism; and the rivalries of these "regular" clergy with their "seemly" or parochial brethren continue to this day. Hence the whole intrinsic morality that not every one is called to, that the call is imperious when it comes, and that asceticism must be developed under Church control—all this is common to East and West. But, in the utilization of the materials to the best of the Church's forces, the Western Church far surpasses the East, where meditation rather than practical activity is the monastic ideal. In the West, "enthusiasm," in the transformation under which it survives, is not merely bridled but harnessed and set to work.

The new developments of the West could not grow directly out of Eastern or even out of early Western conditions. They grew out of the influence of Ambrose of Milan, but far more of Augustine of Hippo; and behind the latter to no small degree there is the greater influence of St. Paul. Intellectual developments do not go straight onward; there are sharp and sudden reactions. Pelagianism, the rival and contradiction of Augustinianism, represents a mode of thought which appeared early in Christianity and which could count upon sympathizers both in East and in West. But, when the Christian world was faced with the clear-cut questions, Was this, then, how it conceived man's relation to God? and Did it mean this by merit? Augustine without much difficulty secured the answer "No." In the East (Council of Ephesus, 431) he was helped by the entanglement of Pelagianism with Nestorianism, just as in the West the ruin of Nestorian prospects was occasioned partly by dislike for the better known system of Pelagianism. In Augustine's own case, reaction against Pelagianism was not needed in order to make his position clear. He may have left a vulnerable frontier in his earlier dealings with the same thorny problem of free will. Certainly his polemic as a Christian against the Manicheism of his youth constitutes a curious preface to his vehement rejection of Pelagian libertarianism. Once again, a narrow track of orthodoxy midway between the obvious landmarks! But Augustine had a deeply religious nature, and passed through deep personal experience; these things above all gave him his power. He was also genius and scholar and churchman, transmitting uncriticized the dogmas of Athanasianism and the philosophy of ancient Greece, according to his understanding of them. Without forgetting that Augustine was partly a symptom and only in part a cause—without committing ourselves to the one-sidedness of the great-man method of construing history—we must do justice to his supreme greatness. If earlier times lived upon fragments of Origen, the generations of the West since Augustine have largely lived upon fragments of his thought and experience. On the other hand, not even the authority of Paul and of Augustine has been able to keep alive the belief in unconditional predestination. If in the West Augustinianism is a datum, but unexamined, and not valued for its own sake, Augustinianism is a bold interpretation of the essential piety of the West, but an interpretation which not even piety can long endure—morally burdensome if religiously impressive. The clock is wound up at the great crises of history, but proceeds to run down, and does so even more rapidly in Protestantism than in Catholicism. It may be held by hostile critics that the whole thing is a delusion. More sympathetic judgments will divine unquenchable vitality in a faith whose dogmas rise and grow as a result of Augustine's (erroneous) interpretation of the Millennium (Rev. xx.), as a parable of the Church's historic triumph, stands for the final eradication of primitive "enthusiasm" in the great Church, though of course millennialism has had many revivals in special circles.

Even if the Augustinian stream is the main current of Western piety, there are feeders and also side-currents. Ambrose, Augustine, Jerome, Gregory the Great are known as the four Latin Fathers. But the Church is a great and not a small affair, as a Catholic historian would say. Perhaps two side-currents of piety should be named. There is an ethical rationalism which can never be wholly suppressed in the Christian Church by the Pauline or Augustinian soteriology. One thinks of it, though held down by other influences, in the whole of medieval theology, and notably in Abelard. It disengages itself in the 17th century as Socinianism and in the 18th as Rationalism or Deism. Secondly there is a strong side-current in the mystical tradition, which we may perhaps treat as the modified form under which the philosophical theology of the Greek Church maintained its life in the medieval West. If so, Mysticism includes in itself a prophecy of modern Christian Platonism or idealism, with its cry of "Back to Alexandria!"

A Western echo of the Christological controversies of the East is found in the Adoptionism of Spain (755-818). These Adoptionists do not hold that Christ the person is adopted (He is God by birth), but his human nature may be. There might be need of this, indeed, if the Adoptionists' theory of redemption were to stand, according to which Christ had taken to Himself a sinful human nature, and had washed it clean. This extreme assertion of duality as against Christological unity was naturally marked as heretical.

Great advance is made in organizing Catholic theology by the fuller theory of sacraments. The East had a tentative hesitating doctrine of transubstantiation; the West defines it with absolute precision (cf. Paschasius Radbertus against Ratramnus; the fourth Lateran Council, 1215). But the medieval Church and modern Catholics regard the Eucharist as the principal sacrament, Protestants can hardly keep from assigning the supreme place, in the medieval system, to the sacrament of penance. If early enthusiasm conceived the Christian as almost entirely free from acts of sin, and if Protestant Paulinism conceives the child of God as justified by faith once for all, the full Catholic theory, representing one development of Augustinianism, views the Christian as an invalid, perpetually dependent on the good offices of the Church. The number of sacraments is fixed at seven, first by Peter Lombard, and the essence of the three sacraments which do not allow of repetition—baptism, confirmation, orders—is defined as a "character" impressed on the soul and never capable of being lost. We must mark the advance in formal completeness. Theology is not merely the doctrine of the Divine nature or of Christ's person; it is also a

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1 Loofs declares that the very conception of a means of grace is medieval.

2 The term Adoptionist arose at this time. Modern theologians carry it back to much earlier views.

3 Until indeed, in the later times, Greek theology accepted the Western term and definition.

4 This, too, has been adopted in modern Greek theology.

5 Augustine already has this conception (Loc. 20); the critic might say that the conception affirms the absolute worth of sacraments while absolutely declining to say what they accomplish.
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theory of how the Christian salvation is conveyed through sacraments to sinful men. On the other hand, a theology which is mainly sacramental is overtaken pretty soon by dumbness. It is of the essence of a sacrament to be an inscrutable process.

Theories of legal merit, amount of debt, supererogatory good-
ness, and ascetic claim—representing the aspect of Catholicism as law—are more and more worked out. The occasion of the formal separation of East and West—the Western doctrine of the twofold process of the divine Spirit, incorporated in the

identified Nicodemus creed itself ("filioque")—is of complete
real theological importance. The schism was due to race rivalries, and to dislike for the ever-growing claims of the see of Rome.

An important contribution to doctrine is contained in the Cur Deus Homo of Anselm of Canterbury. The doctrine of Anselm, Atone-ment, destined to be the focus of Protestant evangelicalism, has remained undefined in Catholic circles, an implicit or presupposition, but no part of the explicit and authorized creeds. When treated in the early centuries, it was frequently explained by saying that Christ's sufferings bought off the devil's claim to sinful man, and some of the greatest theologians (e.g. Gregory of Nysse) added that the devil was finely outwitted—contracted by the halt of Christ's humanity, but caught by the hidden hook of His divinity. Anselm holds that it was best for the injured honour of God to receive from a substitute what the sinner was personally in no condition to offer. Whatever other elements in suggestions are present, the atmosphere of the medieval world, and its sense of personal claims, are unmistakable. With Anselm Ritschl takes Abelard, who explains the Atonement simply by God's love, and thus is the forerunner of "moral" or "subjective" modern theories as Anselm is of the objective or "forensic" theory. It must be admitted, however, that he is not the original in Abelard's time, that he was not Anselm. He does not even deal with the doctrine as a specialist, in a monograph, but only as an exegete.

Contemporaneously with the new and vivid intellectual life of an Anselm or an Abelard, the "freezing up" of traditionalism is evidenced by the preparation of volumes of Sentences from Scripture and the Fathers. One of the earliest of such collections is that of Isidore (q.e.) of Seville (560–636), who, from this mass of writings, retrenched the few chapters of unconvoked ancient learning to the middle ages. His Sentences are selected almost (though not quite) exclusively from Augustine and Gregory the Great. Direct influence from the Greek Fathers on the West is manifest in the Gregorianism is forgotten. The great outburst of Sentences at a later time has been referred to the consternation produced by Abelard's Sic et Non. The modern reader can readily banish the impression that Abelard writes in the spirit of mere schiffiness. Probably it would be truer to say that he rots in the pleasures of discussion, and in setting tasks to other irresponsible and ingenious spirits. He does not fear to contrast authority with authority, upon each point in succession; the harder the task, the greater the achievement when harmony is reached! In regard to Scripture alone does he maintain that seeming error or discrepancy must be due to our misinterpreta-

tion. If throughout the middle ages Scripture is treated as the ultimate authority in doctrine, yet Abelard seems to stand alone in definitely contrasting Scripture with later authorities. Moderns will question the possibility of asserting Bible infallibility a priori, but it is more really startling and noteworthy that Abelard should preserve a living sense of fallibility outside the Bible.

There are many great collections of Sentences, notably by Hugh of St Victor and Pierre Lombard. The last-named—though with more continuity of texture than Isidore—quotes largely from the Bible and the Latin Fathers. If Abelard stands for the intel-
llectual daring of scholasticism, Lombard represents its other pole—interest and piety—within the Church. He is almost timidity cautious. He does not open up difficulties like Abelard, but smooths them over. This suits the coming age. The great writer of his time was a scholar's and men's writer not in the breadth of their treatment but in a theological penmanum. And the characteristic task for living theologians was to consist in writing commentaries on the Lombard's Sentences; for a time these were the only ones that existed, and men's minds were not in the breadth of their treatment but in a theological penmanum. And the characteristic task for living theologians was to consist in writing commentaries on the Lombard's Sentences; for a time these were the only ones that existed, and men's minds were not in the breadth of their treatment but in a theological penmanum.

Had this been all, Western theology might have sunk into a purely Chinese devotion to ancient classics. But the medi-

eval world had not one authority but two. Thin and turbid, the stream of classical tradition had flowed on through Cassiodorus or Boethius or Isidore; through these, at second-hand, it made itself known and did its work. But before the great outburst of scholasticism, ancient literature found a somewhat less inadequate channel in Arabic and partly even in Jewish scholarship. Aristotle was no longer strained through the meshes of Boethius; and the new light inspired Roscellinus with hery. The Medieval must be separated from the scholastic. There was no genuine renaissance of civilization, such as marked the dawn of modern history. The medieval world did not copy the free scientific spirit of Aristotle; it made him, so far as known, a sort of philosophical Bible side by side with the theo-
litical Bible. But it was a very great matter to have two authorities rather than one. And if any man was to be put in the preposterous position of a secular Bible, no writer was fitter for it than Aristotle. The middle ages did their best in this grouping; only here and there a rare spirit like Roger Bacon did something more, something altogether superior to his age, something that could find the fault with the scholasticism every-thing was not quite extinct. It is possible to exaggerate the influence of the revived knowledge of Aristotle; but, so far as one can trace causes in the mysterious intellectual life of mankind, that influence gave scholasticism its vigour. (See ARABIAN PHILOSOPHY, SCHOLASTICISM.)

With the new knowledge and impulse, there came a new method. Alexander of Hales is the first to adopt it, in place of the "rhetori-
cal" method of previous theologians. Everything is now matter of debate and argument. The Sentences method was adopted with increasing enthusiasm; with scholasticism each topic dissolves into a string of arguments for and against. These arguments are made up of "ratiocines" and "argumenta" ("proofs") which are held together by ar-

tories. They are as litigious as a lawsuit—without any summing up; it all comes in a moment with a text of Scripture or an utterance by one of the great Fathers. Once such a dictum has been cited, the rest of the discussion is treated by as by and goes for nothing. "I am a transmitter," Confucius is reported to have said. The great schoolmen were transmitters—putting in order, stating clearly and consecutively, conclusions reached by their predecessors. But the scholastics have failed to pe-

ant? Their guarantee is the tireless criticism carried on by rival systems. No parallel display of debating acuteness has ever been carried through in the schools. Moderns are driven by their need to keep their minds bright and clear. The schol-

men. Indolence in every age escapes difficulties by shirking them, but the schoolmen's activity raised innumerable awkward questions. On the other hand, they possessed to perfection the scholastic method of "under-estimation." They worked in the doctrinal foundations of the Church, it will be a tacet under-

standing among the schoolmen that such questions are not to be pressed. Above all, one must not look to a schoolman to speak "a piercing and a reconciling word." There is no revision of the premises in debate from a higher or even from a detached and independent point of view. The premises from which he may select are fixed; many of the conclusions to be reached are also fixed. He speaks, most cleverly, to his brief, but he will not go outside it. He may argue as he likes so long as he respects the Church's decisions and reaches her conclusions.

That schoolmen always sat in glory above the schoolmen. And their rank above their contemporaries upon the Lombard's Sentences, as the greatest of all systems of theology. Especially is that honour due to St Thomas Aquinas's larger Summa Theologica. A we may briefly remark that he is called to his inferior, and in a way best. He is not an Augustine, still less perhaps an Aristotle, but he is the Aristotle and the Augustine of his age, the normal thinker of the present and the lawyer of the future. He teaches the medieval Platonic realism, but he accepts the Aristotelian philo-

sophy of his day, marking off certain truths as proved and under-

stood by the light of nature, and stamping those which are not so proved as not understood or understandable, i.e. as "myster-

ies."
necessarily. To use technical language, Calvinism holds that sacraments are needful ex ratione praecepti, (merely) because they are needful; in this sense, they are needful, for baptism and the Lord's Supper are both necessary to teach baptismal regeneration and consubstantiation, as well as justification by faith. It is hard to see how the positions harmonize. Zwingle and Calvin, developing a hint of Hus, introduce a distinction of the sacrament of the Eucharist; the former repudiates but later Lutheranism adopts. The Articles of the Church of England (19, 26) speak of the visible Church, but unless by inference do not assert a Church invisible. Upon most points Anglicanism seeks for a via media between Calvinist and Protestant in early days and even Calvinistic, it yielded to the suggestions of its episcopal constitution and sacramental liturgies; and to its theologians range from Calvinism at one extreme and Catholicism at the other. Historically, great issues have hung upon the dislike by which High Lutheranism and High Anglicanism, those two midway fortresses between Rome and Geneva, have been estranged from each other.

It is thus plain that the stream of Protestantism was very early split up into separate channels. Did any of these theologies do justice to the great master thought of grace given to faith? Antecedently to their separation from each other the Reformers took over the theology of Greek orthodoxy as a whole. Complaints against that theology may be quoted from early writings of every Reformer, even Calvin. They knew well that the centre of gravity in their own belief lay elsewhere than in the elaborately detailed scheme of relations within the Godhead or in the Theanthropic person. But ultimately they persuaded themselves to accept these definitions as normal and biblical, and made them the presupposition of Christ's saving work. The decision had immense results, both for orthodoxy and for theology. Nor did the unity of Protestant theology—Lutheran and Calvinist—confuse itself to the period before the great divergence. Men of the second or third generation—often called the "Protestant Scholastics"—worked together upon two characteristic doctrines which the fathers of Protestantism left vague. The Reformers hold that the doctrine of Atonement, with St Anselm, in making God the guarantor of a system of public law rather than of His private or personal honour. This conception came to be more fully defined. Christ's twofold obedience, (a) active and (b) passive, produces jointly a twofold result, (r) satisfaction to the moral law, (a) merit, securing eternal life to Christ's people. There is no such full and careful theory of Atonement in any Catholic theology, and, according to so unbiased a judge as A. Ritschl, it represents the last word in doctrine along the lines laid down by the Reformers. Could Catholics adopt it? Hardly; for the Protestant assertion of Christ's merit is shadowed, if any doctrine of merit in the Christian is brought in. Yet the very words remind us of the legal piety which characterizes Western popular religion through its history. We now find "merit" confined to Christ, and the usual application ruled out, somewhat as St Paul's intense use of Pharisaic conceptions destroyed instead of confirming the idea of righteousness by works. But it is by no means clear that this Protestant doctrine of Atonement is a unity. "Merit" is an intruder in that region of more strict and majestic law; yet Christ's "merit" is the only form under which the positive contents and promises of the Christian Gospel are there represented. Even the most requisite modern orthodoxy usually tried to modify this doctrine. They break with the past, which no revival or reaction can quite conceal. Again, the Reformation had drawn a line round the canon—sharply in Calvinism, less sharply in Lutheranism which also gave a quasi normative position to its Confessions of Faith. Anglicanism once more resembles Lutheranism with differences.

Few Lutheran churches possess bishops. In Germany the "episcopal system" is a right claimed on behalf of the civil government. The doctrine is not fully formulated even in the Lutheran Formula of Concord, nor yet in the Calvinistic canons of Dort and Confession of Westminster, though these and other Protestant creeds have various instalments of the finished doctrine. One might add a still further distinction of the Protestant scholasticism. The Amyrtium imparts to the believer (a) forgiveness, (b) positive acceptance. Actual renewal is, of course, something beyond either of these.
it enjoins public reading of certain lessons from the Apocrypha and uses in worship even the "Athenian" as well as the two more ancient creeds. On the basis of belief in inspiration we find, during the days of Protestant scholasticism, the most reckless and insane assertions of scriptural perfection. Even in our own time, popular Protestant evangelicalism joins with the new emphasis upon conversion the two great early Prot- estant appeals—to Atonement and to infallible Scripture. But the Protestant Church is by no means alone in making such assertions. Other Churches make them too, though they overlay and disguise them with appeals to tradition and to the authority of the Church itself, or the Fathers. The definite and limited burden had to be more definitely dealt with; hence these Protestant extravagances.

The first great rival to Protestant orthodoxy, apart from its old enemy of Rome, was Socinianism, guided by Laelius Socinus. Socinus's doctrine was, more or less, by his nephew Faustus Socinus. Thoroughly intellectualist, and rational, and supernaturalist, it has no one to champion it to-day, yet its influence is everywhere. Jesus, a teacher who sealed His testimony with His blood, and, raised from the dead, was exalted or adopted to divine glory, thus giving to men for the first time the certainty that God's favour could be won and eternal life enjoyed—such is the scheme. There is no natural theology; the teachings so described are really part, or rather are the essence, of the revelation of Jesus. Atonement is a dream, and an immoral dream. Supernatural sacraments of course drop out. The Lord's Supper is a simple memorial. Baptism were better disputed, though Faustus will leave the matter to each Christian man's discretion. There is not in all Church history any statement of doctrine better knit together. Socinus's church is a school—a school of enlightenment. He was also—like Calvin, if on more narrowly common-sense lines—an admirable exegete. Harnack ranks his system with Tridentine and post-Tridentine theology on the one hand, and with Protestantism on the other hand, as the third great outcome of the history of dogma. Nevertheless the judgment of history declares that this brilliant, most brilliant, was entirely eccentric, and could only in indirect ways subserve theological study. Those to-day who are nearest the Socini in belief are as far as any from their fashion of approaching and justifying their chosen version of Christian doctrine.

Even after the loss of the Protestants and the suppression or expulsion of the Jansenists, the doctrinal history of the Church of Rome is described as governed by discus- sions in regard to Thomist Augustinianism. The Molinists (i.e. followers of Louis Molina the Jesuit, not Michael Molinos the mystic) are the leading representatives of a different theology. Harnack, a keenly hostile critic, draws attention to a change in the region of moral theology, not dogmatics. After long controversy, St. Alfonso Liguori's doctrine of Predestination (originated by Molina), definitely triumphed everywhere. Conduct is considered lawful if any good Church authority holds it to be defensible; and "probability" warrants the confessors in taking a lenient view of sins which he himself, and authorities of weight in the Church, may regard as blanks in the extreme. From Harnack's point of view, the theory destroys Augustinianism, whatever honour may still be paid to that name. Another important change in Roman Catholic theology has been the increasing personal power of the pope. This was significantly foreshadowed when Pius IV, put forward by his own act what is known as the creed of the Council of Trent; and, after the coldness of the 18th century and the evil days of the French Revolution, an Ultramontane revival, relying with enthusiasm on the papacy, grew more and more strong until it became all-powerful under Pius IX. It gained a notable victory when that pope, acting on his own authority, defined (1854) as of faith a doctrine which had been long and hotly discussed—the Immaculate or absolutely sinless Conception (deeper than mere sinlessness in act and life) of the Blessed Virgin. The second and decisive victory followed at the Vatican Council (1870), which, at the cost of a small secession of distinguished men, declared the pope personally infallible (see Infallibility) and irrefutable as often as he rules ex cathedra points of faith or morals. This once again seems to be the last word in a long development. Uncertainty as to the authorities determining religious belief—Scripture, tradition, Fathers, Doctors—is now, at least poten- tially, at an end; the pope can rule every point definitely, if he chooses to do so.

The theory of Development (J. A. Möhler, J. H. Newman), which throws so new a light upon the meaning of tradition, is a valuable support of the conception of a sovereign pontiff drawing out dogmas from implicit into explicit form. Still, new and obscure questionings may still arise. When is the pope ruling faith and morals from his throne? When may the Church be assured that the infallible guidance is being given? As startling a development is suggested by Harnack, who vehemently dismissed it as impossible by a former Protestant scholar, H. M. Gwatkin. May a reforming or innovating pope arise? He would find, in theory at least, that he possessed a weapon of matchless power and precision. But hitherto Roman Catholic theology has refused to conceive of any development except by enlargement of the Church's creed. Much may be added to formulated belief; it is not admitted that anything has been or can be withdrawn. Brilliant Modernist scholars like A. Loisy may have successors who will champion theories of evolutionary transformation. But at the present hour a repre- sentative of the writer maintains the traditional Catholic view in his commend of the Assumption of the Virgin. Perhaps we may say, the Assumption has lost a dogma hastening towards definition. Is the theory or tradition correct, that, after death and burial, Mary was bodily received into heaven and her grave left empty? Such problems engage the official theologians of the Church of Rome.

It is natural that the "variations" with which Bossuet re- approached the Protestants should demand more space. The Christological problem seems to require separate treat- ment. In regard to the Trinity, Protestantism has nothing very new to say, though "Sabellianism" is revived by Swedenborg and Schleiermacher. But in regard to Christology opinion takes fresh forms as early as Luther himself. While this became conspicuous in connexion with the doctrine of the Eucharist and the doctrine of the Resurrection, it appears that he had a genuine speculative interest in the matter. Communio idiomatum was well known in the schools as an affair of terminology. You might say correctly that God has died (meaning the Godman), or that a man is to be worshipped—Christ Jesus. According to Luther, however, it is not merely in words that the attributes of the Godhead qualify Christ's human nature. That takes place in fact; and so the human glorified body of Christ is, or may become under conditions which please Him, e.g. at the Enchurist, ubiquitous. This new quasi-monophysitism directed the Lutherans to make much of Christ's human nature; St. John's human nature is formed, partly from the scholarly tradition of Calvin, partly from the polemical laid great emphasis on the manhood. A. Ritschl even speaks of the Reformed as teaching Kenosis in the modern sense; but it is to be feared they rather taught alternately the manhood and the Godhead than made a serious effort to show the compati- bility of divine and human predicates in one person. Christ as man was one of the Elect (and their head); He needed grace; He depended upon the Holy Spirit. On the other hand, as God, He was the very source of grace. The Lutherans held that the Incarnate One possessed all divine attributes, but still bound to observe the doctrine of the Incarnation in the Lutheran school of Thübingen in the 17th century; or concealed their working; the latter was the doctrine of the Giessen school.

A theory which flickers through Church history in the train of mystical influence proceeding from the pseudo-Dionysius Areopagita has become more prominent in modern times—that Christ would have become Incarnate even had man not sinned. Rejected by Thomas, it is patronized by Duns—not, one thinks, that he loved rational certainties more, but that he loved redemptive necessities

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1 According to I. A. Dorner.
2 To be sure, human predestination are not held to modify the Divine nature, except by modern Kenotists, who therefore, when they are Lutherans, claim to be completing Luther's theory.
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less. In a sense this theory puts the coping-stone upon Christological development. If we are warranted in regarding the Second Person of the Godhead as in very deed "Himself vouchsafing to be made," that great Becoming cannot well be suspended upon a contingency which might or might not arise; and theologians in general regard the sin of man as such a contingent event. Incarnation almost demands to be speculatively interpreted as necessary, and self-manifestation and self-importing of God. Yet interest in man's moral necessities threatens to be lost amid this cosmological wisdom. Theology pushed too far may overlap itself. Those who shrink from the old confident assertion, "Christ would not have become incarnate but for man's sin," might claim to say, from reverence and not from evasiveness, ignoramus. On the other hand, the type of thought which would perfect Christianity in the form of a philosophy, and subordinates Atonement to Incarnation, is pledged to this doctrine that Incarnation was a rational necessity. Such speculative views are associated with the revival of another traditional piece of mysticism—the Holy Spirit the Cepula or bond of union in the Godhead. There is no such assertion anywhere in the New Testament.

For modern German theories of Kenosis among Luther and Reformed, see A. B. Bruce's *Humiliation of Christ*. Basing on the language of Phil. ii. 7, they teach, in different forms, that Christ was humbled because he surrendered the operations of conception at birth, and resumed divine predicates at His exaltation. It might be put in this way—a real human being, a really human experience. Such as are the terms of Phil. ii. 7, so we choose that St Paul had a metaphysical theory of Christ's person in view. In Great Britain and America many have adopted this theory. It is often taught, e.g. that Christ's statements on Old Testament literature are to be interpreted in the light of the Kenosis. The enemies of the theory insist that, while it safeguards the unity of Christ's personal experience at any one point, it breaks up by absolute guile the continuity of experience and destroys the identity of the person. Indeed, those forms of the theory, which give us a Logos in heaven (John iii. 13) along with the humbled or Incarnate Christ on earth, an over-riding canonicity even at the point of excision. Other suggestions in explanation of the mystery have been: a gradual Incarnation, the process not being complete until Christ's exaltation (I. A. Dorner's earlier view); impersonal pre-existence of the Logos, who became personal—compare and contrast Marcellus of Ancyra—at the Incarnation (W. Böschlag's earlier view, practically adopted by Dorner in his later days); Jesus the man who was absolutely filled with the consciousness of God (Schleiermacher); Jesus not to be defined in terms of 'nature,' either human or divine, but as the perfect fulfiller of God's absolute purpose (E. Lohse in later days, partly); the absolute (Böschlag). The orthodoxy which refuses all new theories may look for help to the pathological dissociation of personality, or at least (e.g. J. O. Dykes in *Expository Times*, Jan. 1906; Sunday Churchman May 1906) of the soul itself among those who song of the soul is in part modulated by the knowledge that a person has a soul even as a bird or a flower has a flower or a bird. We are not here concerned with the question of the sort of pre-existence which Christ had before the world was.
Protestantism has two principles: a "formal principle," the authority of Scripture, and a "material principle," the doctrine of justification by faith. We have already indicated that some such pair of principles was prominent when historic Protestantism pulled itself together for defense during its scholastic age. But surely serious thought cannot acquiesce in dual control. Pneumatically inspired systems have always believed to continue in power, there seems no hope of making theology a living unity, which will claim respect from the modern age.

One great attempt at unifying Christian theology came from the side of philosophy. Kant's scheme, which in religious theory as well as in chronology may be regarded as a link between the 18th and the 19th centuries, led on to the modern school of Hegel; and the latter system began almost at once to influence Church doctrine.

D. F. Strauss (gest) applied it with explosive effect to the study of the life of Jesus. P. C. Baur, assisted by able colleagues, if hardly less revolutionary, was much more in touch with theology than had been. The Hegelian threefold rhythm was to run through all history, especially for Baur through the history of the Christian Church and of its doctrine. Baur maintained a thorough-going evolutionary optimism. "The real was the rational" from first to last. However biased, this a priori study had its merits. It was not a theory but a method, and this it was which made Hegel, and less exclusively, but still as much, was Hegelian philosophy as a whole.

Influence of Hegelianism.

The orthodox wing of idealists take as their watchword Incarnation; Christianity is the religion of the Incarnation (sub-title of Hegel's "Theosophy of Religion"). B. F. Westcott, a typical representative of this philosophical view, consists in that Hegel's thought, which brings it into harmony with the philosophical scheme, is found in E. Erdmann and the theologians P. K. Marheineke and Karl Daub. Influences from Hegel are also to be traced in Richard Rothe, J. A. Dorner, A. M. Fabricius, and others. The second and last of the three great theologians Hegelianism has widely affected British theology. Schleiermacher him towards a post-historic interpretation of the New Testament.

Schleiermacher set himself to explain what is distinctive in religion. What is the relation of religion from philosophy as looked in contrast with thought; but when he has done that (Reden über die Religion, 1799) he has little to add. Any type of highly wrought feeling may make a man religious, some of them believe the whole spirit of Romanticism, Schleiermacher puts a peculiarly high estimate upon the pantheistic type. What else can we expect from a thinker who was so passionately in favor of the "soul"? Here his Gläubenschaft (1811) Schleiermacher had become much more of a Christian churchman. "Christianity is one of the theological pieties," and has as its peculiarity "that in everything is referred to the redemption accomplished through Jesus of Nazareth." But it is doubtful whether the elements of his final synthesis really interpenetrate. He tells us (Kurze Darstellung des theologischen Studiums, 1811) that the theologian, while himself loyal to Church, must expound, as a historian, the beliefs actually held in the church of which he represents. Oil and water do not mix. Do the unchecked individual enthusiasm of the Reden, and the loyal and enlightened philosophy of the system, combine to form a living theology? It is little wonder if Schleiermacher attains a compromise rather than a unity. He has been one of the great fermenters in modern Protestant doctrine both of the Right and of the Left. His position at between his general positions more nearly than any other. But there is no Schleiermacher church. W. Herrmann, from his own point of view, has quoted J. C. K. Hofmann and F. R. Frank as making important additions. (Die Philosophie der Religion, 1832.) In the last chapter of his "The Philosophy of Religion," he says laid down by Schleiermacher, while J. S. Clandish, representing a moderate Scottish Calvinism, was half inclined to welcome the rededication of the Church to the ideas of Jesus Christ, and to the influence of the church. J. T. Beck, and the Dutchman, J. j. van Oosterzee, i.e. Scripture the true source of doctrine, but the religious consciousness its ordering principle.

1 Hence R. B. Haldane, in the Scottish Church lawyer of 1904, is found telling the House of Lords that Justin Martlar had a grasp of speculative truth which was impossible to St Augustine. 2 Or the Dutchman, J. j. Scholten.
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assumed a tainted human nature and washed it clean, thus making it a promise and potency of the world's redemption.

Even if we accept the programme of reconstructing theology from a single point of view, we may desire to criticize not merely Ritschl's execution of the scheme, but his selection of the ruling principle. Is it enough to extricate the spirit of Protestantism from the imperfect letter of its early creeds? Yes, one set of difficulties is raised by the progress of science. No Protestant can deny that it is a duty for Christianity to come to terms with scientific discoveries, and few Catholics will care to deny it. Anxious negotiations thus arise, which colour all modern schemes of theology. But with a certain school theory became central and dominant. I hope to place this position from the new emphasis on Christology, whether churchly or radical. Those who find a gospel in philosophy are ready to dictate terms to outsiders; but those who wait upon science for its verdicts supplant terms of peace. Just as much of Christianity is to survive as science will spare. Often the theologians in question look to psychology as the permanent basis of religion; who is to deny that religion is a psychological fact, and the natural expression of something in man's constitution? This strain may be recognized, mingled with other ideas. Scammel, for example, was interested in the contributions of H. J. Holtmann and Ernst Troeltsch to the volume dealing with Christianity in Die Kultur der Gegenwart. Christ is confessed as the greatest figure of the past, and as one of no small importance still for the present and future. But, with entire decision, Christianity is called to the bar of modern culture. From that tribunal there is to be no appeal, whether to a higher revelation or to a deeper experience. This view stands in connexion with the study of comparative religion. One of the main tasks of very Ritschl school, which began by despising all religions except those of the Bible, has developed the religionsgeschichtlich method, which dissolves Christianity in the wider stream. Such a policy is at the opposite pole to Ritschl's; he desired to interpret Christianity in the light of its own central thought. If Christians can find in their faith new resources to meet the new needs, they may hope to command the future. Theology if it is to live must be henceforth at once more Christian and more scientific than it has ever yet been.

A less threatening yet important possibility of modification arises out of the scientific study of the New Testament. Augustine, in his ecclesiastical revival, went back to St Paul; can Christianity not dig deeper by going back to Jesus? A Protestant has to view the past history of doctrine very much as a succession of declensions and revivals, the latter more than counteracting the former. He does not claim to have regained the inspiration of a Paul; but he holds that Augustine was more Christian than the sub-apostolic age, and Luther more Christian than Augustine. That is the hopeful feature in the past. The task for the present, with its unequalled scientific resources, is to get nearer than ever to the heart of the Gospel. Must Pauline categories always be supreme? The Ritschl school, and others too, have made an earnest effort to incorporate Christ's words in Dogmatic and no longer shunt them into systems of "Christian Ethics." They have not idolized Paulinism; but have they not idolized Luther? They seem to take for granted that the spirit—though not the letter—of that great man was a definitive statement of the Christian principle. To interpret Christianity out of itself is one thing; to interpret it out of Luther, even out of a distillate of Luther, is possibly a lower thing. The theology of the future may draw more equally from several sources, the types of doctrines. The scheme that includes most may be the successful scheme. Unity may be safeguarded in the confession of Christ, and theology indeed prove "Christocentric." Above all, the social message of Jesus may well prove a gospel to our materially prosperous

1 Thomasius and H. B. Smith are quoted as holding the "Christocentric" ideal. A. M. Fairbairn, mindful of the vast importance of the conception of God, amends the programme. Theology is to be formally Christocentric, materially Theocentric (Fatherhood of God), but inwardly sorrowful age. Any school of thought which despires that hope has small right to call itself Christian.

Casting a backward glance once more over the evolution of Christian theology, we may say very roughly that at first it recognized as natural or rational truth the being of the Logos, and as special fact of revelation the Incarnation of the Word in Jesus Christ. In medieval times the basis was altered. What had been rational truth now claimed acceptance as supernatural mystery. Modern idealists, ill at ease with this inheritance, try to show that Christ's Incarnation no less than His eternal divine being is a natural and rational truth. But, when this programme is carried out, there is no small danger lest the relations traced out between God and men should collapse into dust; of Christ transform themselves into symbols, and the idealistic theology of the right wheel to the left.

Again, Western theology, very roughly summarized, while accepting the earlier doctrinal tradition, has broken new ground for itself, in affirning as rational necessity that God must punish sin (this is at least latent in Aquinas's doctrine of natural law), but as contingent fact of revelation that God has in Christ combined the punishment of sin with the salvation of sinners; this is the Reformation's quasi- Reformation thought. Here again the question is raised: Is His mercy not as inherent as His justice? If so, must He not redeem? For, if He mayly redeem but must punish, then His greatest deeds on our behalf wear an aspect of caprice, or suggest unknown if not unknowable motives. The doctrine of penal substitution in the Atone- ment, as usually conceived, seems to point in the same direction as predestinarianism. Behind superificial manifestations of grace there is a dark background, almost like the Greek Fate. The ultimate source of God's actions is something either unintelligible or unfathomable. From this we conclude that in such a day especially it must seek to light up every doctrine with the genuine Christian belief in God's Fatherhood. And yet here again incautious advance may seem to overlap itself. If it should come to be held that with so kind a God no redemption at all is necessary, the significance of Christ is immensely curtailed if not blotted out. Even if He should still be taken as the prophet of the divine good will, yet the loss of any serious estimate of sin makes good nature on God's part a matter of course. Christianity of such a type is likely to be feeble and precarious. Perhaps more is third and best possibility by aiming at a scientific understanding of God, either limited or unlimited. Perhaps what concerns the Christian is rather the assured revelation that God is acting in character, like Himself, and yet acting wonderfully by methods which we could not predict but must adore. The free life of personal beings is no more to be mastered by a formula than it is to be assigned to caprice. A God who is love will act neither from wilfulness nor from what is called rational but might more correctly be called physical necessity. He will act in and from character. Always wise, always holy, always unsearchable, the Christian God is that heavenly Father who has His full image and revelation in Jesus Christ.

While the greatest of all theological systems, the Summae of the middle ages, include everything in the one treatise, it has been the business of post-Reformation learning to effect a formal improvement by distributing theological studies among a definite number of headings. The new theory lived and grew throughout the 18thcentury Age of Enlightenment (e.g. J. S. Semler), connecting Protestant scholasticism with modern thought, and stringing the continuity of scientific in spite of great revo- lutionary changes. The beginning is ascribed to A. Hyperius (Gerhard of Ypres), a professor at Marburg, and, it seems, a conciliatory Lutheran, not, as sometimes said, a Reformed (1521-64). He published Four Books on the Study of Theo- logy (1556). Book iv. is said to be the first appearance of Practical Theology—Liturgies, Pastoral Theology, &c. In virtue of another work (De Formandis Concionibus, 1553),

Natural revelation—

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Hyperius has been further termed the father of Homiletics. L. Danaeus (Danae), a French Protestant, has the merit of publishing for the first time on Christian Ethics (1577). It has been supposed that the Reformed divinity here set itself to remedy the dogmatic dryness of Protestant scholasticism, fifty years before the Lutheran G. Calixtus moved in the matter (Theol. Moralis, 1634). Too much has been made of this. Danaeus hardly represents at all what moderns mean by Christian ethics. He does not contrast the Christian outlook upon ethics with all others, but dwells chiefly upon the super-eminence of the Ten Commandments as a summary of duty. Of his distinguished opponent J. T. Gabler, wrote in 1877 De Justo Discipline Theologicae Bibliicae et Dogmaticae. Biblical Theology is a historical statement of the different Bible teachings, not a dogmatic statement of what the writer holds for truth, qua truth. Again, P. K. Marheineke is named as the first writer (1810) on Symbolics, the comparative study of creeds and confessions of faith. In 1764 the introductory study of theology as a whole, which Hyperius invented, had been given by S. Murisima the name it has since undergone, and come to be assigned to the branch Encyclopaedias have been "material," i.e. connected treatises, giving a brief outline of theology as a whole; not, of course, alphabetic indexes or dictionaries. The most famous of all, however—Schleiermacher's Kurz Darstellung des theologischen Studiums (1st ed. 1811)—belongs to the class of "formal" encyclopaedias. It states how theology should be divided, but does not profess to give a bird's-eye view of results.

Schleiermacher's treatise is highly individual. Theology is viewed as essentially a branch of church administration. True, in the theologian's proper—so called the scientific interest is strong; where the religious or practical interest is stronger, he gets church rulers or administrators in a narrower sense. Still, even to the theologian the practical interest in church welfare is vital. Theology loses its savour when studied in a spirit of merely scientific curiosity; and it does not concern the lay Christian.

In spite of what may be deemed eccentric in this standpoint, Schleiermacher's summary is full of interest. He divides as follows:—I. Philosophical Theology; A. Apologetics; B. Polemics. II. Historical Theology: A. Exegetical—Including the determination of the canon; B. Church History proper; C. The depicting of the present state of the Church; (1) its faith—Dogmaties; the behavior and life of Church and Churchmen; (2) Statistics; these should be universal. Symbolics is to be a branch of statistics. Biblical "Dogmaties" also is said to be nearer this than it is to Dogmaties proper. III. Practical Theology: A. the service of the Church; B. History, the moral, political, and Church Government of the (national or international) Church; questions of relation to the State, &c. The reader will note Schleiermacher's peculiar way of dealing with Dogmatic as the belief of the Church—an unproven statement, according to A. Kirschl—and his requiring that belief to be reported qua historical fact.

It is singular that Schleiermacher on the whole sums up in the Kurz Darstellung against the separation of Christian Ethics from Dogmaties. But he grants that much may be said on both sides of that question, and in his own Glaubenslehre he follows ordinary usage and as far as possible banishes Ethics to a Christliche Sittenlehre, a book which has caused him to be regarded by Protestants as the founder of modern Christian Ethics. There are therefore three parallel studies, on all of which Schleiermacher published—Dogmatic or Glaubenslehre, Christian Ethics, Philosophical Ethics.

Curiously enough, it is from Schleiermacher's philosophical ethics that a threefold division—the Chief Good, Virtues, and Duty or the Law—passed into almost all textbooks of Christian Ethics, till recently a rebellion rose against it on the ground that books of this sort should not be included in the curriculum of the Kingdom of God, which Paulinized dogmatic systems were slow to admit. It should also be noted that Schleiermacher's place for Apologetics is by no means undisputed. Many dislike the subject; some would thrust it into practical theology. Again, the new study of the religions of the world is seeking its place in the curriculum of Christian theology, just as it is seeking—in some way—to modify Christian thought. The recognized place, the assured results, have not yet been attained further details must be sought in textbooks. But it may be affirmed that Dogmatic must remain the vital centre; and so far we may set Flint's censure of the British School of thoughtlessness which has called that study by the name "systematic theology." Systems of ethics and apologetics are welcome to the theologian; "encyclopaedia" is a new and broader-based "systematic theology" in itself; but none of these is central as Dogmatic is. One may also venture to declare that Dogmatic rests upon philosophical and historical studies, and exists for practical uses. Thus a triple or fourfold division of theological sciences seems natural.

One often confounds that in the beginning of the 20th century there is more life or health in doctrine, in philosophy, and much more in either than in dogmatic theology.

Sub-divisions of Dogmatic, whether well chosen or ill, throw light upon theology as developed in the past. The six usual Protestant headings are as follows: Theology proper, Anthropology, Christology (C. Hodge here inserts Hamartiology), Soteriology, Ecclesiology (omitted by C. Hodge), Eschatology. The Lombard's Sentences deal in bk. I. with God; bk. II. the creatures; bk. III. Incarnation, Redemption, Virtues; bk. IV. the threefold estate.

Two Things. Aquinas's Summa has no such clear lines of division.

The Church carried forward from the middle ages a tradition of "Moral Theology" answering to Christian Ethics, alongside of Dogmaties or of all-inclusive Summae. Casuistry (with parallels in early Protestantism like Jeremy Taylor's Ductor Dubitantum), growing out of the Confessional, is characteristic of this Roman Catholic Ethics; yet the study is not restricted to the technical equipment of confessors. The Roman Catholic contributors to the volume on Christianity in Die Kultur der Gegenwart write on:—I. Dogmatic: A. Apologetic or General Dogmatic; B. Special Dogmatic or Dogmatic proper. II. Moral Theology. III. Practical Theology. The Protestant contributors, representing somewhat varied standpoints in German religion, follow much the same plan. Apologetic has no separate place with them; but the system of theology (in a sense midway between the dogmatists and the encyclopedists), is allotted between Dogmatic, Christian Ethics and Practical Theology.

Literature.—A bibliography of theology cannot name every important book. The effort is made here (1) to mention works covering the threefold division, (2) to the chief works to some one Christian confession, (3) without needless repetition of what has already been said, (4) dogmatic treatises being preferred but not to the exclusion of everything else.

One of the great interests in theology is the system. Athanasius's On the Incarnation of the Eternal Word represents his central thoughts not less interestingly because it is earlier than the Arian controversy of the 3rd century. The chief object of doctrine for popular use, but arranged as a complete system. Gregory of Nyssa's Great Catechesis is an instruction to catechists how they should proceed—though of course stating the writer's theology and apologetic, with his belief in universal salvation. Theodoret has an outline of theology in the last book (v.) of his treatise Against Heresies. Theodore of Mopsuestia is a more respected representative of the same scholarship—that of Antioch. John Chrysostom is the orator of the school of Alexandria. Theology represents the later Alexandrian theology. With John of Damascus the progress of Greek divinity ends. A good modern statement is in Gregory of Sinai's Summa Christiana. The West's contribution is chief again in breaking new ground for theology. The Enchiridion ad Laurentium is a slight but interesting sketch of a system, while the De Doctrina Christiana is another lesson in the imparting of Christian instruction, as is also, naturally, the De Christianis Ritus. The City of God and the Confessions are of unmatched importance in their several ways; and nothing of Augustine's was without influence. Gregory the Great's Magna Moralia should also be named.

In the middle ages Isidore (at its gateway, then Peter Lombard), then Aquinas (and his rivals), are pre-eminent for system, Anselm and Abelard for originality, Bernard of Clairvaux as the theologian who pre-eminent by its practical medieval and popular character, its most literary, its most characteristic forms, while Thomas à Kempis' devotional masterpiece, The Imitation of Christ, with Tauler's Sermons and the Theologia Germanica belongs to the world's classics. All the Protestant reformers are of theological importance—Luther, Melanchthon and

1 "Mystical Theology" is described in Addis and Arnold's "A Branch" of Moral Theology.
Theo-Phaneses, surnamed "the Confessor" (c. A.D. 758-817). Greek ascetic, chronicler and saint, belonged to a noble and wealthy family, and held several offices under Constantine V. C. Copronymus (741-775). He subsequently retired from the world and founded a monastery (rōu Μεγάλον Ἀγρόν) near Sighiara. He was a strong supporter of the worship of images, and in 815 was summoned to Constantinople by Leo the Armenian, who formally ordered him to renounce his principles. He, however, refused, and, after two years of imprisonment, was banished to the island of Samothrace, where he died. He subsequently received the honours of canonization. At the request of his dying friend, George the Synellus (q.v.), Theophanes undertook to continue his Chronicle, which he carried on from the accession of Dicriotian to the downfall of Michael I. Rhangabes (824-873). The work, although wanting in critical insight and chronological accuracy, is of great value as supplying the accounts of lost authorities. The language occupies a place midway between the stiff ecclesiastical and the vulgar Greek. In chronology, in addition to reckoning by the years of the world and the Christian era, Theophanes introduces in tabular form the regnal years of the Roman emperors, of the Persian kings and Arab caliphs, and of the five oecumenical patriarchs, a system which leads to considerable confusion. The Chronicle was much used by succeeding chroniclers, and in 873-875 a compilation in barbarian Latin (in vol. ii. of De Boor's edition) was made by the papal librarian Anastasius from Niecephorus, George the Synellus, and Theophanes for the use of a deacon named Johannes. The translation (or rather paraphrase) of Theophanes really begins with the work of Fredegar in II. and there is a good deal of genuine material; but the latter part, especially the section in the latter part,
THEOPHANO—THEOPHILUS

THEOPHANO (c. 950–991), wife of the Roman emperor Otto II, was a daughter of the Eastern emperor Romanus II, and passed her early years amid the tragic and changing fortunes which beset the court of Constantinople. Otto the Great having prevailed over his rival to his son Otto II, she was married to him and crowned empress at Rome by Pope John XIII, on the 14th of April 972. In return for costly gifts brought by her to his wife, she was granted extensive estates in all parts of the empire. She appears to have been a woman of great beauty and considerable intelligence, and after the death of Otto the Great in 973 gradually superseded her widow Adelaide as the chief adviser of the new emperor, whom she accompanied on several military expeditions. She introduced many Byzantine customs into the German court. After the death of Otto in December 983 she returned to Germany, which she governed with conspicuous success in the name of her son, Otto III. In 989 she visited Rome, where she exercised as imperatrix the imperial prerogatives, and probably compelled the Romans to swear to acknowledge her son. Theophano died at Nimwegen on the 15th of June 991, and was buried in the church of St Pantaleon at Cologne.

See J. Moltmann, Theophano, die Gemahlin Otto II. in ihrer Bedeutung für die Politik Otos I. und Otos II. (Göttingen, 1878).

THÉOPHILE, the name by which Théophile de Viau (or Viav), French poet (1591–1626), is more commonly called. He was born in 1591, at Clairac, near Agen, and died some forty years at Boussetres de Mazères, his father's property. He was educated at the Protestant college of Saumur, and he went to Paris in his twentieth year. In 1612 he met Balzac, with whom he made an expedition to the Netherlands, which ended in a serious quarrel. On his return he seems to have been for two years a regular playwright to the actors at the Hôtel de Bourgogne. In 1615 he attached himself to the ill-fated Henry, duke of Montmorency (1595–1632), under whose protection he produced with success the tragedy of Pyrame et Thisbé, acted probably about 1617 and printed in 1623, although placed later by some critics. This piece, written in the extravagant Spanish-Italian manner, which was fashionable in the interval between the Pléiade model and the innovations of Corneille, was ridiculed by Boileau (Preface to his Œuvres, 1701). Théophile was the acknowledged leader of a set of Parisian libertines, whose excesses seem to have been chiefly dictated by a general hatred of restraint. He himself was not only a Huguenot, but a freethinker, and had made unsparing use of his sharp wit in epigrams on the Church and on the government. In 1615 he was accused of blasphemous and indecent writings, and was banished from Paris. He took refuge in the south of France, where he found protection with many friends. He was allowed to return in the next year, and effected a partial reconciliation with one of his most powerful enemies, the duc de Luynes. He served in that year in the campaign against the Huguenots, but in the autumn was again in exile, this time in England. He was recalled in 1621, and began to be instructed in the Roman Catholic religion, though his abjuration of Protestantism was deferred until the end of 1622. There is nothing to show that this conversion was purely political; in any case it did little to mollify his enemies. In 1622 he had contributed four pieces to the Nouveau Parnasse Soltièrge, a collection which had caused him much trouble. In the next year a new edition appeared, with the addition of some licentious verse, and the inscription par le sieur Théophile on the title-page. Contemporary opinion justified Théophile's denial of this ascription, but the Jesuit father, François Garasse, published a tract against him entitled La Doctrine curieuse (1623). Théophile was again prosecuted. This time he fled from Paris, to the court of Montmorency, and was condemned in his absence (19th of August 1623) to death. On his flight to the border he was arrested, and imprisoned in the Conciergerie in Paris. He defended himself in an Apologie au roi (1625), and was liberated in September, his sentence being commuted to banishment for life. Under Montmorency's protection he was able to hide in Paris for some time, and subsequently accompanied his friend and patron to the south. He died in Paris on the 25th of September 1626.

The great interest aroused by the prosecution and defence of Théophile is shown by the number of pamphlets on the subject, for many years after his death Georges de Scudéry edited his work with a Tombeau (copy of obituary verses), and a challenge in the preface to anyone who might be offended by the editor's eulogy of the poet. A copy of a printed, but not entitled to be called a Theophile's, and is not included in his works, the standard modern edition of which is that of Alleaume in the Bibliothèque Illustrée (4 vols. 1856). Besides Pyrame et Thisbé, his works include a para-phrase of the Roman de Thèbes in Latin, a translation of the Greek and Latin letters, his Apologie, a promising fragment of comic prose narrative, and a large collection of occasional verses, odes, elegies, stanzas, &c.

THEOPHILUS, East Roman emperor (829–842), the second of the "Phrygian" dynasty. Unlike his father Michael II, he was a Greek as well as a Cypriot, and spent most of his years at Boussetres de Mazères, his father's property. He was educated at the Protestant college of Saumur, and he went to Paris in his twentieth year. In 1612 he met Balzac, with whom he made an expedition to the Netherlands, which ended in a serious quarrel. On his return he seems to have been for two years a regular playwright to the actors at the Hôtel de Bourgogne. In 1615 he attached himself to the ill-fated Henry, duke of Montmorency (1595–1632), under whose protection he produced with success the tragedy of Pyrame et Thisbé, acted probably about 1617 and printed in 1623, although placed later by some critics. This piece, written in the extravagant Spanish-Italian manner, which was fashionable in the interval between the Pléiade model and the innovations of Corneille, was ridiculed by Boileau (Preface to his Œuvres, 1701). Théophile was the acknowledged leader of a set of Parisian libertines, whose excesses seem to have been chiefly dictated by a general hatred of restraint. He himself was not only a Huguenot, but a freethinker, and had made unsparing use of his sharp wit in epigrams on the Church and on the government. In 1615 he was accused of blasphemous and indecent writings, and was banished from Paris. He took refuge in the south of France, where he found protection with many friends. He was allowed to return in the next year, and effected a partial reconciliation with one of his most powerful enemies, the duc de Luynes. He served in that year in the campaign against the Huguenots, but in the autumn was again in exile, this time in England. He was recalled in 1621, and began to be instructed in the Roman Catholic religion, though his abjuration of Protestantism was deferred until the end of 1622. There is nothing to show that this conversion was purely political; in any case it did little to mollify his enemies. In 1622 he had contributed four pieces to the Nouveau Parnasse Soltièrge, a collection which had caused him much trouble. In the next year a new edition appeared, with the addition of some licentious verse, and the inscription par le sieur Théophile on the title-page. Contemporary opinion justified Théophile's denial of this ascription, but the Jesuit father, François Garasse, published a tract against him entitled La Doctrine curieuse (1623). Théophile was again prosecuted. This time he fled from Paris, to the court of Montmorency, and was condemned in his absence (19th of August 1623) to death. On his flight to the border he was arrested, and imprisoned in the Conciergerie in Paris. He defended himself in an Apologie au roi (1625), and was liberated in September, his sentence being
THEOPHRASTUS—THEOPOMPUSS

1897); and authorities under ROMAN EMPIRE, LATER. On the early campaigns against the Arabs see J. B. Bury, in Journ. Hell. Stud. vol. xxvi., p. 550. 1900.

THEOPHRASTUS, the successor of Aristotle in the Peripatetic school, a native of Eresus in Lesbos, was born about 372 B.C. His original name was Tyrtamus, but he later became known by the nickname "Theophrastus," given to him, it is said, by Aristotle to indicate the grace of his conversation. After receiving his first introduction to philosophy in Lesbos from one Leucippus or Alcippus, he proceeded to Athens, and became a member of the Platonic circle. After Plato's death he attached himself to Aristotle, and in all probability accompanied him to Stagira. The intimate friendship of Theophrastus with Callisthenes, the royal-pupil of Alexander the Great, the mention made in his will of Aristotle being bequeathed to him at Stagira, and the repeated notices of the town and its museum in the "Plants," are facts which point to this conclusion. Aristotle in his will made him guardian of his children, bequeathed to him his library and the originals of his works, and designated him as his successor at the Lyceum on his own removal to Chalce. Eudemus of Rhodes also had some claims to this position, and Aëtornaxus is said to have resented Aristotle's choice. Theophrastus presided over the Peripatetic school for thirty-five years, and died in 287 B.C. Under his guidance the school flourished greatly during the period more than 2000 students—and at his death he bequeathed to it his house and colonnades as a permanent seat of instruction. Menander was among his pupils. His popularity was shown in the regard paid to him by Philip, Cassander and Ptolemy, and by the complete failure of a charge of impiety brought against him. He was honoured with a public funeral, and "the whole population of Athens, honouring him greatly, followed him to the grave" (Diog. Laërt.).

From the lists of the ancients it appears that the activity of Theophrastus was directed to the cultivation of contemporary knowledge. His writing probably differed little from the treatment of the same themes, though supplementary in detail (see PERIPATETICS). He served his age mainly as a great popularizer of science. The most important of his books are two large botanical treatises, *On the History of Plants*, in nine books (originally ten), and *On the Causes of Plants*, in six books (originally eight), which constitute the most important contribution to botanical science during antiquity and the middle ages. We also possess in fragments a *History of Physics*, a treatise *On Sense*, and a work *On Sensation*, and certain metaphysical *Apologia*, which probably once formed part of it. Various smaller scientific fragments have been collected in the editions of Stahl (1759), Renard (1817), Beecles (1837), and F. Wimmer (1842-62) and in Usener's *Analecta Theophrastae*. The Ethical Characters (Προσωπικές) *deserves a separate monograph* in the work consists of brief, vigorous and trenchant notices of moral types, which contain a most valuable picture of the life of his time. They form the first recorded attempt at systematic character writing. The book has been regarded by some as an independent work; others incline to the theory that the sketches were written from time to time by Theophrastus, and collected and edited after his death; others, again, regard the Characters as part of a larger systematic work, but the style of the book is against this. Theophrastus has found many imitators in this kind of writing, notably Hall (1668), Sir Thomas Overbury (1613-16), Bishop Earle (1628) and La Bruyere (1688), who also translated the Characters.

BIBLIOGRAPHY.—A good account of Theophrastus is found in Zeller, Aristotle and the Earlier Peripatetics (Eng. trans. by B. F. C. Costelloe and J. H. Muirhead, vol. ii., chap. 18, 1897). For his astronomical work a monograph on the "Antikythera" astronomic and botanical works, see Dr J. Berendes, *Die Pharmacie bei den alten Culturolken* (vol. i., 1891). The Ethical Characters was edited by Cambridge in 1892 and translated by La Bruyere (1688-89); the best modern translation (with introduction) is that by R. C. Jebb (1870; new ed. J. E. Sands, 1909); recent editions are that of J. M. Edmonds and G. E. V. Austen (1904), containing text, transliteration, critical notes (literary and scientific schools), and that of C. E. Bennett and W. A. Hammond (1902), containing a transliteration and introduction. The work has been translated into nearly all European languages (see Baldwin's *Dict. of Philos. and Psych.*, vol. iii., pp. 99-103 (E. Wh.).

THEOPHYLACT (d. c. 1130), biblical commentator, was born most probably at Epirus, in Euoboea, about the middle of the 11th century. He became a deacon at Constantinople, attained a high reputation as a scholar, and became the tutor of Constantine Porphyrogenitus, son of the Emperor Michael VII., for whom he wrote *The Education of Princes* (Μαθησια του Βασιλείου). About 1078 he went into Bulgaria as archbishop of Achepia. In his letters he complains much of the rude manners of the Bulgarians, and he sought to be relieved of his office, but apparently without success. His death took place after 1107.

His commentaries on the Gospels, Acts, the Pauline epistles and the Minor Prophets are founded on those of Chrysostom, but preserve the considerable place they hold in exegetical literature for their appositeness, sobriety, accuracy and judiciousness. His other extant works include 130 letters and various homilies and discourses, on various other topics. A careful edition of nearly all his writings, in Greek and Latin, was published from 1862 with a full critical apparatus, was published in 1754-63 by J. F. B. m. de Rossi (4 vols., fol., Venice).


THEOPOMPUSS (b. c. 380), Greek historian and rhetorician, was born at Chios about 380 B.C. In early youth he seems to have spent some time at Athens, along with his father, who had been exiled on account of his Laconian sympathies. Here he became a pupil of Isocrates, and rapidly made great progress in rhetoric; we are told that Isocrates used to say that Euphorus required the spur but Theopompos the bit (Cicero, *Ad Att.*, xii. 3). At first he appears to have composed epidemic speeches, in which he displayed such proficiency that in 352-351 he gained the prize of oratory given to him in honour of his husband, although Isocrates was himself among the competitors. It is said to have been the advice of his teacher that finally determined his career as an historian—a career for which he was peculiarly qualified owing to his abundant promiscuity and his wide knowledge of men and places. Through the influence of Alexander, he was restored to Chios about 333, and figured for some time as one of the leaders of the democratic party in his native town. After Alexander's death he was once again exiled, and took refuge with Ptolemy in Egypt, where he appears to have remained with a somewhat cold reception. The date of his death is unknown.

The works of Theopompos were chiefly historical, and are much quoted by later writers. They included an *Epitome of Herodotus* *History* (the genuineness of which is doubted), the *Hellenics* (Πολεμικά, *Ἐλληνικά ἀριστοτέλεια*), the *History of Philip* (Πολεμικά, * PHI*., *Φιλίππη*), of several epicycles and horatious addresses, the chief of which was the *Letter to Alexander*. The *Hellenics* treated of the history of Greece, the *Philippic* (Πολεμικά, *Φιλίππη*), of 411 (where Thucydides breaks off) to 394—the date of the battle of Leuctra (B.C. 371) to 338. Of this work only a few fragments were known up to 1907. The papyrus fragment of a Greek historian of the 4th century B.C., discovered by H. P. R. Strassburger, and published by them in *Oxyrhynchus Papiri*, vol. v. (1908), by J. Hales and E. Meyer, *Untersuchungen* (1892). Of this we possess only a few fragments is of considerable extent, to Cratinus (4th to 5th century, B.C.), a far more elaborate work was the *Μεταμορφωμένα* in 58 books. In this *Theopompos* narrated the history of Philip's reign (350-336), with digressions on the names and customs of the various races and countries of which he had occasion to speak, which were so numerous that Philip V. of Macedon reduced the bulk of the history from 58 to 16 books by cutting out those parts which had no connexion with Macedonia. It was from this history that Trogus Pompeius (of whose *Historiae Philippicæ* we possess the epitome by Justin) derived the material of his *Historiae Philippicae* and *Alexandrines*. In the 3rd century B.C. a similar oration of the *Letter to Alexander* we possess one or two fragments cited by Athenaeus, animadverting severely upon the immorality and dissensions of Harpalus. The *Attack upon Plato*, and the treatise *On Poetry*, (φιλοσοφία), which are from a different hand and have been ascribed to Athenaeus, are perhaps only two of the many digressions in the history of Philip; some writers have doubted their authenticity. The libellous attack (τραχύσας.executeUpdate) on the three cities—Athens, Sparta and Thebes—was published under the names of Theopompos by his enemy Anaximenes of Lampscus. The nature of the extant fragments fully bears out the divergent criticisms of antiquity on the works of Theopompos. The style of Theopompos was much the same as that of his master and pointed expressions, but lacking in weight and dignity. The artistic unity of his work suffered severely from the frequent and lengthy digressions already referred to. The most important was
that *On the Athenian Demagogues* in the 10th book of the *Philippicas*, containing a bitter attack on many of the chief Athenian statesmen, and generally recognized as having been freely used by Plutarch in several of the *Lives*. Another fault of Theopompus was his excessive fondness for romantic and incredible stories; a collection of some of these (ομανδα) was afterwards made and published under his name. He was also severely blamed in antiquity for his audacity, and throughout his fragmentary nature is more striking than this. On the whole, however, he appears to have been fairly impartial. Philip himself censures severely for drunkenness and immorality, while Demosthenes receives his warm praise.


**THEORBO** [Fr. théorbe, Ger. Theorbe, Ital. theorbo, Barbitonel, the large double-necked bass lute much used during the 16th and 17th centuries as general bass in the orchestra. The body of the theorbo was constructed on the same principles as that of the lute but larger, and of greater capacity. The construction was followed. The theorbo, instead of being bent back at an angle to form the head, was straight, having sufficient pegs set in the sides of the body for from 12 to 16 strings tuned in pairs of unisons; on the fingerboards were marked 8 or more frets for semitones. Above this neck was another without frets, curving forwards and slightly to one side to enable the long bass strings, stretched not over but at the side of the neck, to escape the pegs of the shorter strings. These free strings, known as diapason strings (Ger. *Begleitseilen*) were plucked à side like those of the lyre, each giving but one note; the number of these strings varied from 8 to 11.

The theorbo was made in two sizes, the ordinary instrument measuring about 3 ft. 6 in., and the Paduan, also known as archlute, about 5 ft. The chitarrone, or Roman theorbo, was the largest of all, a contrabass lute in fact, and frequently stood over 6 ft. high. It differed slightly from the theorbo; the body was a little smaller, about 2 ft. 4 in., and the bridge of the extra length not being in the second neck. The strings over the fingerboard were of steel or brass, and the diapason strings of spun wire. For the history of the theorbo, see *Barbiton and Lute*.

**THEOSOPHY** (from Gr. θεός, god, and εὐφως, wisdom), a term used to denote those forms of philosophic and religious thought which claim a special insight into the Divine nature and its constitutive moments or processes. Sometimes this insight is claimed as the result of the operation of some higher faculty or some supernatural revelation to the individual; in other instances the theosophical theory is not based upon any special illumination, but is simply put forward as the deepest speculative wisdom of its author. But in any case it is characteristic of theosophy that it starts with an explication of the Divine essence, and endeavours to deduce the phenomenal universe from the play of forces within the Divine nature itself.

**General Theory.**—Theosophy is thus differentiated at once from all philosophic systems which attempt to rise from an analysis of phenomena to a knowledge, more or less adequate, of the existence and nature of God. In all such systems, God is the unknown, and throughout his fragmentary nature is more striking than this. The theosophist, on the other hand, is most at ease when moving within the circle of the Divine essence, into which he seems to claim absolute insight. This, however, would be insufficient to distinguish theosophy from those systems of philosophy which are sometimes called "speculative" and "absolute," and which also in many cases proceed deductively from the idea of God.

In a wide sense, the system of Hegel or the system of Spinoza may be cited as examples of what is meant. Both thinkers claim to exhibit the universe as the evolution of the Divine nature. They must believe, therefore, that they have grasped the inmost principles of that nature; so much is involved, indeed, in the construction of an absolute system. But it is to be noted that, though there is much talk of God in such systems, the known universe—the world that now is—nowhere truly matters, and so it is the principle of unity is omitted in the whole. Hence, while the accusation of pantheism is frequently brought against these thinkers, the term theosophical is never used in their regard. A theosophical system may also be pantheistic, in tendency if not in intention; but the transcendent character of its Godhead definitely distinguishes it from the speculative philosophies which might otherwise seem to fall under the same definition. God is regarded as the transcendent source of being and purity, from which the individual in his natural state is alienated and afar off. An historical survey shows, indeed, that theosophy generally in contact with religious needs, and is the expression of religious convictions or aspirations. Accepting the testimony of religion that the present world lies in wickedness and imperfection, theosophy faces the problem of speculatively accounting for this state of things from the nature of the Godhead itself. It is thus in some sort a mystical philosophy of the existence of evil; or at least it assumes this form in some of its most typical representatives.

The term Mysticism (q.v.) has properly a practical rather than a speculative reference; but it is currently applied as to include the systems of thought on which practical mysticism was based. Thus, to take only one prominent example, the profound speculations of Meister Eckhart (q.v.) are always treated under the head of Mysticism, but they might with equal right appear under the rubric Theosophy. In other words, while an emotional and practical mysticism may exist without attempting philosophically to explain itself, speculative mysticism is almost another name for theosophy. There is still a certain difference observable, however, in so far as the speculative mystic remains primarily concerned with the theory of the soul's relation to God, while the theosophist gives his thoughts a wider range, and loudly devotes himself to the elaboration of a fantastic philosophy of nature.

In the above acceptation of the term, the Neoplatonic doctrine of emanations from the super-essential One, the fanciful emanation-doctrine of some of the Gnostics (the aeons of the Valentinian system might be mentioned), and the elaborate esoteric system of the Kabbalah, to which the two former in all probability largely contributed, are generally included under the head of theosophy. In the two latter instances there may be noted the allegorical interpretation of traditional doctrines and sacred writings which is a common characteristic of theosophical writers. Still more typical examples of theosophy are furnished by the mystical system of Meister Eckhart and the doctrine of Jacob Boehme (q.v.), who is known as "the theosophist" par excellence. Eckhart's doctrine asserts behind God a predicateless Godhead, which, though unknowable not only to man but also to itself, is, as it were, the essence or potentiality of all things. From it proceed, and in it, as their nature, exist, the three persons of the Trinity, conceived as stadia of an eternal self-revealing process. The eternal generation of the Son is equivalent to the eternal creation of the world. But the sensuous and phenomenal, as such, as far as they are, are to imply independence of God. This thingness; things exist only through the presence of God in them, and the goal of creation, like its outset, is the repose of the Godhead. The soul of man, which as a microcosmos resumes the nature of things, strives by self-abnegation or self-annihilation to attain this unspeakable reunion (which Eckhart calls being buried in God). Regarding evil simply as privation, Eckhart does not make it the pivot of his thought, as was afterwards done by Boehme; but his notion of the Godhead as a dark and formless essence is a favourite thesis of theosophy.
Besides mystical theology, Boehme was indebted to the writings of Paracelsus. This circumstance is not accidental, but points to an affinity in thought. The nature-philosophers of the Renaissance, such as Nicolaus Cusanus, Paracelsus, Cardan and others, curiously blend scientific ideas with speculative notions derived from scholastic theology, from Neoplatonism and even from the Kabbalah. Hence it is customary to speak of their theories as a mixture of theosophy and physics, or theosophy and chemistry, as the case may be. Boehme offers us a natural philosophy of the same sort. As Boehme is the typical theosophist, so the theosophist is almost in every case upon the study of his works, his dominating conceptions supply us with the best illustration of the general trend of this mode of thought. His speculation turns, as has been said, upon the necessity of reconciling the existence and the might of evil with the existence of an all-embracing and all-powerful God, without falling into Manichaeanism on the one hand, or, on the other, into a naturalistic pantheism that denies the reality of the distinction between good and evil. He faces the difficulty boldly, and the eternal conflict between the two may be said to furnish him with the principal of his philosophy. It is in this connexion that he insists on the necessity of the Nay to the Yea, of the negative to the positive. Eckhart's Godhead appears in Boehme as the abyss, the eternal nothing, the essenceless quiet ("Ungrund" and "Stille ohne Wesen") are two of Boehme's phrases. But, if this were all, the Divine Being would remain an abyss dark even to itself. In God, however, as the condition of His manifestation, lies, according to Boehme, the "eternal nature" or the mysterium magnum, which is as anger to love, as darkness to light, and, in general, as the negative to the positive. This principle (which Boehme often calls the evil in God) illuminates both sides of the antithesis, and thus contains the possibility of their real existence. By the "Qual" or torture, as it were, of this diereption, the universe has qualitative existence, and is knowable. Even the three persons of the Trinity, though existing ideäler beforehand, attain reality only through this principle of nature in God, which is hence spoken of as their matrix. It forms also the matter, as it were, out of which the world is created; without the dark and fiery principle, we are told, there would be no creature. Hence God is sometimes spoken of as the father, and the eternal nature as the mother, of the world. (Of his philosophy, conceived of as an eternal process) begins with the creation of the angels. The subsequent fall of Lucifer is explained as his surrender of himself to the principle of nature, instead of dwelling in the heart of God. He sought to make anger predominate over love; and he had his will, becoming prince of hell, the kingdom of God's anger, which still remains, however, an integral part of the Divine universe. It is useless to follow Boehme further, for his cosmogony is disfigured by a wild Paracelsian symbolism, and his constructive efforts in general are full of the uncouth straining of an untrained writer. In spite of these defects, his speculations have exercised a remarkable influence.

Schelling's Philosophical Inquiries into the Nature of Human Freedom (1800) is almost entirely a reproduction of Boehme's ideas, and forms, along with Baader's writings, the best modern example of theosophical speculation. In his philosophy of identity Schelling (q.v.) had already defined the Absolute as pure indifference, or the identity of subject and object, but without advancing further into theogony. He now proceeded to distinguish three moments in God, the first of which is the pure indifference which, in a sense, precedes all existence—the primal basis or abyss, as he calls it, in agreement with Boehme. But, as there is nothing before or besides God, God must have the ground or cause of His existence in Himself. This is the second moment, called nature in God, distinguishable from God, but inseparable from Him. It is that in which is not God Himself, it is the yearning of the eternal One to give birth to itself. This yearning is a dumb unintelligent longing, which moves like a heaving sea in obedience to some dark and indefinite law, and is powerless to fashion anything in permanence. But in correspondence to the first stirring of the Divine existence there awakes in God Himself an inner reflective perception, by means of which—since no object is possible for it but God—God beholds Himself in His own image. In this, God is for the first time as it were realized, although as yet only within Himself. This perception combines, as understanding, with the primal yearning, which becomes thereby a free creative will, and works formatively in the originally lawless nature or ground. In this wise is created the world as we know it. In every natural existence there are, therefore, two principles to be distinguished—first, the dark principle, through which the world is separated from God, and exists, as it were, in the middle ground; and, secondly, the Divine principle of understanding. The first is the particular will of the creature, the second is the universal will. In irrational creations the particular will or greed of the individual is controlled by external forces, and thus used as an instrument of the universal. But in man the two principles are consciously present together, not, however, in inseparable union, as they are in God, but with the possibility of separation. This possibility of separation is the possibility of good and evil. In Boehme's spirit, Schelling defended his idea of God as the Trinitarian hypothesis, in which there is consciousness which naturalism denies, and which ordinary theology emptily asserts. This theosophical transformation of Schelling's doctrine was largely due to the influence of his contemporary Baader (q.v.). Baader distinguishes, in a manner which may be paralleled from Boehme, between an immanent or esoteric process of self-production in God, through which He issues from His unrevealed state, and the emanant, exoteric or real process, in which God overcomes and takes up into Himself the external "nature" or the principle of selfhood, and appears as a Trinity of persons. The Creation of the world is still further to be distinguished from these two processes as an act of freedom or will; it cannot, therefore, be speculatively constructed, but must be historically accepted. Baader, who combined his theosophy with the doctrines of Roman Catholicism, has had many followers. Among thinkers on the same lines, but more or less independent, Molitor is perhaps the most important. Swedenborg (q.v.) is usually reckoned among the theosophists, and some parts of his theory justify this inclusion; but his system as a whole has little in common with those speculative constructions of the Divine nature, within which form the essence of theosophy, as strictly understood.

Besides the books mentioned under Mysticism, and those referred to under individual authors, Baur's Die christliche Gnosi in ihrer geschichtlichen Entwicklung (1835) and Hamberger, Stimmen aus dem Heiligtum der christlichen Mystik und Theosophie (1867), may be mentioned. (A. S. P.-P.)

**ORIENTAL THEOSOPHY**

The term "theosophy" has in recent years obtained a somewhat wide currency in a restricted signification as denoting the beliefs and teachings of the Theosophical Society. This society was founded in the United States of America in the year 1875 by Madame H. P. Blavatsky (q.v.), in connexion with Colonel H. S. Olcott (d. 1906) and others. The main objects of the society were thus set out: (1) To establish a nucleus of the universal brotherhood of humanity; (2) to promote the study of comparative religion and philosophy; (3) to make a systematic investigation into the mystic potencies of life and matter, or what is usually termed "occultism." As regards the first object the mere fact of joining the society and becoming an "initiated fellow" was supposed to involve a certain kind of intellectual and social brotherhood, though not implying anything in the nature of an economic union. This latter aspect of the fraternity was to be satisfied by the contribution from each fellow of five dollars by way of initiation fee. The society's theory of universal brotherhood was, however, of far wider scope, being based upon a mystical conception of the "One Life"—an idea derived from and common to various forms of Eastern thought, Vedie and Buddhist. It implies the necessary interdependence of all that is—that ultimate Oneness which underlies and sustains all phenomenal diversity, whether
inwardly or outwardly, whether individual or universal. The theosophical conception of brotherhood is thus rather transcendental than materialistic, and is not therefore to be regarded as the exact equivalent of the socialistic doctrine of the solidarity of the human race.

The second object of the society, the study of comparative religion and philosophy, soon crystallized into an exposition of a more or less definite system of dogmatic teaching. The leading tenets of the system had its origin in the great religions of the world, as well as from various other sources; but all were to be regarded as so many divergent expressions of one and the same fundamental truth, or "Wisdom Religion," in such form and dress as was best adapted to suit the times and the people for whose spiritual growth and development religious instruction was required. Now, in order to discern this underlying truth in the various and apparently conflicting world creeds, appeal was made to a "Secret Doctrine," and "Esoteric Teaching," which Madame Blavatsky proclaimed had been held for ages as a sacred possession and trust by certain mystic adepts in occultism, or "Mahâtmâs," with whom she said she was in psychological as well as in direct physical communication. It is here that the theosophical movement showed its most serious shortcomings. From time to time Madame Blavatsky's numerous friends and associates were allowed to witness the manifestations of "occult phenomena," which she averred were the outcome of her connexion with these "Mahâtmâs." The fraudulent character of the "phenomena" was on several occasions exposed by numerous painstaking investigators (see Proceedings of the Society for Psychical Research, vol. iii. and iv.; A Modern Priestess of Isis, by Solovyoff). There are, moreover, numerous passages in the sacred books of the East, especially those of the Buddhists, which warn the student against the assumption that "magical" performances of any kind are to be regarded as proving the truth of the performer's teaching; and indeed it must be owned in justice to the theosophists that similar warnings are to be found scattered throughout their writings; while even Madame Blavatsky herself was wont to expatiate on the folly of accepting her "phenomena" as the mark of spiritual truth. Yet at the same time it cannot well be denied that she was in the highest degree sensitive to the said marvels as evidence of her Mahâtmâ's existence.

If theosophy were to be judged solely by the published revelations of this "Secret Doctrine" it would hardly be deserving of serious consideration; for, as suggested in the separate article on Madame Blavatsky, the revelations themselves appear to have been no more than a crude compilation of vague, contradictory and garbled extracts from various periodicals, books and translations. It was an article of faith with her disciples that the outward and visible Helena Petrovna Blavatsky was on certain occasions the vehicle of psychic powers of transcendent spiritual import. Although there is not much to justify such a proposition, it may perhaps be conceded that she was in many respects abnormal and that some of her work is characteristic of a process known to modern psychologists as "automatism," or in other words that it is the result of a spasmodic uprush to the surface of sub-conscious mental activities. Apart, however, from these pseudo-revelations the Theosophical Society has given rise to an extensive literature, some of which displays a high degree of argumentative and expository ability; and moreover the movement has from time to time attracted the attention and secured the co-operation of many earnest seekers, of some few of whom it can be truly said that they possessed undoubted spiritual power, insight and knowledge.

Soon after the death of Madame Blavatsky a split in the society was brought about by Mr Wm. Q. Judge (d. 1896) of New York, who claimed the leadership; and there came into existence two if not three separate theosophical societies (following Judge and later Mrs Katherine Tingley in America, Olcott and Mrs Annie Besant in America and India, with a more or less independent organization in England), each one contending that the original affair of the founder had descended upon it exclusively. The fortunes of the societies are, however, of less importance than their leading doctrine.

It will be surmised from what has been said that any concise statement of orthodox theosophy is hardly to be expected; though from the materials available a fairly definite outline of its leading tenets can be deciphered. We will try to give a cursory view of three of the most important of these, viz.: the constitution and development of the personality or ego; the doctrine of "Karma"; and the Way or Path towards enlightenment and emancipation. Human personality, we learn, is the temporary manifestation of a complex organization consisting of "seven principles," which are united and interdependent, yet divided into certain groups, each capable of maintaining temporarily a spurious kind of personality of its own and sometimes capable of acting, so to speak, as a distinct vehicle of our conscious individual life. Each "principle" is composed of its own form of matter, determined and conditioned by its own laws of time, space and motion, and as, in it waxes and wanes alternately, more especially those of Professor T. W. Rhys Davids, and also from the many translations in all the European languages of the Bhagavad Gitâ and Upanishads. Theosophic teachings on this subject are not, however, exclusively Oriental, for following their contention that they are the exponents of the universal and unchangeable "Wisdom Religion" of all the ages, theosophists have selected from various sources—Vedic, Buddhist, Greek and Cabalistic—certain passages for the purpose of exposition and illustration. To the uninitiated it would appear that this selection has been made, generally speaking, at random; it is at any rate lacking in the wise discrimination one would expect from the supposed source of its inspiration. Nevertheless theosophists by their investigations and expositions have undoubtedly been brought in touch with some of the most profound thought in both ancient and modern worlds; and this fact in itself has assuredly had an inspiring and ennobling influence upon their lives and work. The histories of all the great religious and philosophic movements show them as developments of an evolutionary process, arriving at their accepted dogmas through long periods of contention between numerous tendencies and cross-currents, resulting in some compromises and not a little confusion of thought. So it is in the main with theosophy. It has followed Buddhism in deprecating any reliance upon ritual. Ceremonial and sacrificial observances of all kinds are held to be useless in themselves, but operative for good or ill indirectly by their effect upon the mental attitude of those who practise them. Theosophists insist, however, that all religious observances had their origin in some mystical process, the true meaning of which has in most instances been lost. The Path is represented as the great work whereby the inner nature of the individual is consciously transformed and developed. The views of life held by the ordinary mortal as well as his aims and motives
must be radically altered; and simultaneously a change must take place in his modes of speech, conduct and thought. The Path is said to be long and difficult, and with most individuals must extend over many lives. It is divided into four stages, each one representing the degree of spiritual growth and karmic development at which the "chela" or disciple has arrived. But even the entrance upon the very first stage implies something more than, and something fundamentally different from, the life of common morality; otherwise, how hopefully, indeed this life may be. Morality, important though it be as preparatory to the "higher life," does not alone lend itself to that awakening of the spiritual faculties without which progress along the Path is not possible. In good citizenship morality is practised out of regard to certain preconceived notions of the needs, the health and happiness of ourselves, our fellows and the community at large. According to theosophy, it would appear that these notions are for the most part mistaken, or at any rate they are quite insignificant in comparison with the interests with which the traveller along the Path soon finds himself absorbed. It is not that human needs are to be disregarded, but that the pabulum which he now sees that humanity really requires is of an incomparably higher order than that which is generally so considered. The physical methods and spiritual exercises recommended by theosophists are those inculcated in the systems known in Hindu philosophy as Rāja Yoga in contradistinction to the Hath Yoga system, which is most commonly to be met with in India, and in which the material aspects are given greater prominence. The Path has an active and a passive side. Fitness of both faculties and faculties, has to be acquired by positive and strenuous effort. On the one hand, delusions and superstitions are to be abandoned by an attitude of conscious neglect; or to use the phraseology of the Hindus, Avidyā, nescience—the mental state of the unenlightened—through which the individual energies are scattered and dissipated in futile effort, is gradually replaced by Vidyā, the higher wisdom which dispels the darkness of the mind, awakens our latent faculties and concentrates our efforts in the direction of that harmonious union, which ultimately results in Nirvāna. Although the way of the disciple or "chela" is always represented as long and difficult, it is said that he proceeds, the transcendental faculties which arise to help him enable him to pursue the right course with ever increasing confidence and security. These powers of the mind, or "śiddhi," should never be sought for their own sake, or be used for selfish purposes. The attempt to develop and use them without regard to the higher purpose is spoken of as practising the arts of "black magic," the exercise of which invariably leads to disaster. It is proclaimed that were the "chela" to attempt to make an improper use of his powers—that is to say, were he to yield to the promptings of selfishness, lust or antagonism—such a lapse would at once set in action countering forces, which not only retard his upward growth, but which would, were such evil courses persisted in, lead ultimately to the obliteration of all his newly acquired psychic possessions.

The Path may also be described in terms of the "seven principles." It may be said to be a process of unification, whereby the centres of volition, consciousness and active memory are systematically shifted upwards from the lower to the higher "principles" until they have become firmly established in the "Buddhi," or "sixth principle." As this last stage is approached the "chela" becomes less and less dependent on the guidance of traditions and scriptures. The truth becomes revealed to him by the opening of his inner vision, and he learns to see Dharma, the Eternal Law, as it were, face to face. Thus theosophists may be said to accept in their own sense the saying: "He who does the Will shall know the doctrine."

Along the Path are ranged ten great obstacles, or fetters, the Buddhist Sanyojanas, which have to be successively overcome before the final goal is reached. As these sanyojanas give a very good idea of what has been termed the negative aspect of the Path, we may enumerate them as follows:

1. The delusion of personality—the belief in a permanent and unchangeable egoentity.
2. Doubt as to the use of the higher efforts, or as to the possibility of solving the great mysteries of life.
3. The reliance upon ritual—seeking salvation through outward acts.
4. Lust.
5. Illicit, or antagonism.
6. Love of this life and its possessions—"The care of the world and the deceitfulness of riches."
7. The egoistic longing for a future life.
8. Pride.

A few words should be added as to the theosophic hell, or "Avīchā." This is described as a long drawn-out dream of bitter memories—a vivid consciousness of failure without volition, or the power of initiative—a dream of lost opportunities and futile regrets, of ambitions thwarted and hopes denied, of neglected duties, abused powers and impotent hate; a dream ending ultimately in the oblivion of utter annihilation.

There is no doubt much of valuable suggestion to be found in the philosophic system, or rather the conglomerate of systems, which pass to-day under the name of theosophy; and probably much has been done by means of its propaganda to popularize Eastern thought in the West, and in the East to reawaken a truer appreciation of its own philosophic treasures; but however that may be, the serious student would be well advised to seek his inspiration and his inspiration from the fountain-heads of the theosophists' doctrines, which are all easily accessible in translations; and to avoid the confusions and errors of writers who in most cases have but a superficial if any knowledge of the original languages and systems from which their doctrines have been arbitrarily culled.

(Sr G. L. F.-P.)

THÉOT, CATHERINE (d. 1794). French visionary, was born at Barenton (Manche). From her youth a victim of hallucinations, a long course of religious asceticism in the convent of the Miramiones in Paris unhinged her mind, and she was placed under restraint. Liberated in 1782, her early delusions concerning a Messiah became accentuated; that she was destined to be the mother of the new Messiah, she was now assured; she pictured to her followers the fantastic features of the coming Paradise on earth; and was hailed as the "Mother of God." From the idea of the advent of a Messiah to its realization was but a step; in Robespierre the Théotists saw the redeemer of mankind; and preparations for his initiation were put in train. The enemies of Robespierre, resenting his theocratic aims, seized upon his relations with the Théotists as an engine of revenge; Catherine, with Gerle (q.v.) and others, was arrested and imprisoned, and a letter to Robespierre discovered in her house. In the Convention M. G. A. Vadier trumped up the conspiracy of Théot, asserting that Catherine was a tool of Pitt, that the mummeries of the Théotists were but a cloak for clerical and reactionary intrigue, and hinting that Robespierre had this longchered their designs. The case was adjourned to the Revolutionary Tribunal, and figured in the proceedings of the 9th Thermidor. The accused were ultimately acquitted, Catherine herself having died in prison on the 1st of September 1794.

THERA, the southernmost island of the Sporades, now called Santorin (q.v.). It was known as Thera until after the Fourth Crusade, when it became part of the duchy of the Archipelago.

THERALITE (Gk. ἁγνᾶς, to pursue), in petrology, a group of plutonic holocrystalline rocks consisting of nepheline, basic plagioclase, augite and olivine, and so called because it is of rare occurrence, and its discovery was looked forward to with interest as completing the series of basic rocks containing nepheline as an essential constituent. The felspars are mostly of basic character and are often zonal; the nepheline is of later crystallization, rarely idiomorphic and often decomposed. Pyroxene in these rocks may be of green colour or purplish-brown and rich in titanium; olivine is usually abundant. Among the accessories may be mentioned apatite and iron oxides, biotite and dark brown hornblende, the latter often surrounding the purple augite. The rocks have rarely ophitic structure, but their minerals tend to have good crystalline form, except in the case of nepheline and orthoclase (if that be...
present). By decomposition the nepheline yields zeolites such as natrolite and analcine. The theraites are rarely crystalline and have much resemblance to dolerites in hand specimens. Among these rocks are Doupau in central Bohemia, Friddazo (W. Alps), Umpire (on the White Sea), Madagascar and the Crazy Mountains in Montana. A variety of them are known in British Columbia, Canada, and rocks from Crawford John in Lanarkshire and from Carsley in Renfrewshire have recently been ascribed to this group.

Very close to the theraites is a series of rock types known as the teschenites (from Teschen in Moravia). Instead of nepheline they usually contain analcine from their microscopic characters it is by no means likely that the analcine, which is very rare after nepheline in this case; it appears, in fact, to be either primary or of pneumatolytic origin. Nepheline, however, has been found in saprolites in North and South America, so that the distinction between the two series practically vanished. In central Scotland, around Edinburgh and Glasgow, teschenites are abundant, forming thick sills intrusive into the Carboniferous rocks, and some are also known from Leicestershire (Whitchick) and from Aran.

These teschenites are sometimes ophitic and present transitions to olivine-diabases on the one hand and to picrites on the other. They are the deep-seated representatives of the basaltic lavas which were emitted in great numbers in the early part of the Carboniferous period. Other localities for teschenite are the Caucasus and the coast of California (Cuyuna Valley, &c.).

They contain serpentine containing a large amount of alkali feldspar. Nepheline also occurs by no means uncommonly; the augite is sometimes green, but in other specimens is a rich purple colour with well-marked zonal structure. Olivine is by no means common. They are derived from hornblende biotite in some cases and from biotite in others.

The type rock is from Essex (Massachusetts) and other examples have been described from Rongstock on the Elbe, from Mount Royal (Montreal), from S. Norway, north of Christiania, and from St. Vincent in the Cape Verde Islands. A few specimens have been found in Britain, accompanying the Carboniferous teschenites near Edinburgh and in the Campsie Hills of Stirlingshire. As they contain both orthoclase and plagioclase feldspar they have a certain affinity to the olivine-monzonites and kentallenites.

The shonkinites are dark grey rocks consisting of olivine, green augite, dark brown biotite, nepheline and orthoclase, which are frequently present in the Hessisch Lichtenberg Mountains. They are basic varieties of sodalite-syenite and have some resemblance to theraites, especially in the association of nepheline with large amounts of augite and olivine. They are of exceedingly rare occurrence.

**THERAMENES**

(d. 403 B.C.), Athenian statesman, was the adopted son of Hagnon, a prominent conservative who in 430 impeached Pericles, and after the Sicilian expedition became one of the ten **probuli** (προβολοί, commissioners) appointed to devise economies in the administration. As a pupil of the sophist Prodicus he acquired facility in public speaking. Under his father's patronage he joined in the conservative reaction which came to a head in 411, when hopes of a Persian alliance or peace with Sparta strengthened the existing dissatisfaction with the democratic rule. Theramenes specially studied the constitution of the **boule** (πολίτης) and formulated a new party-cry, "the constitution of our fathers." It was no doubt largely due to his advocacy that the **probuli**, strengthened by further members, were commissioned to draft new measures on behalf of the public safety and to examine Cleisthenes' "ancestral code." In their report the following measures were recommended: (i.) annulment of the act promulgating illegal measures; (ii.) abolition of pay, save for the troops in the field and the archons; (iii.) restriction of the franchise to 5000 able to serve "with person and purse." (iv.) the appointment of 400 to hold office of the **boule**. When these proposals were passed (apparently in a packed assembly outside the walls), a Constituent Assembly of 100 was elected, nominally by the 5000, who as yet were a mere phantom body, in point of fact by the leading conspirators. The new constitution provided for a boule whose members were to be recruited by lot from all citizens above thirty; the functions of this body to be exercised by four sections succeeding one another by yearly rotation and serving without pay; all high officials to be chosen by it out of its own members. This scheme embodied the chief reforms desired by Theramenes, and marks the triumph of his policy. But before it could be carried into effect it was superseded by "provisional constitution," which gave unlimited power to a boule of 400 (chosen by a roundabout system which favoured intrigue) and its nominees, the ten "absolute" generals. This extreme reaction displeased Theramenes, who in return began to agitate for the calling of the 5000 into real existence. Furthermore he warned Athens against the treason of the extreme oligarchs, and induced the troops to raise a mole erected to facilitate a Spartan descent on Piraeus.

After the disaster at Eretia (see PELOPONNESIAN WAR), which caused the fall of the extremists and the institution of a government of "5000" (i.e. all citizens who could afford a suit of armour), Theramenes stood in high esteem. After assisting in the prosecution of his former colleagues he received the command of a squadron with which he helped to win the great victory at Cyaicus (410) and to recover the Bosporus. After the triumph of the radical democrats which followed upon these successes he lost his high command. At Arginusae (406) he fought as a simple ship's captain, but after the battle was commissioned by the generals to rescue some drowning men, for which, with his ill-trained and exhausted troops, in a heavy storm, he was unable to carry out. For this failure the generals were severely criticized at Athens; an inquiry by the boule led to their arrest, and before the ecclesia they aggravated their case by pleading (i.) that the storm made a rescue impossible, (ii.) that Theramenes was to blame. Theramenes in reply brought out the implied contradiction in these statements, and in consequence the assembly condemned the accused to death and subsequently returned Theramenes general.

In 405 Theramenes went as plenipotentiary to Lyons (q.v.) to obtain peace terms; after long negotiations he proceeded to Sparta and arranged a settlement which the Athenians ratified (April 404). In spite of this peace the disorder in Athens did not abate. The restored fugitives selected five "ephors," including Critias, to organize a revolution, while the radicals opposed that return to the "ancestral constitution," for which Theramenes had stipulated. Hereupon Lysander returned to Athens and had a Constituent Committee elected, of whom ten members were nominees of each section. In this body Theramenes at first assumed the chief part, and the new measures, regarding the laws against the Areopagus and suppressing sycophancy were well received. But, exactly as in 411, a more violent party under Critias, forgetting its real duties, appointed an autocratic boule of its own creatures, and proceeded by judicial murders and confiscations to earn for the new government the name of "the Thirty Tyrants." Theramenes protested, and managed to get a citizen-body of 3000 admitted to a share of the government. Critias, however, fearing a renewal of the collapse of 411, disarmed the people and decided to remove Theramenes before he could create a new democratic party. The latter successfully repelled Critias' denunciation of treason, but was led away by violence and forced to take poison. His well-known gibe, "Here's to the noble Critias," attests his strength of mind at the hour of death.1

Theramenes demonstrably had a definite policy throughout his career. His ideal was a return to a 6th century constitution, which his contemporaries could equally regard as a moderate oligarchy or a restricted democracy. The main features of his programme were: (i) property qualification for franchise; (ii) abolition of pay; (iii) transference of some judicial powers from the popular courts to a restored Areopagus. At times he seemed likely to succeed, but amid the violent oscillations of party he could not definitely join any one faction, and so earned the nickname Κάποιος (a stage-boot fitting either foot). Aristotle, however, discerned Theramenes' real policy, and, like Cicero and Caesar, in later years ranked him among the greatest Athenian statesmen.

**Sources.**—**The Constitution of Athens** with its numerous documents affords much valuable knowledge, but does not give the inner history of 411. Thucydides viii. supplies this, but his

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1 The attempted rescue by Isocrates (Pseudo-Plutarch, *Vitae X. Orationum*) is improbable; but Theramenes may have taught Isocrates in oratory.
knowledge of the constitutional side of the revolution and of Therapeutae—Therapeuthics

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of the Law to the spiritual truth that lay hidden within. When the president's address had been duly applauded, there followed the singing of hymns ancient and modern. Then came the meal of the simple kind already described. And after this a per-vigilium, celebrated with antiphonal and joint singing on the part of men and women and with choral dancing in imitation of Moses and Miriam at the Red Sea. At sunrise, turning to the east, they decreed that the lights of ancient might illumine their minds, and then returned to their studies.

Such is the account of the Therapeutae given by Philo. It seems to have formed part of the Apology for the Jews (Eus. Pr. Ev. viii. 10, § 12)—hence its highly rhetorical character—from which Eusebius gives the extract about the Essenes; while this in its turn may have constituted the fourth book of a large work entitled "sarcastically," says Eusebius, H. E. ii. 18 ηεϊ Απέρων, of which the Legatio ad Gaium formed the first. The De Vita Contemplativa thus owes its place next to the Quod Omnium Probus Liber, a place which it already occupied in the copy of Philo's works possessed by Eusebius (H. E. ii. 18), merely to the mention of the Essenes at the beginning of it.

To the modern reader the importance of the Therapeutae, as of the Essenes, lies in the evidence they afford of the existence of the monastic system long before the Christian era. We have no clue to the origin of the Therapeutae, but it is plain that they were already ancient when Philo described them. Eusebius was so much struck by the likeness of the Therapeutae to the Christian monks of his own day as to claim that they were Christian converts from the preaching of St Mark. He goes so far as to say that "the men of the sect," referred to by Philo, may very well have been the Gospels and Epistles (which were not yet written). This is a strong instance of how the wish may be father to the thought even in a fairly critical mind. Eusebius having gone wrong on this point, others of the Fathers followed suit, so that Philo is reckoned by Jerome among the ecclesiastical writers of the Christians.

Nothing is more likely than that Christianity gained adherents among the Therapeutae, and that their institutions were adapted to the new religion, just as they seem to have been borrowed by the Jews from the Egyptians. Strabo (xi. 29, p. 866) tells us how he saw at Heliopolis large buildings belonging to the priests, which had once been tenanted by men skilled in philosophy and astronomy, who had been consulted by Plato and Eudoxus, but that the σωτηρία and δοξασις (the very words used by Philo in speaking of the Therapeutae) had then fallen into decay. The system, however, was not even then extinct, for it was described by Chaeeron the Stoic, a contemporary of Strabo's. Chaeeron's account has been preserved by Porphyry (Life of Apollonius, vi. 9), and has curious resemblances to Philo's description of the Therapeutae, even down to such details as their posture and gait and the eating of hyssop with their bread.

After 1879 a theory became current in Germany (first stated in P. E. Lucius, Die Therapeutae und ihre Stellung), and accepted in England, to the effect that the De Vita Contemplativa is not a work of Philo's at all, but a forgery put forward about the end of the 3rd century and intended to procure the authority of Philo's name for the then rising monasticism of the Church. But this theory was signaly refuted by F. C. Conybeare in his Philo about the Contemplative Life (Oxford, 1893).

See also works quoted by Conybeare (pp. 591-599); Bousset, Religion des Judenmoden im nieutestamentlichen Zeitalter (1903); A. Harnack, s.v. "Therapeutae" in Herzog-Hauck, Realencykl., xi. 677 (1907).

ThERAPEUTHICS (Gr. θεραπευτης, sc. της, from θεραπευω, to serve), the name given to that branch of medicine which deals specifically with the means employed to cure disease if possible, or to control and lessen its evil results when a cure is impossible.

The cure which is sought for may either be symptomatic or radical. Various morbid conditions of the body generally may give rise to different symptoms. Thus a gouty condition may
manifest itself in one man as eczema of the skin, giving rise to redness and intense itching; in another as neuralgia, causing most severe pain; in a third as bronchitis, producing a distressing cough; in a fourth as dyspepsia, giving rise to flatulence and intestinal disturbance; and in a fifth as inflammation of the great toe, accompanied by redness, swelling and pain. The therapeutic measures employed in these different cases may be directed towards alleviating the symptoms, such as itching, pain, cough and swelling, in which case the treatment will be merely symptomatic; or they may be directed towards removing the root of the disease, viz. the gouty condition underlying them all, and thus effecting a radical cure. It very frequently happens that we do not know what the underlying condition is, and consequently rely to a great extent on empirical methods, the most prominent and most distressing symptoms. In symptomatic treatment we are frequently obliged to use remedies simply because we know they have done good before in similar cases, and we expect them to do so again without having the least idea of how they act. Thus in acute gout the most common and most trusted remedy for removing the pain is colchicum, but at present we do not know what action it has upon the system, or why it gives so much ease in the pain of gout while it has comparatively little effect upon pain due to other causes. This plan of treatment is termed empirical. It is a useful method of attack, and if the treatment is attended with success, the patient is satisfied, but it has the disadvantage that it admits of but little progress, and when a trusted empirical remedy fails we do not know precisely in what direction to look for a substitute. In contradistinction to empirical we have rational therapeutics, by which we mean the application of a remedy, whose mode of action we know more or less perfectly, in diseased conditions, the nature of which we also understand more or less fully. As an example may be taken the use of nitrite of amyl in angina pectoris. It has been found that in many cases of this disease the pressure of blood within the arteries becomes increased, probably from spasmodic contraction of the arteries themselves. Nitrite of amyl has the power of dilating the arteries; it has consequently been employed with much success in lowering the blood pressure and removing the pain in angina pectoris. But such rational knowledge as this not only enables us to remove pain at the time, but helps us to prevent its recurrence. For on the one hand knowledge of the fact that nitrite of amyl lessens blood pressure has led to the successful employment of other nitrites and bodies having a similar action, and on the other the knowledge that increased blood pressure tends to cause anginal pain leads to the prohibition of any strain, any food, any exposure to cold, and avoidance of any medicines which would unduly raise the blood pressure. Here we notice one of the greatest advantages of rational over empirical therapeutics. In cases of angina, while the resistance opposed to the action of the heart by spasm in the vessels may be great, the heart itself may be feeble, and it may therefore be necessary to give some remedy which will increase the power of the heart. But if such a remedy were given alone it might, and probably would, act on the arteries as well as the heart, and by causing the contraction of the vessels do more harm than good. But if we know what remedies will increase the power of the heart and yet not affect the arteries we may combine them and thus obtain the objects we desired, viz. removal of the pain, better action of the heart, and more perfect circulation.

The testing of ideas by observation and experiment which was begun in anatomy by Vesalius, and by Harvey in physiology, was applied by Morgagni to alterations in the organs produced by disease, by Bichat to the tissues, and by Virchow to the cell. The study of disease in the living body may be said to have been begun by John Hunter, developed by Magendie, Claude Bernard, Brown-Séquard and others. Of late years enormous impulse has been given to our knowledge of the causation of disease by microbes, through the works of Gaspard, who injected putrid matter into the veins of a living animal; by Villemain, who discovered that tuberculosis is infective; by Davaine; and especially by Pasteur, Koch and others too numerous to mention, who have worked, and are still working, at the microbe causation of disease with marvellous success.

The natural end of life is that all the organs should become old and gradually decay at the same time, so that at the last the individual should become less and less active, weaker and weaker, and finally die without any definite disease, without pain and without struggle. But this is exceptional, and generally one part gives way before another, either on account of one part being naturally weaker or of one part having been overtaxed or more severely attacked by some injurious external influence, or by some undue preponderance of another part of the body itself. For health consists in a due proportion between the actions of all the different parts of the body, and if one part be abnormally strong it will lead the system to destruction. Thus a very strong heart, although it may be useful to its possessor for many years, driving the blood rapidly through the vessels, and supplying all his tissues with such abundant nutriment as to enable him to endure great exertion, mental or bodily, may in the end cause death by bursting a vessel in the brain, which might have resisted the pressure of a feeble circulation for years longer. On the other hand, a heart that is too feeble may cause its owner's death by its inability to carry on the circulation against increased resistance, or by acting as a valve, and being obstructed. If the resistance is increased in the arterial system by a sudden exertion or strain, and more slowly when the resistance is increased in the pulmonary circulation by inflammation of the respiratory passages. The thyroid gland, which is situated in front of the neck, yields a secretion which passes into the blood and there tends to maintain a state of moderate dilatation in the blood-vessels and of oxidation in the tissues, so that the circulation remains good and the body-heat and muscular activity remain well maintained. When this gland becomes enlarged, and its secretion consequently increases, the vessels dilate, the heart beats more rapidly, the skin becomes too hot, the nervous system becomes irritable, and tremors occur in the limbs. On the other hand, when it becomes atrophied the circulation becomes feeble, the face heavy and dull, the patient suffers from cold, the features grow lumpy, mental processes become sluggish, and bodily vigour diminishes.

Disease of the whole body may thus be produced by over-action or under-action of some part of it, but such causes of disease are slight as compared with the effect of external noxious influences, and more especially the effect of microbes. These enter the body through various channels, and once they have effected a lodgment they grow, multiply and give rise to various poisons which attack and injure or destroy different tissues or organs in the body. Various safeguards are provided by nature to prevent their entrance. On the skin we have a thick epidermis through which microbes cannot pass, although if an entrance is obtained for them by a prick or cut they may readily grow in the tissues below and spread from them throughout the whole body. They pass more readily through mucous membranes, but almost every one of these is provided not only with a coating of mucus, which obstructs their passage, but also with abundantly supplied with leucocytes - white blood-cells. Thus irritation of the eye causes winking and secretion of tears, by which the irritant is removed; irritation of the nose causes sneezing; of the air-passages, coughing; of the stomach, vomiting; and of the intestines, diarrhoea. Even when they have passed through an abrasion in the skin or through the mucous membranes and enter the blood they are met, in some instances, by a toxic action of the blood itself upon them; and in others they are attacked by the white corpuscles, which destroy them, eat them up, and digest them, the process being known as phagocytosis. The greater the number of leucocytes that can reach the spot where the invading microbes enter the more quickly can the microbes be destroyed and general infection prevented. The microbes appear in many cases to attract the leucocytes (positive chemiotaxis), but when very virulent they usually repel the leucocytes (negative chemiotaxis).
and excrete toxins which kill the leucocytes. The irritation caused by the microbes generally is followed by dilatation of the vessels of that part and thus more leucocytes are brought up to the fight. This dilatation may be increased by local warmth, and poultices or fomentations are commonly applied to inflamed parts; recently suction apparatus has been used for the same purpose or ligature so as to cause venous stasis (Bier’s treatment). Blisters also cause local dilatation of vessels, but are usually applied to the skin for inflammation in deep-seated parts, such as the lungs, though they also relieve pain in the joints in acute rheumatism. Bier increases the blood in a part by compressing the veins and thus producing passive instead of active congestion. The toxins produced by microbes, however, are weak in their destructive power, but are able to secrete anti-toxins, which not only act as antidotes to the toxins and are injurious to the microbes, but also increase the phagocytic power of the leucocytes (opsonius of Wright). By inoculation with increasing doses of these the resistance of the organism is greatly increased and the invading microbes destroyed. The vaccine is usually made by sterilizing a virulent culture and the proper dose is ascertainment by noting the extent to which the power of the leucocytes to envelop and digest the microbes is increased.

Moreover, the products of microbial secretion tend to produce fever. The high temperature characteristic of this condition is no doubt injurious to the body itself, but it is frequently more so to the microbes which have invaded the organism; and thus fever, instead of now being regarded as a morbid condition to be suppressed by every means in our power, is considered to be a reaction of the organism tending to protect it by destroying the infection. But it must be kept within limits, lest it should of itself cause death, and here again we see the difference between empirical and rational medicine. Fever is not to be looked upon as an unmitigated evil to be removed if possible, but rather as a defensive mechanism by which the organism may prevent invasion from noxious microbes. Nevertheless, as in a campaign the general’s plan may be spoiled by too hasty or too eager action on the part of some of his troops, so the defensive arrangement carried to excess may prove injurious or fatal to the organism. Thus too great a rise of temperature in fever may kill the patient; and the aim of therapeutics is to restrain the temperature within proper limits, neither allowing it to rise too high nor to fall too low. The old plan of lowering it by means of cold baths was known to Musa, the physician of Augustus, and it is said he saved the emperor’s life; but the same treatment killed the emperor’s nephew. The introduction of the clinical thermometer, which allows us to ascertain exactly the amount to which the temperature rises in fever or to which it is reduced by antipyretic measures, is to the physician like the compass to the sailor, and allows him to steer safely between two extremes.

After the struggle between the organism and the microbes is over, even when it has ended victoriously for the former, injuries are left behind which require repair. Every one has noticed after prolonged fever how thin and weak the patient is, and both the muscular and nervous power throughout the whole body are sadly in want of repair. Where there has been local mischief due to inflammation the dead leucocytes must be removed, and this is done either by their being converted into pus in one mass, and making their way through the tissues to the nearest surface, whether of skin or mucous membrane, from which it can be discharged, or they may undergo a process of fatty degeneration and absorption, leaving behind in some cases cheesy matter, in others hard connective tissue.

Poisons formed by microbes are partly eliminated by the kidneys, partly by the mucous membrane of the stomach and intestines, and possibly also by the skin. In old days free elimination by these channels was looked upon as a sign of returning health, and was termed a “critical” diuresis, diarrhoea or sweating, according to the channel through which the eliminative act had occurred.

By therapeutic measures we strive to limit as far as possible the entry of injurious microbes into the organism, to expel or destroy them and their harmful products, and to maintain the strength of the organism itself. One of the influences which is most injurious to the body, and favours most the invasion of microbes, is chill. So much is this the case that some diseases which are now known to be due to infection were formerly attributed entirely to the effect of cold. Thus pneumonia is now known to be due to the diplococcus pneumoniae, and yet its invasion occurs so frequently after a chill that it is almost impossible not to look upon chill and pneumonia as cause and effect. The reason of this appears to be that the diplococcus is frequently present in the mouth or air-passages without giving rise to any symptoms; but when the patient is exposed to a chill, and the tissue resistance weakened, the diplococcus grows, multiplies and gives rise to inflammation of the lungs. Even what are known as common colds are probably due chiefly to microbial infection aided by a chill, just as in the case of pneumonia. Therapeutic measures which are commonly adopted in the treatment of a cold have for their object to destroy the microbes before they penetrate fairly into the organism, and to restore the balance of the circulation and increase the strength of the invaded parts.

By the use of hot spirits or carbolized ammonia are sniffed into the nose to destroy the microbes, which are destroyed by an antiseptic solution as a nasal douche; bismuth or morphine are insufflated, or zinc ointment is applied, to cover the mucous membrane, and protect it from further irritation; and various antiseptic gargles, paints and powders applied to the pharynx in order to prevent the microbial inflammation from extending to the pharynx and down the trachea and bronchi, for many a severe bronchitis begins first by sneezing and nasal irritation. Sometimes the patient is put to bed and the circulation is encouraged, especially on the surface of the body, by the use of hot spirits and water, or opium and pepsicum, while the outside of the nose is protected to a certain extent from loss of heat, and consequent irritation, by smearing it with a tallow candle or rubbing some ointment over the skin. At the same time, if the throat has begun to show signs of being involved, a hot poultice or wet pack is applied to the neck.

Both inflammation and fever are protective processes calculated to defend the organism against the attacks of microbes. But protective processes misdirected or carried to excess may become injurious or even dangerous to the organism. As an example of this take the irritation which may come about in the eye after a particle of dust has been removed from it or the itching of the skin which occurs in eczema. The irritation of the conjunctiva caused by dust leads to winking of the eye-lids, lachrymation and rubbing, which tend to remove it; but after the dust has been removed violent rubbing tends rather to keep up the irritation; and sometimes, if the particle of dust remains under the eyelid and is sharp and angular, the process of rubbing may cause it to injure the conjunctiva much more than if it were left alone. In the same way itching is often caused by the presence of insects or other irritants upon the skin, and it tends reflexly to cause rubbing, which is useful by removing the irritant. But when the irritation is situated in the skin itself, as in eczema, the scratching tends to increase inflammation, and makes the irritation worse. In the same way, the reflex act of coughing is useful in removing either foreign bodies or excessive secretion from the air passages; but when the mucous membrane of the respiratory tract is irritated and inflamed, it produces a feeling of tickling and a desire to cough sometimes very violently; yet the coughing simply tends to exhaust the patient, because there is really little or nothing to bring up. The same microbes in the organ to which the lung substance itself. As an example of excessive action we may take sneezing, which is calculated to remove irritants from the nose, but when too powerful may cause the patient to burst a blood-vessel. In phthisis also, although there may be some expectation to bring up, yet a good deal of the irritation is in the lung substance, and the efforts of coughing are far greater and more continuous than are required for the removal of
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expectoration, and they simply exhaust the patient. In inflammation of the stomach also such continuous vomiting occasionally occurs that the patient’s life is in danger by his inability to retain food; and similar danger also occurs from inflammation of the intestines and consequent diarrhoea.

We will next take the various parts of the body, and consider more in detail the therapeutic measures most commonly employed in the treatment of their diseases. The defensive measures. protective powers of the body against microbes, when actually on or in it, may be classed as means (1) of passive defence, (2) of active defence, and (3) of repair. Besides these, however, we may regard as passive defence the inhibition of the whole body from injury caused by (a) inaction, or (b) overaction, or (c) weakness of any one of its parts. The means of passive and active defence are sometimes so closely associated that it is difficult to distinguish between them. Thus if a little diphtheritic sputum were coughed into a person’s eye, or some blood containing anthrax bacilli were to touch a raw spot upon the hand, the removal of microbes in either case by washing with simple water might be regarded as a means of passive defence, whilst washing them away with an antiseptic lotion might be regarded as active defence, because the antiseptic would tend not only to take the microbes off, but to destroy the microbes. In the same way, washing the skin with spirit would tend to harden the epidermis and thus prevent the entrance of microbes; and the application of an ointment to an abrasion would have a similar action. But by the addition of some antiseptic to the ointment its defensive action would be converted from passive to active, and its power to prevent infection would become greater; and if inflammation had already set up in the skin, the addition of opium, belladonna, or cocaine would lessen local pain; and an astringent, either metallic or organic, would restrain inflammation and accelerate repair. The thickening of the epidermis in the hands and feet, which occurs from constant use, is nature’s provision for meeting the extra wear to which these parts are subjected by much use; but pressure is apt to cause the defensive process to be carried too far, and to lead to corns, which give rise to much pain and annoyance. To remove these salicylic acid dissolved in flexible collodion is now generally employed. When this is painted upon the part the corn usually peels off in a day or two, and the patient is cured.

But the object of therapeutics is not merely to cure. It is, in the words of the old formula, Curare, cito, iuto, et jucunde, to cure quickly, safely, and pleasantly. There are principles to cure, therefore in most prescriptions (1) a basis or chief ingredient intended to cure (curare), (2) an adjuvant to assist its action and make it cure quickly (cito), (3) a corrective to prevent or lessen any undesirable effect (iuto), and (4) a vehicle or excipient to make it suitable for administration and pleasant to the patient (jucunde). In the remedy just mentioned the salicylic acid forms the basis; but sometimes chloride of zinc or lactic acid is added to it to make it act more quickly, and these are the adjuvants. Extract of belladonna is added to lessen the pain which might occur during the removal of the corn, and this acts as a corrective; while the flexible collodion forms a means of applying it conveniently, and constitutes the vehicle.

The surface of the skin may be invaded by parasitic organisms and may exhibit spots, which are removed by something which will destroy the parasite, such as ointments containing mercurial salts. In psoriasis the epidermis separates in flakes at various spots which have not been subjected to pressure, and to cure it ointment containing tar or other products of the dry distillation of wood is employed. When the true skin is inflamed various appearances may arise, according to the intensity and extent of the inflammation, and the eruption may be papular, vesicular, pustular, tubercular, bullous or ulcerative. To lessen irritation the skin is protected by dusting powders, such as oxide of zinc, starch, fuller’s earth, &c., or by ointments. Irritation is lessened by lotions containing substances that will diminish irritability of the nerve-endings and skin, such as carbolic acid, hydrocyanic acid, morphine or opium, cocaine, belladonna or atropine. Where the surface is ulcerated it may be protected from external violence and placed under favourable conditions for healing by covering it with lint moistened with water and with oil-silk over it to prevent evaporation. If the granulations tend to become too abundant, some astringent, such as sulphate of copper or sulphate of zinc, is added to the water. On the other hand, when the ulceration is old and the circulation through it poor, the aim of the therapeutist is to reawaken the normal reparative process, to bring about increased circulation and increased tissue change, and thereby induce healing. For this reason a substance is placed upon the callous ulcer, which heals with the fresh inflammation thus excited.

The treatment of inflammation of mucous membrane is based upon the same principles as inflammation of the skin, and there too we usually associate means (1) for removing microbes, (2) for destroying them, (3) for lessening the irritation they produce, and (4) for repairing any mischief they have done. Thus in the eye and ear, lotions containing an antiseptic, a sedative and an astringent are very generally used. For inflammation of the mouth a similar combination is used as a gargle, or in the form of a salve, in the latter case, and sometimes as an ointment or spray, the ointment possessing the advantage of protecting the delicate nasal mucous membrane from irritation by stopping the entrance of irritant dust into the nasal cavities. In the stomach we aid the vomiting by which microbes or the products of decomposition of food are usually eliminated by giving to the patient repeated draughts of hot water so as to wash the stomach clean. Frequently this is sufficient; but if the stomach refuses to eject its objectionable contents, we may either give an emetic or wash it out by means of a stomach-pump or siphon. Similar procedures are used for the intestine, and one of the best methods of treating the diarrhoea consequent upon the presence of irritating substances in the intestinal canal is to give a dose of castor-oil together with a few drops of laudanum. For bowel movements the irritating substances are removed, and the laudanum which is mixed with the purgative soothes the intestine. Even in cases of very acute intestinal diseases similar treatment is now pursued, and instead of treating dysentery simply by sedatives or astringents, an eliminative treatment by means of sulphate of magnesia is largely employed. After the irritant has been removed either from the stomach or intestine, a feeling of irritation of the mucous membrane may remain, and sickness and diarrhoea or pain may continue in the stomach and intestine although the irritant is no longer present within them, just as the flow of tears and desire to rub may remain in the eye after the piece of grit which has occasioned it may have been removed. The condition which remains after the irritant has been removed is one of inflammation more or less intense. The process of inflammation is a defensive one, but if carried too far may prove injurious.

For the purpose of checking the inflammatory processes and lessening discharge from mucous membranes astringents are employed. Some of these are of mineral and some of vegetable origin, but they almost all possess one chemical property in common, namely, they precipitate albumin. This power is possessed alike by a glass of brandy, by solution of lime, soluble salts of zinc, copper, or silver, by tannic and gallic acids, as well as vegetable juices and extracts which contain them. The strength of the astringent application and the mode of its administration are varied according to the delicacy and position of the mucous membrane affected. Thus to the eye we may use a solution of sulphate of zinc of half a grain to the ounce, while to the ear, urethra or vagina a solution of four to eight grains or even more may be applied. For the stomach and intestines we employ the same drug in the form of a pill; and when it is desired to act especially upon the intestines, the pills are made of a harder consistence or less soluble preparation, or are covered with keratin, so that they may not act much, if at all, upon the stomach while passing through it before reaching the intestines. The heat which occurs in inflamed parts is chiefly due to the
larger amount of blood circulating in the part on account of the dilatation of the vessels. The pain is due to stretching of the nerve fibrils or compression of them by the turgid vessels in the swollen tissues. This latter cause is chiefly observed when the tissues are of a very unyielding character; for example, when the inflammation occurs in a bone or under a thick fibrous and unyielding membrane. The swelling, heat and pain may sometimes be relieved by mere change of position altering the flow of blood to the inflamed part. Thus when inflammation occurs in the finger, as in a whitlow, the pain is not only constantly severe, but it is increased by every pulsation of the heart. A rapid rise and fall of the heart, as occasioned by rapid dilating the vessels around forms a side channel through which the blood passes, the tension in the seat of inflammation being thus lessened in both cases. When the inflammation occurs in soft parts where the surrounding vessels can be readily dilated, heat often affords more relief to the pain than cold, but when the inflammation is in a bone or in unyielding fibrous tissues, cold generally gives more relief. For example, the pain of a gum-boil is generally relieved more by warmth, because the yielding tissues of the gum, mouth and cheek can be readily relaxed by heat and their vessels dilated; but when the pain is dependent upon inflammation in the hard unyielding socket of a tooth, cold generally gives greater relief. The removal of blood, either by incision or by the application of leeches, sometimes gives considerable relief to the pain and tension of inflamed parts. Blisters applied at some distance from inflamed parts are also sometimes useful; and probably they produce this good effect by causing a reflex contraction of the arteries in the inflamed part, and thus acting like a cold application. Certain drugs have the power of relieving inflammation by slowing the heart and rendering its impulse more feeble. Amongst those are volatile oils, which when applied to the forehead generally by means of a fan especially tends to lessen the process of inflammation generally, when it is not too severe. There can be little doubt that the intensity of inflammation frequently depends very much on the condition of the blood, and that by altering the blood inflammation may be lessened. Thus free purification, and especially purification by chologogues and salines, has long been recognized as a useful means of reducing the inflammatory process. For example, a mercurial pill at night, followed by salts and scena in the morning, will often relieve the pain in toothache or gum-boil, and lessen inflammation not only in the mouth, but other parts of the body as well. Such remedies are termed antiphlogistic. Venesection (blood-letting) at one time was highly esteemed as an antiphlogistic measure, and while it is possible that it has now fallen too much into disuse, there can be no doubt that at one time it was very greatly abused, and was carried to such an excess as to kill many patients who would have recovered perfectly had they been let alone. Although the high temperature in an inflamed part is chiefly due to the increased circulation of blood in it, yet the presence of inflammation appears to cause increased formation of heat either in the inflamed part itself or in the body generally, because we rarely find inflammation exist to any extent without the temperature of the body being raised and a febrile condition produced.

Two very old remedies for fever are acetate of ammonia and nitrous ether. These were formerly given empirically, simply because they had been found to do good. Now we can see the reason for their administration, because the nitrous ether, consisting chiefly of ethyl nitrite, dilates the superficial vessels and thus allows greater escape of heat from the surface; while acetate of ammonia, by acting as a diaphoretic and stimulating the secretion of sweat, increases the loss of heat by evaporation. When a patient is covered with several blankets, loss of heat from the surface both by radiation and evaporation is to a great extent prevented, but if a cradle be placed over him, so as to raise the bedclothes and allow of free circulation of air around his body, both radiation and evaporation will be increased and the temperature consequently lowered. If his body be left uncovered except by the sheet or blanket thrown over the cradle, the loss of heat is still greater, and may be much increased by sponging the surface with either hot or cold water so as to leave it slightly moist and increase evaporation. The temperature may be still further reduced by placing vessels filled with ice inside the cradle. When the patient is very restless, so that cradling is impossible, a wet pack may be employed, a sheet wrung out of cold water being wrapped round him, and over this a blanket. The pack has the double effect of restraining his movements and thus lessening the production of heat, while at the same time it dilates the vessels of the skin and produces loss of heat. The restraint on the body and the moisture on the surface frequently cause sleep quickly in patients who have previously been wildly delirious and entirely sleepless. When the temperature continues to rise in spite of wet sponging and cradling, recourse must be had to the cold bath. The bath should be brought to the bedside and the patient, wrapped in a sheet, should be lifted into it by two attendants. The water should be at the temperature of 90° and gradually reduced by the removal of hot water and displacement by cold, until the temperature of the patient as taken in the mouth is reduced to about 95° or 96°. After this the patient should be taken out and again put into bed. It is inadvisable to lower the temperature quite to the normal while the patient is in the bath, as frequently it falls after his removal, and may fall so far as to induce collapse. In cases where no bath is available a large mackintosh sheet may be spread upon the bed under the patient, the sides and top may be raised by pillows, and cold water may be applied to the surface of the body with large sponges. The mackintosh sheet forms a shallow bath, and the water may afterwards be run off from it at the lower end of the bed. Another way of applying cold is to dip an ordinary sheet into cold water, ring it out, and apply it to the body, then remove it and replace it by another sheet while the first one is being dipped in water. By the alternate use of the two sheets, or by the use of one quickly wrung out of cold water as soon as it becomes warm, the patient's temperature may be rapidly reduced.

There are a number of drugs which have a very powerful action in lowering temperature. Most of these belong to the aromatic group of bodies, although one of them, antipyrin, belongs rather to the furfurol group. Carbohelic acid has an antipyretic action, but on account of its poisonous properties it cannot be employed as an antipyrin. Salicylic acid has a strong antipyretic action, and is most commonly used in the form of its sodium salt, which is much more soluble than the acid itself. Amongst other antipyretics, the most important are quinine, phenacetin and antifebrin. These probably lessen fever by their action upon the nerve centres which regulate the temperature of the body, and partly by their peripheral action in causing the secretion of sweat. Very high fever in itself will cause death, the fatal temperature in rabbits being 114.5°. Before death occurs the pulse and respiration become extremely rapid and weak, and complete unconsciousness sets in. That these symptoms are simply due to heat is shown by the fact that if the temperature be quickly reduced by the application of cold the symptoms at once subside. But the delirium which is common in fever, although it may be partly due to rise of temperature, is very often due to poisons in the blood, for in some cases it occurs with quite a low temperature, 101° or 102°, whereas in others the temperature rises to 104° and 105° with no delirium whatever. The presence of toxins in the blood not only
affects the brain, causing delirium, but also other organs, the heart and lung, and may cause fatal syncope or respiratory failure.

Many years ago Dr S. L. Mitchell (1764-1831) pointed out in America the resemblance which exists between symptoms of poisoning by snake venom and infective fevers. S. Weir Mitchell and others have shown that serpent venom consists chiefly of albumoses, and the toxins formed by infective bacilli have a somewhat similar chemical nature. Calmette and Fraser found that when small doses of some snake venom are injected into an animal, temporary disturbance is produced; but after a few days the animal recovers, and a larger dose is then required to produce any symptoms. By gradually increasing the dose the animal becomes more and more resistant, until at last a dose fifty times as great as that which would at first have produced immediate death can be injected without doing the animal any harm. If a horse be chosen for the experiment, a considerable quantity of blood may be withdrawn without injuring the animal. When this is clotted the serum is found to act as an anti-aemic in that way it hardens the plasma and makes the snake venom harmless. Although this result is best obtained when the venom and serum are mixed in a glass before injection, yet if they be injected at the same time in different parts of the body the animal will still be protected and the poison will not produce its usual deadly results. What occurs with snake venom takes place also when the toxins are formed by microbes, and a new method of treatment by anti-toxic serums has been introduced of late years with great success. This is most commonly and successfully used in the treatment of diphtheria. This disease depends upon the presence of a bacillus which grows rapidly at the back of the throat and in the air passages specially of children, causing the formation of a membrane which, by plugging the windpipe, causes suffocation and death. At the same time it produces a poison which causes inflammation of the nerves, leading to paralysis, which sometimes proves fatal. By growing this bacillus in broth a toxin is formed which remains in solution and can be separated from the bacilli themselves by filtration. This toxin-containing broth is injected into a horse in increasing doses, just as in the case of the serpent venom, and after the resistance of the horse has been increased to that into which it has been infected the filtrate blood is allowed to coagulate. The serum is then removed and its anti-toxie power tested by ascertaining the amount necessary to counteract a given amount of active toxin in a guinea-pig of a certain size, the standard weight being three hundred grammes. The serum, the strength of which has thus been ascertained, is distributed in bottles and injected in the proper quantity under the skin of children suffering from diphtheria. If used at an early stage of the disease, and in sufficient quantity, the results are wonderful. The same method of serum therapeutic has been used in other infective diseases, but not with the same success.

Another therapeutic method which is historically much older than that of serum therapeutic is that of inoculation.

Inoculation. The virulence of infective diseases varies in different epidemics, and at different times in the same epidemic. It had been noted that many infective diseases did not attack an individual a second time, the first attack appearing to protect from subsequent ones. The idea of inoculation, therefore, was to infect an individual with a mild form of the disease, so that he should escape infection by a more virulent one. This was tried largely in the case of smallpox, and since at least in Dr Erasmus Darwin's case of scarlet fever. The worst of this method was that the disease thus inoculated did not always prove of a mild character, and in the case of Dr Erasmus Darwin's son the scarlet fever was exceedingly severe and very nearly proved fatal. To Edward Jenner we owe the discovery that vaccination protects against smallpox, and it is now generally acknowledged that smallpox and vaccine are probably the same disease, the virus of which is modified and its virulence lessened by passing through the body of the cow. Pasteur found that the germs of anthrax could be cultivated outside the body and their virulence weakened either by growing them at too high a temperature or in an unsuitable medium. By inoculating first with a weak virus and then with others which were stronger and stronger, he was able completely to protect oxen either from the effects of inoculation with the strongest virus or from infection through contact with other animals suffering from the disorder. On the other hand, he found that homogenized virus could be again strengthened by inoculating a feeble animal such as a guinea-pig a day or two old with it, and then inoculating stronger and stronger animals; an increase in strength was gained with each inoculation, until at last the virus could attack the strongest. A similar increase in virulence appears to occur in plague, where animals, especially rats and mice, seem to be affected before human beings, and not only increase the virulence of the microbes, but convey the infection. Two methods of protective inoculation have been used. In one, Halfkine employs the toxins obtained by growing plumps in broth for six weeks, and then heating the whole to 65° or 70° C. so as to destroy the bacilli. This preparation is prophylactic, but does not seem to be curative. Yersin has prepared a serum from horses in the same way as diphtheria anti-toxin, and this is said to have a curative action during the attack. In the same way sterilized cultures of typhoid bacilli have been used to protect against attacks of typhoid fever, and an anti-typhoid serum has been employed with intent to cure. Protection does seem to be afforded, but the curative action of the serum is still somewhat doubtful. Although the anti-toxins which are used in the cure of infective diseases are not dangerous to life, yet they sometimes cause unpleasant consequences, more especially an urticarial eruption almost exactly like that which follows eating mussels or other shell-fish. Sometimes the swelling of the skin is much more general, so that the whole body may be so swollen and puffy as exactly to resemble that of a person suffering from advanced kidney disease. These disagreeable results, however, are not to be compared with the benefits obtained by the injection of anti-toxic serum, and this method of treatment is likely to maintain its place in therapeutics.

For many years peptone has been used as a remedy in dyspepsia to supplement the deficiency of digestive juice in the stomach, and it has been used popularly in dyspepsia for a still longer period. From time immemorial savages have been accustomed to eat the hearts of lions and other wild animals, under the belief that they will thereby obtain courage and strength like that of the animal from which the heart had been taken, but in 1889 Brown-Séquard proposed to use testicular juice as a general tonic and stimulant. Observations were made on the connexion between thyroid gland and myxoedema, which appeared to show that this disease was dependent upon atrophy of the gland. Accordingly the liquid extracts of the gland, or the gland substance itself compressed into tablets, have become largely used in the treatment of the disorder. The success which has been achieved has led to the use of many other organs in a raw or compressed form, or as extracts, in other diseases; e.g. of suprarenal capsule in Addison's disease, of bone marrow in pernicious anaemia, of thymus and suprarenal capsule in exophthalmic goitre, of kidney in renal disease, and of pituitary body in acromegaly. To this method of treatment the name of organo-therapeutics or opo-therapy has been given. The first scientific attempt to employ organs raw or in the testicular juice was made by Lauder Brunton in diabetes in 1873, sixteen years before Brown-Séquard's paper on the effect of testicular juice. From considering the nature of diabetes, he had come to the conclusion that many cases were due to imperfect oxidation of sugar in the body; that this oxidation was normally carried out by a ferment in the muscles, and that probably the disease was in some cases dependent upon absence of the ferment. He tried to supply this by giving raw
meat and glycerine extract of meat, but although he seemed
to get some benefit from the treatment, it was not sufficiently
marked to attract general attention. His attempts to isolate
a glycolytic ferment from flesh were also only partially success-
ful. One of the great difficulties in the way of applying this
treatment is that in all probability many of the ferments or
enzymes are altered during the process of absorption in the same
way as the normal ferments of digestion, and unless the tissue
enzymes can be isolated and injected subcutaneously the desired
results will not be obtained. The most striking of all the results
of the treatment obtained in myxoeema. In this disease
the face is heavy, puffy and expressionless; the skin is thick,
the speech slow, the hands shapeless and spade-like, the
patient apathetic, the circulation slow and the extremities
cold. Under the influence of thyroid gland these symptoms all
disappear, and the patient is frequently restored to a normal
condition. When the thyroid gland is absent in children, not
only is the expression of the face dull and heavy as in the adult,
but the growth both of body and mind is arrested, and the child
remains a stunted idiot. The effect of thyroid gland in such
cases is now notorious; the child growing in body and becoming
healthy and intelligent in those children in which this adenoma
of the gland appears to be a preparation which is poured
out into the blood and alters tissue-change. When the thyroid
tables or extract of thyroid are given in too large quantities
to patients suffering from myxoeema, the symptoms of
myxoeema disappear, but in their place appear others indi-
cative of increased metabolism and accelerated circulation.
The pulse-rate becomes very rapid, the extremities become
warm, so that the patient is obliged to wear few clothes, the
temper becomes irritable, the patient nervous, and a fine tremor
is observed in the hands. On stopping the administration of
thyroid these symptoms again disappear. When the thyroid
is hypertonished, as in Graves’s disease, the same symptoms
are observed, and these are probably due to increased secretion
from the thyroid. At the same time other symptoms, such as
exophthalmos, may appear, which have an independent origin
and are not due to the secretion of the gland. The whole of
the secretion here is poured into the blood and not at all on to
a mucous surface, and herein the thyroid gland differs largely
from such glands as the pancreas or peptic and intestinal glands.
But it seems probable that all glands which have what
may be termed an external secretion like the pancreas, stomach,
intestine, skin and kidneys have also an internal secretion,
so that while they are pouring one secretion from the ducts
into the intestine or external air, they are also pouring into the
lymphatics, and thus into the blood, an internal secretion.
In fact, a splitting appears to take place in the process of
secretion somewhat resembling that which takes place in the
formation of a toxin and anti-toxin. The secretion of some
digestive glands would prove poisonous if absorbed unchanged.
For example, the trypsin of the pancreas (see NUTRITION)
digests albuminous bodies in neutral or alkaline situation, and
if the whole of that which is secreted in the pancreas for the
digestion of meat in the intestine were absorbed unchanged into
the circulation, it would digest the body itself and quickly
cause death. The secretion of trypsin by the pancreas may
therefore be looked upon as the formation of a toxin. We do
not know at present if any corresponding anti-toxin or anti-
trypsin, as we may term it, is returned into the lymphatics or
blood from the gland, but the pancreas, which in addition to
secreting trypsin secretes a diastatic ferment forming sugar
from starches, moves this into the intestine and secretion at the
same time a glycolytic ferment which breaks up sugar, and this
latter passes into the blood by way of the lymphatics. Thus
the gland not only breaks up starch into sugar in the intestine,
but breaks up the sugar thus formed after it has been absorbed
into the blood. It is known that several, perhaps very many,
if not all glands have also the power of secreting substances
to which Starling has given the name of “hormones.” These
pass into the blood and cause other glands to secrete. Thus
an acid in the duodenum causes it to secrete a hormone to which
the name of “secretin” has been given. This passes to the
pancreas and causes increased secretion from that gland. It
is probable that the pancreas in its turn also secretes something
which activates a ferment in the muscles. It is evident there-
fore that the connexion between the different glands of the
body is a very complicated one and that the effects of a drug
which acts upon any one of them may be of a very far-reaching
character. It is by no means improbable that all glands have
a double or even triple function, and that sometimes the external
may be even less important than the internal secretion. On
this point, however, we have but little definite knowledge, and
it is probable that the subject is open for future research. At the same time,
there are many indications of the importance of an internal
secretion in popular treatment. For example, there are many
people who feel very much better after prose perspiration,
and as sweat appears to contain little but water and a few salts,
it is not improbable that the improvement in their condition
is due rather to the internal secretion from the skin than to
the elimination effected by the sweat. It is probable that the
kidneys also have an internal secretion, and that the great
oeedema sometimes found in kidney disease is rather due to the
lack of this secretion than to the development of a streptococcus anti-toxin, than to accumulation of water due to
imperfect action of the kidney. Similarly the beneficial effects
of purgation may be due not only to the elimination which
takes place through the bowel, but also to the internal secretion
from the intestinal glands.

The health of the body depends upon the proper kind and
and supply of food, upon its proper digestion and absorption, on
the proper metabolism or tissue-change in the body, and the
proper excretion of waste. We have considered how these may
also be disturbed by microbes from without and from within. We
have also considered in a general way the treatment of local
diseases by passive protection, active protection and repair of
waste; but both maintenance of health and repair of waste
depend very largely upon the condition of the blood. When
this is healthy the attacks of microbes are resisted, wounds heal
readily, and patients recover from serious diseases which in
persons of debilitated constitution would prove fatal. In order
to keep the blood in a satisfactory condition it must be well
supplied with fresh nutriment, and the products of waste freely eliminated. The food required for
nutrition and elimi-
nation.
THERAPEUTICS

being more complete, because persons cannot wash the unnastipated food down by drinking, and it prevents the gastric juice from being greatly diluted, and so allows it to digest more rapidly. Should these rules be insufficient, then (4) protein and farinaceous food should be taken in separate meals—farinaceous food at breakfast, proteid alone at lunch; farinaceous in the afternoon, and proteid again in the evening. The reason for this is that farinaceous foods are digested in the intestine and not in the stomach, where they may undergo fermentation, whereas proteid foods are to a great extent digested in the stomach. When the secretion of gastric juice is deficient it may be excited by farinaceous tonics, such as ten grains of bicarbonate of soda and a drachm of compound tincture of gentian in water shortly before meals, and may be supplemented by the administration of pepsin and hydrochloric acid after meals. When the nervous system is below par, and both secretion and movements are deficient in the stomach, nervous tonics, such as nux vomica or strychnine, are most useful.

High tension in the arteries is often associated with sleeplessness, the pressure of blood being such that the circulation in the brain is constantly maintained at a high rate of speed and the brain is unable to obtain rest. The means of removing the excess may be divided into those (1) which lessen the circulation, and which (2) diminish the excitability of the brain cells. The circulation in the brain may be lessened by warmth to the feet, cold to the head, warm food in the stomach, warm polioites or compresses to the abdomen, antipyretics, which reduce the temperature and consequently slow the beats of the heart in fever, and cardiac or vascular tonics, which slow the heart and tend to restore tone to the blood-vessels, so that the circulation in the brain may be more efficiently regulated. Amongst those which lessen excitability of the brain-cells are opium, morphine, hyoscyamus, chloral, sulphonal, trional, paraldehyde, chloralamide, chlorose, hop and many others. A combination of the two kinds of remedy is sometimes useful, and chloral sometimes succeeds where other things fail, because it depresses the circulation as well as lessens the activity of the brain-cells.

Irritation of sensory nerves tends to cause contraction of the vessels and to raise the blood pressure, and where pain is present opium or morphine is the most efficient sedative. The sensation of pain is felt in the brain, and the cause of it may be in the sensory centres of the brain alone, as it may be by a general pain, with no lesion to cause it. Ordinarily, however, it is due to some peripheral irritation which is conducted by sensory nerves to the spinal cord and thence up to the sensory centre in the brain. Pain may be stopped by removing the cause of irritation, as, for example, by the extraction of a carious tooth or by rendering the nerve-endings insensitive to irritation, as by the application of cocaine; by preventing its transmission along the spinal cord by antipyrin, phenaacetin, acetanilide, cocaine, &c.; or by dulling the perceptive centre in the brain by means of opium or its alkaloids, by anaesthetics, and probably also, to a certain extent, by antipyrin and its congeners.

Both sleeplessness and pain are sometimes due to the action of toxins absorbed from the intestine, and both of them may sometimes be relieved more efficiently by thorough purgation than by narcotics. Another condition which is probably due to toxins is high pressure within the arteries. When this continues for a length of time it tends by itself to cause deterioration of the blood-vessels and leads to death either by cerebral apoplexy or by cardiac failure. It is therefore very important to discover high tension at an early period. It may be diminished or its increases prevented by a diet from which red meat and meat extracts are excluded, by the use of the lactic acid bacillus, by the administration of laxatives and cholagogues to regulate the bowels, and by the use of iodides and nitrates. By such régime and medicines life may sometimes be prolonged for many years.

Deficient nervous action also leads to defective secretion and movement in the intestine, sometimes with flatulent accumula-

Platulence.

In such cases nux vomica or strychnine is useful. Flatulent distension in the stomach or bowels is partly due to air which has been swallowed and partly to gas which has been formed by the decomposition of food. The stomach may become distended with gas on account of acid fermentation leading to the frequent swallowing of saliva, and both this form of flatulence and that caused by the actual formation of gas are much diminished by such drugs as tend to prevent fermentation. Amongst the best of these are carbolic acid in doses of one or two grains, creosote in one or two drops, and sulpho-carbulate of soda in doses of ten grains. Others which may be mentioned are carbonate of bismuth, salol, 8-naphthol and naphthalene. By preventing fermentation in the intestine these also tend to prevent or check diarrhoea, and they may do good after the irritant has been removed by castor oil. After the irritant has been removed and fermentation stopped, the irritation still remaining in the intestinal wall may be soothed by chalk mixture and bismuth, to which if necessary small quantities of opium may be added. In cases where diarrhoea is very obstinate and lasts for weeks, sulphuric acid is sometimes more efficacious than alkalis; and in chronic colic it is the practice sometimes to introduce a few grains of charcoal or a local application of astringent solutions. For this purpose solutions of sulphate of copper or of nitrate of silver may be gently introduced into the bowel in quantities of a quart at a time. It is essential that a large quantity should be used, as otherwise the seat of irritation may not be reached by the astringent. Flatulence and diarrhoea as well as many general disorders are often due to intestinal depression caused by microbes. To these injurious microbes Metchnikoff has given the name of "wild," and he proposes to restore health by giving tame "microbes, such as lactic acid bacilli. This treatment on the principle of "setting a thief to catch a thief" is frequently very useful. The lactic acid bacilli are given either in the form of tablets or milk soured by them, or cheese made from the sour milk. The most efficient form is soured milk, which acts as a food as well as medicine.

Constipation is so common that it may be almost looked upon as the normal condition in civilized countries. Two of its chief causes probably are (1) improvement in cookery, whereby the harder and more irritating parts of the food are softened or removed; and (2) improvement in grinding machinery; whereby the harder and more stimulant parts of the grain are separated from the finer flour which is usually used for bread. In consequence of the absence of mechanical stimulant the bowels act more slowly, and constipation is the result. It may be considerably diminished by a return to a more natural system of feeding, as by using brown bread instead of white, by taking oatmeal porridge, and by eating raw or cooked fruits, such as apples, oranges, prunes and figs, or preserves made of fruit, such as raspberry and strawberry jam, marmalade, &c., by vegetables or by dried and powdered seaweed. Should these means fail, aperients may be used. The commonest are senna in the form of compound liquorice powder, sulphur in the form of lozenges, cascara sagrada, either in tablets or in the form of liquid or dry extract, rhubarb, colocynthis and especially aloes. The last acts chiefly upon the lower bowel, and forms a constituent of nearly every purgative pill. The medicines above mentioned may be taken either in a moderate dose at bedtime or in the form of a dinner pill, or they may be taken in small doses three times a day just before or after meals. Some sufferers from constipation find that they get greater relief from salts dissolved in water, or from natural aperient water taken on rising in the morning; and others again find that the best way of opening the bowels is to inject one or two dracones of glycerine into the rectum, or use it as a suppository. If these means fail, exercise, massage and electricity may help a cure.

The most common diseases of malassimilation (or "metabolic" diseases) are gout, rheumatism and diabetes. In health most of the nitrogenous waste in the body is eliminated as urea, but in gout uric acid is either formed in too great quantity or
Diseases of mal-absorption.

It is generally admitted that the urine of the kidneys, the life of the patient is rendered more or less uncertain and the health frequently seriously impaired. In some cases of chronic inflammation of the kidneys, where the disease is not extensive, the patient may continue in fair health for a number of years, provided attention be paid to the following rules:—(1) The body must be kept warm, and chills must be scrupulously avoided; (2) the diet and provisions must be carefully attended to, so that there shall be no excess of poisonous bodies and meat, or the intestine or absorbed from it; (3) eliminating channels such as the skin and bowel must be kept active. It is usual to reduce the quantity of proteid food to a minimum, in order to lessen the amount of nitrogenous waste to be excreted by the kidneys. Sometimes an entirely milk diet is useful, but in others it does not agree, and a more liberal diet is essential. Alcohol should be avoided as much as possible. The small contracted kidneys, which is common in elderly gouty people, is usually associated with a very large secretion of urine containing only a minute trace of albumin. The tension within the blood-vessels is generally high, and the patients run a risk of anginal attacks or of apoplexy. A nearly vegetarian diet and a complete abstention from alcoholic stimulants is the ideal in such cases, but it must be modified to suit individuals, as sometimes very strict limitations prove injurious. The daily use of potash, and especially nitrates of potash, tends to reduce the tension and increase the patient's safety, but if pushed too far may some- times become very dangerous and fatal.

It has already been mentioned that water is absolutely necessary for the body: by taking it hot it does not lie like a Diets and "cure." before meals it washes out the remnants of the previous meal; and being absorbed into the blood, it probably renders the secretion of gastric juice freer and accelerates digestion, instead of diluting it and interfering with the digestive processes. Where the stomach and bowels are irritable, all food likely to cause mechanical irritation should be avoided, such as skins, bones, fibres and seeds. In some cases of diarrhoea an entirely milk diet has to be prescribed, and in the diarrhoea of children it is sometimes necessary to alternate a diet of barley water with one of beef juice or white of egg and water, or to give whey instead of milk. The drinking of large quantities of whey is used as a means of cure for dyspepsia in adults, and also in cases of chronic bronchitis. The whey is drunk warm, and for this cure it is usual to go to some Alpine resort where pasturage is abundant and fresh milk can be had at all times of the day. The cure is greatly helped by the fresh air and sun. The body being reduced, the salicylate is then supplied as a medicine. The chief remedy for inflammatory stomach and bowels is water, which, being absorbed through the skin, renders the patient cool and comfortable. The cure is often called "Salisbury," and consists of living entire upon minced beef and hot water. Sometimes answers very well in persons troubled with flatulence, since meat does not give rise to the same amount of gas in the intestines as carbohydrates. During its continuance, fat is absorbed from the subcutaneous tissue, since the rapidity of its absorption is much greater than the rate of its deposition. The patient becomes very much thinner, and suffers less from flatulence, but reduces obesity. It is, in fact, very much the same system as that proposed a number of years ago by Banting (see Corpulence). It is very important for those who are trying this diet to bear in mind the necessity of abundance of water, because sometimes they may be tempted to lessen the water on account of the inconvenience produced either by frequent micturition or too profuse sweats. If the meat diet be continued with too small a proportion of water, a gouty condition may be brought on. This diet has been recommended in gout, and no doubt the essential part of it is the hot water, but there can be little doubt that in fat gouty people it is often useful. An entirely opposite dietary is that in which butcher's meat is completely excluded and proteins reduced to a minimum, as advocated by Dr Haig. This dietary also is very useful in gout, but it answers better in thin gouty people than in fat ones.

The diets already mentioned, the whey cure, the grape cure, the meat cure and the vegetarian cure, are all more or less systems of starvation, one or other article of ordinary diet being either reduced to a minimum or omitted altogether. In three of them at least—the whey cure, the grape cure and the meat cure—a diminution in one or other of the solid constituents of food is associated with the ingestion of an unusually large quantity of water. In visiting the most famous watering-places, it is curious to note how one finds, in the various waters, here some chloride, there some sulphate, here some potash, there some magnesium, but in all of them we find water. In watching the troops of patients who go to the wells we notice that most of them do more early rising, take more regular exercise, and drink more water in the course of a month at the commencement of their cure, and no doubt the essential part of it is the water. The watering-places divide themselves, according to the temperature of the waters, into cold and thermal, and according to the composition of the waters, into purgative saline, indifferent saline, sulphur and iron. Amongst the most celebrated saline waters are those of Carlsbad, which contain sulphate of soda and bicarbonate of soda. These salts crystallize out when the water is partially evaporated and may be used with hot water at home, the best imitation of the Carlsbad water being obtained by mixing with hot water the powdered Carlsbad salts (pusver-"formig"), which contain all the constituents of the natural water. Where it is impossible for the patient to visit Carlsbad, half a teaspoonful or a teaspoonful of salt may be taken in a large tumbler of hot water on rising every morning; but when taken at home the treatment is not so effective as at Carlsbad, because

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at the wells sipping water is associated with early rising, considerable exercise and a very carefully regulated diet. It is, indeed, the care with which the diet of patients is regulated and the difficulty that patients find in obtaining forbidden foods at hotels and restaurants, that make Carlsbad better for the liver than any other watering-place. Amongst other places having a similar action are Marienbad, Franzensbad and Tarasp. The waters just mentioned contain free alkali as well as sulphates, and are employed more especially in cases of hepatic disorder, such as congestion of the liver, jaundice, gall-stone and diabetes. A number of other waters containing sulphides and chlorides are powerful purgative, and are more often drunk at home than at the springs. Amongst these are the Hungarian waters, Aesculap, Apenta, Franz Josef and Hunyadi Janos; and the Rubinat and Condal waters of Spain. Waters which have a similar composition are drunk at the springs of Leamington and Cheltenham in England, Bridges Salins and St Gervais in France, for chronic constipation, dyspepsia, gout and hepatic disorders of a milder character than those usually treated at Carlsbad. The waters in which chlorides form the purgative principle are those of Homburg, Kissingen, Wiesbaden and Baden Baden in Germany, and Bridge of Allan in Scotland. Similar waters, but much weaker, are found at Innerleithen and Pitkeithly. Sulphur waters are chiefly used for painful and stiff joints, chronic skin disease, and chronic catarrhal affections. The most important are Aix-les-Bains, and a number of springs in France, such as Vichy, St Gervais, Contrexeville, Royat and Plombieres; also in England, Strathpeffer and Moffat in Scotland. Iron waters are used in anaemia and the affections which are frequently associated with it. The most important are Spa in Belgium, Schwalbach in Germany, St Moritz and Tarasp in Switzerland. Iron waters are, however, common, and are generally found at all those places which have sulphur waters. Simple alkali waters containing carbonates, chiefly of sodium along with some magnesiuim and calcium, are drunk for their utility in gastric and intestinal disorders as well as in rheumatism and gout. They are also employed locally in sprays and douches to the nose, throat, vagina and rectum, for catarrhal conditions of the mucous membranes. The most important are Vichy and Vals in France and Neuenahr in Germany. Alkaline waters containing a little common salt are perhaps even more important than the pure alkaline, as the salt lessens the depressing effect of the alkali. They are therefore used largely in chronic gout, rheumatism and in calculus affections of the kidney. Amongst the most important are Ems and Wildungen in Germany, Contrexéville and Royat in France.

Simple thermal waters are those which contain only a very small quantity of solids, and owe their efficacy chiefly to their temperature. They are used partly for drinking, but even more so for baths. Bath, Buxton and Matlock in England; Mallow in Ireland; Wildbad, Schlangenbad and Badenweiler in Germany; Gastein and Teplitz in Austria; Ragatz in Switzerland; Plombières and Dax in France; and Bormio in Italy are amongst the best known. When water is dashed against the body with more or less violence, its effects are more powerful than when the body is simply immersed in it. Thus the stimulating effect of sea-bathing is more marked than simple bathing for the body. The feeling of exhilaration produced by the skin produced by the salt and by the temperature of the water, we have the quicker removal of heat by the continual renewal of the water as the waves dash over the body, and mechanical stimulus from its weight and impetus. Somewhat similar effects are produced by so-called wave-baths, and at Nauheim, although the fresh movement of the water against the surface of the body is much less than in the sea, yet its stimulating effect is greatly increased by the presence of carbonic acid in it. Douches have a still more powerful action than waves. They are generally given in the air, but at Plombières very simple douches are given under water. These form a more powerful wave-bath, and in combination with intestinal irrigation, are used very successfully for the treatment of abdominal disorders. Douches to the spine are much employed for nervous debility, and good effects are also obtained in such cases from the so-called needle-bath, where small streams of water at high pressure are driven against the whole surface of the body. In the treatment of stiffened joints, massage under water is very serviceable, and in the so-called Aix douche a stream of water continuously streams is fastened to the wrist of the massuer, so that a current of water is constantly playing upon the joint which he is rubbing. While water containing much saline matter, and more especially water containing free carbonic acid, has a very stimulating action upon the skin, mud has a sedative effect, so that in a mud-bath one feels a pleasant soothing sensation as if bathing in cream. These mud-baths are chiefly employed at Marienbad, Franzensbad and Homburg. Sulphur-baths and sulphur waters are chiefly used in combination for rheumatism and gout, and massage, especially under water, is frequently combined most advantageously with baths and drinking water to effect a cure.

Exercises, passive and active, are also used in diseases of the joints, as well as massage and baths, but exercises and training are even more important in cases of cardiac disease.

Exercise.

In very bad cases of heart disease, where the patient is unable to go about, the best plan of treatment usually is to make him stay absolutely quiet in bed and have massage, which aids the circulation, tends to remove waste, and increases the appetite. To this is added gentle exercise, beginning with the fingers at first. At Meran walks have been arranged according to Oertel’s system, and the sea-level. For those who suffer from nervous depression, exercise in the Swiss mountains is useful, and even living at a height of about 6000 ft. above the sea-level seems to have an exhilarating influence. The nature of this is not very easy to analyse, but as mental depression is closely associated with irritation of the vague nerve and weakening of the circulation, it seems not at all unlikely that mountain air acts by accelerating the pulse and quickening the circulation, and thus creating a sense of well-being. Indeed, many patients liken its effect to that of drinking champagne. In some persons rarefied air is too stimulating, so that they find difficulty in sleeping, and for those who suffer from insomnia a warm moist air near the sea-level is preferable.

It sometimes happens, however, that people cannot sleep at the seaside itself, although they do so perfectly well a mile or two inland. Where the nervous system is exhausted, such warm and moist climates as Malaga, Madeira, Tenerife and Grand Canary are suitable. In these places not only is the air moist, but the temperature is particularly equable, and they are therefore suitable places also for persons suffering from kidney disease. Many such persons also do well in dry warm places, such as the higher reaches of the Nile, Egypt, and desert stations in the United States, and the places on the Rivieria. The places mentioned are all suitable for persons suffering from chronic bronchitis, who should avoid any irritation
of the larynx, trachea or bronchi by air which is too dry or which is liable to great changes of temperature. Some cases of phthisis, therefore, do better in warmer and moist climates, and especially those where the larynx has become affected by the disease. Such patients are apt to suffer much from cough and laryngeal irritation in the cold, dry air of the Alps, whereas they live in comparative comfort on the Riviera, Isla de la Madeira, Madeira or at Capri. But warm, moist climates rather favour sedentary habits and tend to lessen appetite, so that the nutrition of the patient is apt to suffer; and although phthisical patients may live in comparative comfort in such climates, their tendency to recovery in them is small. At the Swiss health resorts, on the contrary, during the winter the air is very pure, and has just sufficient coldness to make exercise agreeable to patients. They are thus induced to be out the whole day, and to take food with an appetite which greatly improves their nutrition and aids their restoration to health. The best-known Alpine health resorts are St Moritz and Davos, to which lately Grindelwald has been added. St Moritz is, upon the whole, better for less advanced cases, while Davos is more sheltered and better for cases which are severe. It is a mistake, however, to send those in whom the disease is very far advanced away from home and friends, because when there is no hope of cure it is better for them to die in comfort at home. At the health resorts just mentioned the amount of food taken is regulated by the appetite of the patient himself, but a system of the appetite has been inaugurated by Dr Breher at Götberdorf, by Dr Dettweiler at Falkenstein, and by Dr Walther at Nordrach, in the Black Forest. The most important point in this treatment consists in forced feeding, the want of appetite which is so prominent in many cases of phthisis being regarded as an abnormal sensation not to be regarded; and under the forced feeding, combined with open-air life, many marvellous recoveries are recorded. Numerous other institutions have been started in Great Britain in imitation of Dr Walther's with a considerable amount of success. Even when patients are unable to stay long at a sanatorium they learn there the advantages of open-air and can continue the treatment at home to their great advantage.

In the well-known "rest" cure, which we owe to Weir Mitchell, forced feeding takes a prominent part. The essence of this cure is to give to the patient rest, bodily and mental, by confinement to bed and isolation from the outside world. While this treatment by itself would aid recovery from nervous exhaustion, it would lessen appetite and thus interfere with nervous repair; but the want of exertion is supplied by means of massage, which stimulates the circulation and increases the appetite has been inaugurated by Dr Breher at Götberdorf, by Dr Dettweiler at Falkenstein, and by Dr Walther at Nordrach, in the Black Forest. The most important point in this treatment consists in forced feeding, the want of appetite which is so prominent in many cases of phthisis being regarded as an abnormal sensation not to be regarded; and under the forced feeding, combined with open-air life, many marvellous recoveries are recorded. Numerous other institutions have been started in Great Britain in imitation of Dr Walther's with a considerable amount of success. Even when patients are unable to stay long at a sanatorium they learn there the advantages of open-air and can continue the treatment at home to their great advantage.

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THEREZINA—THERMOCHEMISTRY

though she was far from basing any claim to holiness upon them. The general of the order visited her at Avila, and gave her permission to found other houses of Descalzas, for both men and women. The last fifteen years of her life were spent mainly in hard journeys with this end and in the continually growing labour of organization. Convents were founded at Medina, Malaga, Valladolid, Toledo, Segovia and Salamanca, and two at Alva under the patronage of the famous duke. Then she had three years of rest, as pruissor of her old convent of the Incarnation. She next went to Seville to found a house, thus overstepping for the first time the boundaries of the Castiles, to which her authorization limited her. The latent hostility of the old order was aroused; the general ordered the immediate suppression of the new foundation, and the family of the duke from Gregory XIII. prohibiting the further extension of the reformed houses (1575).

But the movement against her came from Italy, and was repented by Philip and the Spanish authorities as undue interference; and after a fierce struggle, during which Teresa was two years under arrest at Toledo, the Carmelites were divided into two bodies in 1586, and the Descalzos obtained the right to elect all the provincial-general (see CARMELITES). The few remaining years of Teresa's life were spent in the old way, organizing the order she had founded, and travelling about to open new convents for her followers, which were founded by her efforts; she wrote a history of her foundations, which forms a supplement to her autobiography. Her last journey of inspection was cut short at Alva, where she died on the 20th of September 1582. A violet odour and a fragrant oil were said to distil from her tomb; and when it was opened nine months afterwards the flesh was found uncorrupted. A hand cut off by a fervent brother was found to work miracles, and the order became convinced that her founder had been a saint. It was resolved in 1585 to remove her remains to Avila, where she was born, the sisters at Alva being consigned by permission of the king to the care of the Duke of Alva procured an order from the pope enjoining that the body should be restored to Alva, and she was accordingly laid there once more in a splendid tomb. But even then she was not allowed to rest: she was again desecrated, to be laid in a more magnificient coffin, and the greed of reverential relic-seekers made unseemly havoc of her bones.

Teresa was canonized by Gregory XV. in 1622. The honour was doubtless largely due to her asceticism and mystic visions. She called herself Teresa de Jesus, to signify the closeness of her relation to the heavenly Bridegroom, whom she directly and unreservedly loved. Through her devotion to perfection of ascetic severity in others, she scourged herself habitually, and wore a peculiarly painful hair-cloth. But her life shows her to have been, besides, a woman of strong practicality and good sense, full of natural shrewdness, and with unusual powers of organization. “You deceived me in saying she was a woman,” writes one of her confessors; “she is a bearded man.” She was brave in the face of difficulties and dangers, pure in her motives, and her utterances, some of which have been quoted, have the true ethical ring about them. Her MSS. were collected by Philip II. and placed in a rich case in the Escorial; the key of which the king himself charged her with. Besides her autobiography and the history of her foundations, her works (all written in Spanish) contain a great number of letters and various treatises of mystical religions, the chief of which are the Way of Perfection and The Castle of the Soul. Both describe the progress of the soul towards perfect union with God.

Her works, edited by two Dominicans were first published in 1587, and have since appeared in various editions. They were soon afterwards translated into Italian, French (3 vols., Paris, 1840-45) and Latin; an English translation of the Life and works (except the letters) by A. Woodhead appeared in 1669. Other translations of the Life are those by John Dalton (1851), who also translated The Way of Perfection and the Leiters (1902), and by David Lewis (1879), who in 1871 also translated the Foundations. A. R. Waller reprinted Woodhead’s translation of The Way of Perfection in “The Cloister Library” (1901). Biographies appeared soon after her death by the Jesuit Ribera, who had been her confessor (1602), and by Diego de Vépez, confessor to Philip II. (1599).

Details are also given in Ribadeneyra’s Flora Sanctorum and in Alban Butler’s Lives of the Saints. A separate biography, with preface by Cardinal Manning, appeared in 1865; a full and critical edition of the Life is that by Mrs. C. G. Graham, 2 vols. (1894). See also H. Prinz v. Oettingen-Spielberg, Geschichte d. heil. Teresa (Regensburg, 1899); A. Whyte, Santa Teresa, an appreciation, with some of the best passages of the writings (1897); E. Hello, Studies in Sainthood (1903).

THEREZINA, a city of Brazil, capital of the state of Piauhy, on the left bank of the Parahyba river, about 220 m. from its mouth. Pop. (1890) 21,620; for the commune or municipio, 31,523; (1906, estimated), 25,000. It is prettily situated on an open plain and is laid out regularly with broad straight streets. Among its public buildings are the government palace, the legislative and administrative hall, the “Quatro de Setembro” theatre, Misericordia hospital, public market, sanitation and public works, building, courts, police headquarters, barracks, &c. The town is characteristically Portuguese in appearance, its buildings being one or two stories in height, plastered and frequently coloured outside, with large rooms, thick walls, and tile roofs to ensure coolness. There is one lyceum, or high school, with about 400 students, in addition to its primary schools. Its manufacturing industries include a cotton mill, foundry, and soap-works. A steamboat service with three small boats, maintains regular communication with Paranhába, near the mouth of the river, besides which there are a number of independent freight-carrying boats. Therезina was founded in 1582, its site being originally called Chapada de Corisco, and was named in honour of the empress, Doña Thereza Christiana. It was made the capital of Piauhy in succession to Oeiras.

THERMIDOR (from Gr. θερμός, heat, and δόρυ, gift), the name given during the French Revolution to the eleventh month of the year in the Republican Calendar. The month fell in the hottest season of the year, beginning on the 15th or 20th of July and ending on the 15th or 10th of August, according to the year. As in all the other months of the Republican Calendar, each of the days of Thermidor was, in accordance with the suggestion of Fabre d’Églantine, consecrated to some useful object. Thus 1 Thermidor was consecrated to spelt, 10 Thermidor to the watering-pot, 15 Thermidor to sheep, and 27 Thermidor to lentils. The most important event that took place in this month was the revolution of 9 Thermidor year II. (27th of July 1794), which resulted in the fall of Robespierre and the collapse of the Terror. The name Thermidorian (Thermidoriens) was given to the authors of this revolution and to the supporters of the reactionary movement of which it was the signal.

See C. d’Héricault, La Révolution de thermidor (2nd ed., Paris, 1878); E. B. Courtois, Rapport fait au nom de la commission chargée de l’examen des papiers trouvés chez Robespierre et ses complices (1795); D. A. Martin, Papiers inédits ... subparrés ou omis par Courtois (3 vols., 1828); also bibliography in M. Tourneux, Bibliogr. de la ville de Paris ... (1860), vol. I., nos. 4265-4309.

THERMOCHEMISTRY, a branch of Energetics, treating of the thermal phenomena which are associated with chemical change.

That vigorous chemical action is accompanied by a brisk evolution of heat is evident from such familiar examples as the combustion of fuel or the explosion of gunpowder. The heat attendant on these actions, and on the vital processes of the animal organism, naturally first attracted attention. Robert Boyle, A. Crawford, A. L. Lavoisier and P. S. Laplace, P. L. Dulong, H. Davy, Count Rumford, all concerned themselves with thermochemical investigations of such processes. Their quantitative experiments were, however, too rough to permit of accurate generalization; and although Lavoisier and Laplace stated the principle that the same amount of heat must be supplied to decompose a compound as would be produced on its formation, the statement was not based on exact experiment, and only received experimental confirmation much later.

The beginnings of modern thermochemistry, though made independently of the doctrine of the conservation of energy,
are practically contemporaneous with the recognition of that law, and without it the science could scarcely have reached the degree of development which it rapidly attained. Thomas Andrews and, especially, G. H. Hess (1840) were the first who systematically investigated thermochemical effects in solution, and arrived at conclusions from their experimental data which still hold as valid today. Andrews, for example, found that when a series of acids were under similar conditions used to neutralize a given amount of a base, the quantity of heat evolved on the neutralization was the same in all cases. Hess, from his work, arrived at the converse conclusion, that when a series of bases were used to neutralize a given amount of an acid, the heat of neutralization was always the same. Both of these statements are correct when the powerful mineral acid and bases are considered, exceptions only arising when weak acids and bases are employed. Again, Andrews discovered that when one metal displaces another from solution of its salts (e.g., zinc with solutions of copper salts), the thermal effect is practically independent of the nature of the acid radical in the salt employed. Andrews likewise found that when the heat evolved on the displacement from its salts of a metal M' by a metal M is added to the heat of displacement of another metal M'' by M', the sum is equal to the heat which is evolved on the direct displacement of M'' from its salts by M. This affords an example of a principle which had been stated by Hess in a very general form under the name of the Law of Constant Heat Sums—namely, that the thermal effect of a given chemical action is the same, independent of the order in which the stages in which it takes place. Thus, in the above example, it is immaterial whether M displaces M'' from its salt directly, or whether M first displaces M', which is then used to displace M''. This important principle is a direct consequence of the law of the conservation of energy, but was discovered independently by Hess from accurate experiment.

Hess employed this principle to determine indirectly the heat of formation of compounds from their elements, when this magnitude, as is generally the case, was inaccessible to direct measurement. Thus the heat of formation of anhydrous zinc sulphate, ZnSO₄, which cannot be determined directly, may be arrived at by summation (in Hess's units) as follows:

<table>
<thead>
<tr>
<th>Reaction</th>
<th>Hess's Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxidation of Zn to ZnO</td>
<td>5291 units</td>
</tr>
<tr>
<td>S to SO₄</td>
<td>6384</td>
</tr>
<tr>
<td>Dissolution of SO₄ in much water</td>
<td>2566</td>
</tr>
<tr>
<td>&quot; ZnO in the resulting aqueous H₂SO₄</td>
<td>1609</td>
</tr>
<tr>
<td>Deduct heat of dissolution of anhydrous ZnSO₄</td>
<td>15850</td>
</tr>
<tr>
<td>Heat of formation of ZnSO₄ from Zn, S, and q-O</td>
<td>14587</td>
</tr>
</tbody>
</table>

Heats of formation are still determined for the most part in a precisely similar manner.

Hess also stated another principle on empirical grounds, which, although admitting of many exceptions, is of considerable utility and significance. It had been known long before his time that when solutions of neutral salts were mixed, and no precipitate resulted, the mixed solution was also neutral. Hess now observed that in the process of mixing such neutral solutions no thermal effect was produced—that is, neutral salts in aqueous solution could apparently interchange their radicals without evolution or absorption of heat. These experimental results were generalized by him under the title of the Law of Thermoneutrality.

After the investigations of Hess and Andrews, a great deal of excellent experimental work was performed by P. A. Favre and J. T. Silbermann, whose chief theoretical achievement was the recognition that the heat of neutralization of acids and bases was additively composed of two constants, one determined by the acid and the other by the base. This deduction harmonized the observations of Andrews and of Hess previously alluded to, and also accounted satisfactorily for the Law of Thermoneutrality.

Julius Thomsen was the first investigator who deliberately adopted the principle of the conservation of energy as the basis of a thermochemical system. His thermochemical work was begun in 1853, but most of his experiments were performed in the years 1869-82, the whole being published collectively, under the title Thermochemische Untersuchungen, in four volumes. Somewhat later than Thomsen, Marcellin P. E. Berthelot began (in 1873) a long series of thermochemical determinations. It is to these two investigators and their pupils that most of our exact thermochemical data are due.

Thomsen and Berthelot independently enunciated a generalization (commonly known as Berthelot's Third Principle, or Principle of Maximum Work), which may be stated in brief as follows:—Every pure chemical reaction is accompanied by evolution of heat. Whilst this principle is undoubtedly applicable to the great majority of chemical actions under ordinary conditions, it is subject to numerous exceptions, and cannot therefore be taken (as its authors originally intended) as a secure basis for theoretical reasoning on the connexion between thermal effect and chemical affinity. The existence of reactions which are reversible on slight alteration of conditions at once invalidates the principle, for if the action proceeding in one direction evolves heat, it must absorb heat when proceeding in the reverse direction. As the principle was abandoned even by its authors, it is now only of historical importance, although for many years it exerted considerable influence on thermochemical research.

§2. From the standpoint of the law of conservation of energy, the relation between chemical and thermochemical changes may be considered in the following manner. A given amount of any substance under given conditions possesses a perfectly definite amount of intrinsic energy, and, no matter what chemical and physical transformations the substance may undergo, it will, when it returns to its original state, possess the original amount of intrinsic energy. If we consider now the transformation of one system of chemical substances into another system under specified conditions, we shall find that in general the intrinsic energy of the second system is different from the intrinsic energy of the first. Let us assume, as is commonly the case, that the intrinsic energy of the initial system is greater than that of the final system. When the first system then is transformed into the second, the excess of energy which the former possess must appear in the shape of heat, light, electrical energy, &c. It is for the most part a simple matter to obtain the excess of energy entirely in the form of heat, the amount of which is easily susceptible of measurement, and thus the existence of thermochemistry as a practical science is rendered possible. Since the intrinsic energies of the two systems under given conditions are invariably the difference between them is constant, so that the heat evolved when the first system is converted into the second is equal to that absorbed when the second system is re-transformed into the first (cf. Lavoisier and Laplace, ante, § 1). The total thermal effect, too, which is associated with the transformation, must be the same, whether the transformation is conducted directly or indirectly (Hess's Law of Constant Heat Sums), since the thermal effect depends only on the intrinsic energies of the initial and final systems.

Since the intrinsic energy of a substance varies with the conditions under which the substance exists, it is necessary, before proceeding to the practical application of any of the laws mentioned above, accurately to specify the conditions of the initial and final systems, or at least to secure that they shall not vary in the operations considered. It is also a necessary condition for the application of the preceding laws that no form of energy except heat and the intrinsic energy of the substances should be ultimately involved. For example, when metallic zinc is dissolved in dilute sulphuric acid with production of zinc sulphate (in solution) and hydrogen gas, a definite quantity of heat is produced for a given amount of zinc dissolved, provided that the excess of energy in the initial system appears entirely as heat. This provision may not always be fulfilled, since by placing the zinc in electrical contact with a piece of platinum, likewise immersed in the sulphuric acid, we can
generate a current of electricity through the solution and the metallic part of the circuit. The reaction as before is completely expressed by the chemical equation Zn + H₂SO₄ = ZnSO₄ + H₂. The initial and final systems being exactly the same as in the first case; yet the amount of heat generated by the reaction is much smaller, a quantity of the intrinsic energy having been converted into electrical energy. This electrical energy, however, is equivalent to the heat which has disappeared, for it has been shown experimentally that if it is converted into heat and added to the heat already evolved, the total quantity of heat obtained is exactly equal to that produced by the direct dissolution of the zinc in the absence of platinum.

§ 3. The following conditions have to be considered as affecting in a greater or less degree the intrinsic energy of the initial and final systems:

1. Dilution of solutions.
2. Physical state.
3. Change of volume.
4. Allotrophic modifications.
5. Temperature.

1. Generally speaking, there is a considerable thermal effect when substances are used in solution, and this effect varies with the magnitude according to the amount of water employed. It is only, however, when we deal with comparatively concentrated solutions that the heat-effect of diluting the solutions is at all great, the heat change on diluting an already dilute solution being for most practical purposes negligible. In dealing, therefore, with dilute solutions, it is only necessary to state that the solutions are dilute, the exact degree of dilution being comparatively unimportant. It is to be noted that a change in dilution affects the chemical action that occurs. Thus if concentrated instead of dilute sulphuric acid acts upon zinc, the reaction takes place to a greater extent not according to the equation given above, but according to the equation:

\[
Zn + 2H₂SO₄ = ZnSO₄ + SO₂ + 2H₂O
\]

sulphur dioxide and water being produced instead of hydrogen. Here we have a different final system with a different amount of intrinsic energy, so that the thermal effect of the action is altogether different.

2. The physical state of the reacting substances must be considered, since comparatively large amounts of heat are absorbed on fusion and on vaporization. Thus the heat of fusion of ice (for 1 g. = 18 cal.) is 840 cal., and the heat of vaporization of water at 100°, for the same quantity, 9670 cal.

3. The change of effect of volume against external pressure (due to production or consumption of mechanical energy) may be neglected in the case of solids, liquids, or solutions, but must usually be taken into account when gases are dealt with. Each gramme-molecule of a gas which appears under constant pressure during a chemical action (e.g., dilute hydrogen during the action of zinc on dilute sulphuric acid) performs work equivalent to 880 cal. at the ordinary temperature, which must be allowed for in the thermochemical calculation. A similar correction, of opposite sign, must be made with gramme-molecules of gas disappearing during the chemical action.

4. When a substance—e.g., carbon, phosphorus, sulphur—exists in allotropic forms, the particular variety employed should always be stated, as the conversion of one modification into another is frequently attended by a considerable thermal effect. Thus the conversion of yellow into red phosphorus shows about one-sixth of the heat of combustion of the latter in oxygen, and the knowledge of which variety of phosphorus has been employed is of essential importance in the thermochemistry of that element.

5. The influence of temperature on the thermal effect of a chemical reaction is very small, compared with the magnitude of the reaction; but since the initial and final temperatures, which alone determine the variation in the thermal effect, are in almost all cases within the ordinary laboratory range of a few degrees, this influence may in general be neglected without serious error.

§ 4. Methods.—In order to estimate the thermal effect of any chemical process, use is made of the ordinary methods of calorimetry, the particular method being selected according to the nature of the chemical action involved. In almost every case the method of mixture (see CALORIMETRY) is employed, the method of fusion with Bunsen's ice-calorimeter being only used in special and rarely occurring circumstances.

As a very great number of important chemical actions take place on mixing solutions, the method for such cases has been thoroughly discussed. When the solutions employed are dilute, no water is placed in the calorimeter, the temperature-change of the solutions themselves being used to estimate the thermal effect brought about by mixing them. Known quantities of the solutions are taken, and the temperature of each is accurately measured before mixing, the solutions having been allowed as far as possible to adjust themselves to the same temperature. The change of temperature of the solutions after the mixing has taken place is then observed with the usual precautions. It is of course in such a case necessary to know the specific heat of the liquid in the calorimeter. Thomsen by direct experiment found that the heat-capacity of a dilute aqueous solution diverged in general less than 1 per cent. from the heat-capacity of the water contained in it, the divergence being sometimes in one sense, sometimes in the other. He therefore abstained from determining for each case the specific heats of the solutions he employed, and contented himself with the above approximation. Berthelot, on the other hand, assumed that the heat-capacity of an aqueous solution is equal to that of an equal volume of water, and calculated his results on this assumption, which involves much the same uncertainty as that of Thomsen. Since thermochemical measurements of this type may be frequently performed with an error due to other causes of much less than 1 per cent., the error introduced by either of these assumptions is the chief cause of uncertainty in the method.

The calorimeter used for solutions is usually cylindrical, and made of glass or a metal which is not attacked by the reacting substances. The total quantity of liquid employed need not in general exceed half a litre if a sufficiently delicate thermometer is available. The same type of calorimeter is useful in determining the heat of solution of a solid or liquid in water.

Combustion calorimeters are employed for observing the heat generated by the brisk interaction of substances, one of which at least is gaseous. They are of two kinds. In the older type the combustion chamber (of metal or glass) is sunk in the calorimeter proper, tubes being provided for the entrance and exit of the gaseous substances involved in the action. These tubes are generally in the form of worms immersed in the water of the calorimeter. In the newer type (which was first proposed by Andrews for the combustion of gases) the chemical action takes place in a completely closed combustion chamber of sufficient strength to resist the pressure generated by the sudden action, which is often of explosive violence. The steel combustion chamber is of about 250 c.c. capacity, and is wholly immersed in the calorimeter. To withstand the chemical action of the gases, the "calorimetric bomb" is lined either with platinum, as in Berthelot's apparatus, or with porcelain, as in Mahler's. For ordinary combustions compressed oxygen is used, so that the combustible substance burns almost instantaneously, the action being induced by means of some device which is without the calorimeter. The accuracy of heats of combustion determined in the closed calorimeter is in favourable cases about one-half per cent. of the quantity estimated.

§ 5. Units and Notation.—The heat-units employed in thermochemistry have varied from time to time. The following are those which have been in most general use:

- Small calorie or gramme calorie
- Large or kilogramme calorie
- Horsepower or kilogramme calorie
- Calorie
- Kilocalorie
- Joule
- Kilojoule
- Watt
- Horsepower
- Calorie
- Kilocalorie
- Joule
- Kilogramme-molecule

The centipede calorie is the amount of heat required to raise 1 kg. of water from 10° C. to 100° C., and is approximately equal to 100 cal. The large calorie is equal to 1000 cal. In view of the not very great accuracy of thermochemical measurements, the precise definition of the heat-unit employed is not a matter of special importance. It has been proposed to adopt the joule, with the symbol j, as thermochemical unit for small quantities of heat, large amounts being expressed in terms of the kilojoule, Kj = 1000 j. (For the exact relation between these heat-units, see CALORIMETRY.) For ordinary thermochemical work we may adopt the relation 1 cal. = 4.18 j, or 1 Cal. = 4.18 Kj.

Except for technological purposes, thermochemical data are not referred to unit quantity of matter, but to chemical quantities of the grammiequivalents or gramme-molecules of the
reacting substances, or to some multiples of them. The notation which Julius Thomsen employed to express his thermochemical measurements is still extensively used, and is as follows:—The chemical symbols of the reacting substances are written in juxtaposition and separated by commas; the whole is then enclosed in brackets and connected by the sign of equality to the number expressing the thermal effect of the action. The chemical symbols stand for quantities measured in gram atoms, and heat-evolution is reckoned as positive, heat-absorption as negative. Thus

\[ [S, 2O] = 71100 \text{ cal.} \]

indicates that 71100 calories are evolved when 32 grammes of sulphur react with 2\times16 grammes of free oxygen to form sulphur dioxide. It is of course necessary in accurate work to state the conditions of the reaction, and when by the above instance, the sulphur is supposed to be in the solid rhombic modification, the oxygen and sulphur dioxide being in the gaseous state, and the initial and final systems being at the ordinary temperature. Again, the equation

\[ [2N, O] = 18500 \text{ cal.} \]

indicates that it 28 grammes of nitrogen could be made to unite directly with 16 grammes of oxygen to form nitrous oxide, the union would cause the absorption of 18500 calories. When substances in solution are dealt with, Thomsen indicates their state by affixing Aq to their symbols. Thus

\[ \text{NaOH Aq, HNO}_3 \text{ Aq} = 13680 \text{ cal.} \]

represents the heat of neutralization of one gramme-equivalent of caustic soda with nitric acid, each in dilute aqueous solution before being brought into contact. One drawback of Thomsen's notation is that the nature of the final system is not indicated, although this defect in general causes no ambiguity.

The Berthelot notation defines both initial and final systems by giving the chemical equation for the reaction considered, the thermal effect being appended, and the state of the various substances being affixed to their formulae after brackets. W. Ostwald has proposed a modification of Berthelot's method which has many advantages, and is now commonly in use. Like Berthelot, he writes the chemical equation of the reaction, but in addition he considers the chemical formula of each substance to express not only its material composition, but also the (unknown) value of its intrinsic energy. To the right-hand member of the equation he then adds the number expressing the thermal effect of the reaction, heat-evolution being as before counted positive, and heat-absorption negative. The mass-equation then becomes an energy-equation. He thus writes

\[ \text{S} + \text{O}_2 = \text{SO}_2 + 71100 \text{ cal.}, \]

which expresses the fact that the intrinsic energy of the quantities of sulphur and oxygen considered exceeds that of the sulphur dioxide derived from them by 71100 cal. when thermal units are employed. The equation

\[ \text{H}_2 + \text{I}_2 = 2\text{HI} + 12200 \text{ cal.} \]

expresses that under certain conditions the intrinsic energy of hydriodic acid is greater than the intrinsic energy of its component elements by 12200 cal., i.e. that hydriodic acid is formed from its elements by an amount of heat. Energy equations, such as the above, may be operated with precisely as if they were algebraic equations, a property which is of great advantage in calculation. Thus by transposition we may write the last equation as follows:—

\[ 2\text{HI} = \text{H}_2 + \text{I}_2 + 12200 \text{ cal.} \]

and thus express that hydriodic acid when decomposed into its elements evolves 12200 cal. for the quantity indicated by the equation.

Ostwald has made the further proposal that the formulae of solids should be printed in heavy type (or within square brackets), of liquids (solutions, &c.) in ordinary type, and of gases in italics (or within curved brackets), so that the physical state of the substances might be indicated by the equation itself. Thus the equation

\[ \text{Cl}_2 + 2\text{KI}, \text{Aq} = 2\text{KCl}, \text{Aq} + \text{I}_2 + 52400 \text{ cal.}, \]

or

\[ (\text{Cl}_2) + 2\text{KI}, \text{Aq} = 2\text{KCl}, \text{Aq} + [\text{I}_2] + 52400 \text{ cal.}, \]

would express that when gaseous chlorine acts on a solution of potassium iodide, with separation of solid iodine, 52400 calories are evolved.

§ 6. Heat of Formation.—For thermochemical calculations it is of great importance to know the heat of formation of compounds from their elements, even when the combination cannot be brought about directly. As an example of the use of Ostwald's energy-equations for the indirect determination we may take the case of carbon monoxide.

The following equations give the result of direct experiment:—

\[ \text{C} + \text{O}_2 = \text{CO}_2 + 94300 \text{ cal.}, \]

\[ \text{CO} + \text{O} = \text{CO}_2 + 68000 \text{ cal.} \]

If now it is required to find the heat of formation of the compound CO, which cannot be directly ascertained, we have merely to subtract the second equation from the first, each symbol representing constant intrinsic energy, and thus we obtain

\[ \text{C} + \text{O}_2 = 26000 \text{ cal.}, \]

or that is, the heat of formation of a gramme-molecule of carbon monoxide is 26300 cal.

As has already been stated, the heat of formation of a compound is the amount (expressed in thermal units) by which its intrinsic energy exceeds or falls short of that of the elements which enter into its composition. Now of the absolute values of intrinsic energy we know nothing; we can only estimate differences of intrinsic energy of one system is compared with another into which it may be directly or indirectly converted. But since the elements cannot be converted one into the other, we are absolutely without knowledge of the relative values of their intrinsic energy. This being the case, we are at liberty to make the assumption that the intrinsic energy of each element (under specified conditions) is zero, without thereby introducing any risk of self-contradiction in thermochemical calculations. This assumption has the great advantage, that the intrinsic energy of a compound relatively to its elements now appears as the heat of formation of the compound with its sign reversed. Thus if we consider the energy-equation

\[ \text{C} + \text{O}_2 = \text{CO}_2 + 94300 \text{ cal.}, \]

and replace the symbols by the values of the intrinsic energy, viz., zero for carbon and oxygen, and for carbon dioxide, we obtain the equation

\[ 0 + 0 = x + 94300 \text{ cal.} \]

or

\[ x = -94300 \text{ cal.} \]

With knowledge of the heats of formation of the substances involved in any chemical compounds we can from once calculate the thermal effect of the action, by placing for each compound in the energy-equation its heat of formation with the sign reversed, i.e. its heat of decomposition into its elements. Thus if we wish to ascertain the thermal effect of the action

\[ \text{Mg} + \text{CaO} = \text{MgO} + \text{Ca}, \]

we may write, knowing the heats of formation of CaO and MgO to be 131000 and 146000 respectively,

\[ 0 = -131000 + x \]

and therefore

\[ x = 15000 \text{ cal.} \]

Since heats of formation afford such convenient data for calculation on the above method, they have been ascertained for as many compounds as possible.

Substances with positive heats of formation are termed exothermic; those with negative heats of formation are termed endothermic. The latter, which are not very numerous, give out heat on decomposition into their elements, and are more or less unstable. Amongst endothermic compounds none may be more interesting than hydriodic acid, HI, acetylene, C_2H_2, nitrous oxide, N_2O, nitric oxide, NO, azomide, N_2H_4, nitrogen trichloride, NCl. Some of these pass into their elements with explosive violence, owing to the heat generated by their decomposition and the gaseous nature of the products.

§ 7. Heat of Combustion.—The thermochemical magnitude which is universally determined for organic compounds is the heat of combustion, usually by means of the calorimetric bomb. The relation between the heat of combustion of a hydrocarbon and its heat of formation may be readily seen from the following example. The hydrocarbon methane, CH_4, when completely burned to carbon dioxide and water, generates 213800 cal. We may therefore write

\[ \text{CH}_4 + 4\text{O} = \text{CO}_2 + 2\text{H}_2\text{O} + 213800 \text{ cal.} \]

Now we know the heats of formation of carbon dioxide (from diamond) and of liquid water to be 94300 cal. and 683000 cal. respectively. The above equation may consequently be written, if x is the heat of formation of methane,

\[ -x = -94300 + 2(68300) + 213800 \]

or

\[ x = 17000 \text{ cal.} \]

This heat of formation, like that of most hydrocarbons, is comparatively small: the heat of formation of saturated hydrocarbons is always positive, but the heat of formation of unsaturated hydrocarbons is frequently negative. For example, ethylene, C_2H_4, is formed with absorption of 16200 cal., acetylene, C_2H_2, with absorption of 59100 cal., and liquid benzene, C_6H_6, with absorption of 9100 cal. Since the heat of combustion of a hydrocarbon is equal to the heat of combustion of the carbon and hydrogen it contains minus its heat of formation,
those hydrocarbons with positive heat of formation generate less heat on burning than the elements from which they were formed, whilst those with a negative heat of formation generate more. Thus the heat generated by the combustion of acetylene, $C_2H_2$, is 316000 cal., whereas the heat of combustion of the carbon and hydrogen composing it is only 256000 cal., the difference being equal to the negative heat of formation of the acetylene.

For substances consisting of carbon, hydrogen and oxygen, a rule was early devised for the purpose of roughly calculating their heat of combustion (J. J. Welter’s rule). The oxygen contained in the compound was deducted, together with the equivalent amount of hydrogen, and the heat of combustion of the compound was then taken to be equal to the heats of combustion of the elements in it. That the rule is not very accurate may be seen from the following example. Cane-sugar has the formula $C_{12}H_{22}O_{11}$. According to Welter’s rule, we deduct 11 O with the equivalent amount of hydrogen, namely, 22 H, and are left with the residue 12 C, the heat of combustion of which is 1135000 cal. The observed heat of combustion of sugar is, however, 1354000, so that the error of the rule is here 20 per cent. A much better approximation to the heat of combustion of such substances is obtained by deducting the oxygen together with the amount of carbon necessary to form CO, and then ascertaining the amount of heat produced by the residual carbon and hydrogen. In the above case we should deduct with 11 O the equivalent amount of carbon 5.5 C, thus obtaining the residue 6.5 C and 22 H. These when burnt would yield ($6.5 \times 94300$) + ($11 \times 68300$) = 1364250 cal., an amount which is less than 1 per cent. different from the observed heat of combustion of sugar. Neither of the above rules can be applied to carbon compounds containing nitrogen.

§ 8. Heat of Neutralisation.—It has already been stated that the heats of neutralisation of acids and bases in aqueous solution are additively composed of two terms, one being constant for a given base, the other constant for a given acid. In addition to this, the further regularity has been observed that when the powerful monobasic acids are neutralized by the powerful monacid bases, the heat of neutralisation is in all cases the same. The following table gives the heats of neutralisation of the commoner strong monobasic acids with soda:

<table>
<thead>
<tr>
<th>Acid</th>
<th>Heat of Neutralisation (cal.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric</td>
<td>137400</td>
</tr>
<tr>
<td>Hydrobromic</td>
<td>137500</td>
</tr>
<tr>
<td>Hydrobromic</td>
<td>136800</td>
</tr>
<tr>
<td>Nitric</td>
<td>136800</td>
</tr>
<tr>
<td>Chloric</td>
<td>137600</td>
</tr>
<tr>
<td>Bromeic</td>
<td>137800</td>
</tr>
</tbody>
</table>

Within the error of experiment these numbers are identical.

It was at one time thought that the greater the heat of neutralization of an acid with a given base, the greater was the strength of the acid. It is now known, however, that when weak acids or bases are used, the heat of neutralization may be either greater or less than the numerical value for powerful acids and bases, so that there is no proportionality, or even parallelism, between the strengths of acids and their heats of neutralization (see SOLUTIONS).

§ 9. Heat of Solution.—When substances readily combine with water to form hydrates, the heat of solution in water is usually positive; when, on the other hand, they do not readily form hydrates, or when they are already hydrated, the heat of solution is usually negative. The following examples show the effect of hydration on heat of solution in a large quantity of water:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Heat of Solution (cal.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium carbonate</td>
<td>+5600</td>
</tr>
<tr>
<td>Sodium carbonate</td>
<td>+2290</td>
</tr>
<tr>
<td>Sodium carbonate</td>
<td>+280</td>
</tr>
<tr>
<td>Sodium carbonate</td>
<td>+3390</td>
</tr>
<tr>
<td>Sodium carbonate</td>
<td>+1610</td>
</tr>
<tr>
<td>Sodium carbonate</td>
<td>+2180</td>
</tr>
</tbody>
</table>

§ 10. Application of the Second Law of Thermodynamics to Thermochemistry.—What is commonly understood by thermochemistry is based entirely on the first law of thermodynamics, but of recent years great progress has been made in the study of chemical equilibrium by the application of the second law. For an account of work in this direction see CHEMICAL ACTION.


**THERMODYNAMICS** (from Gr. θερμή, hot, δύναμις, force):

1. The name thermodynamics is given to that branch of the general science of Energetics which deals with the relations between thermal and mechanical energy, and the transformations of heat into work, and vice versa. Other transformations of heat are often included under the same title (see ENERGETICS). An historical account of the development of thermodynamics is given in the article HEAT. The object of the present article is to illustrate the practical application of the two general principles—(1) Joule’s law of the equivalence of heat and work, and (2) Carnot’s principle, that the efficiency of a reversible engine is limited by the ratio of the temperature between its working fluids; these principles are commonly known as the first and second laws of thermodynamics. The application will necessarily be confined to simple cases such as are commonly met with in practice, or are required for reference in cognate subjects.

2. Application of the First Law.—The complete transformation of mechanical energy into heat by friction, or some analogous process of degradation, is always possible, and is made the basis of experiments for the determination of the mechanical equivalent of the heat unit (see CALORIMETRY). The converse process, of the transformation of heat into mechanical work or other forms of energy is subject to limitations.

When a quantity of heat, $E$, is supplied to a body, part is expended in raising the temperature of the body, or in expanding the volume against molecular forces, and is represented by an increase in the total quantity of energy contained in the body, which is generally called Its Intrinsic Energy, and will be denoted by the symbol $E$. The remainder is equivalent to the external work, $W$, done by the body in expanding or otherwise, which can be utilized for mechanical purposes, and ceases to exist as heat in the body. The application of the first law leads immediately to the equation,

$$H=E-E_0+W,$$

in which $E_0$ represents the quantity of energy originally present in the body, and all the quantities are supposed, as usual, to be expressed in mechanical units. This equation is generally true for any series of transformations, provided that we regard $H$ and $W$ as representing the algebraic sums of all the quantities of heat supplied to, and of work done by, the body, heat taken from the body or work done on the body being reckoned negative in the summation. $E-E_0$, then, represents the total increase of the intrinsic energy of the body in its final state, which may be determined by measuring $H$ and $W$. If after any series or cycle of transformations the body is restored to its initial state, we must have $E=E_0$ whence it follows that $H=W$. But this simple relation is only true of the net balances of heat and work in a complete cyclical process, which must be adopted for theoretical purposes if we wish to eliminate the unknown changes of intrinsic energy. The method of work in obtaining $H$ and $W$ is usually subject to the limits of temperature in a manner which forms the subject of the second law.

3. Indicator or p.s. Diagram.—The significance of relation (1) is best appreciated by considering the graphic representation of quantities of heat and energy on a work-diagram.

On the familiar indicator diagram the state of the working substance is represented by the position of a point called the state-point, determined by the values of the pressure and temperature or unit mass, as ordinate and abscissa respectively (fig. 1). Any line ("path" or "graph") on the diagram, such as BCD, represents an "operation" or "process" i.e. a continuous series of states through which the substance may move without change of temperature or pressure. Otherwise the transformation could not be fully represented on the diagram, and would not be reversible. The area $B$CDD is

Under the path represents the external work done by the substance in...
expanding from B to D, which is analytically represented by the integral of pdv taken along the given path. Any closed path or figure in the temperature-pressure diagram represents work done on the substance and is equal to the area under the curve in the temperature-pressure plane, which represents work done on the body and is equal to the area under the curve in the temperature-pressure plane. The area ABCD represents a particular cycle, which is one way the energy is used. The area of the cycle, viz., that enclosed by the path BCDA, represents the balance of external work done by the substance in one cycle, and is positive if the cycle is positive. The curve ADEBC represents a heating and cooling process on the temperature-pressure plane, and is arranged in the normal manner as indicated by the arrows. The simplest types of process are those in which the substance is heated or cooled at constant temperature, represented by vertical lines such as AB, called isothermals. The pressure varies, but no external work is done. (2) Heating or cooling at constant pressure, represented by horizontal lines such as NA, called isobars, in which the energy absorbed or released is the product of the pressure p and the expansion or compression. (3) Expansion or compression under the condition of heat-insulation, represented by curves called adiabatics, such as BAZ or CDZ', which are necessarily steeper than the isothermals.

A cycle such as ABCD enclosed by parts of two isothermals, BC, AD, and two adiabatics, AB, CD, is the simplest form of cycle for theoretical purposes, since all the heat is transferred in during the process represented by one isothermal at the temperature T, and all the heat rejected, H', is given out during the process represented by the other at the temperature T'. This is the cycle employed by Carnot for the establishment of his fundamental principle of reversibility as the criterion of perfect efficiency in a heat engine. The area ABCD, representing the work done, represented on the diagram by the whole area BAZcd under the adiabatics through the state-point B, bounded by the isobars AB and CD, is the work done. The change of the intrinsic energy in passing from one state to another is BC cd, and the subtraction of the work-area W = BAZcd. It follows from the first law that the intrinsic energy of a substance in a given state must always be the same, that is, independent of the path followed. The transformation must depend only on the initial and final states, and not on the path or process. It will be observed that the areas representing H and W both depend on the form of the path BC, but the area representing the specific internal energy dE is independent of BC, which is a boundary common to both H and W. This is mathematically expressed by the statement that dE is an exact differential of a function of the co-ordinates defining the state of the body, and since it is more convenient to keep the relation between limits without reference to the representation relating the path along which the variations are taken.

4. Application of Carnot's Principle.—Carnot adopted as the analytical expression of his principle the statement that the efficiency W/H', or the work obtainable per unit of heat by means of a perfect engine taking in heat at a temperature T' and rejecting heat at a temperature T, must be some function F(T') of the temperature T', the lower limit T being supposed constant. He was unable to apply the principle directly in this form, as it would require an exact knowledge of the properties of substances through a wide range of temperatures. The principle in this form is really applicable to all cases, and is independent of any view with regard to the nature of the heat. It simply asserts that the efficiency function F(T') is the same as the efficiency function F(T) of Carnot's cycle, and that the efficiency of any other cycle is less, since its asymptotes coincide with those of the ideal Carnot cycle. The formula for this efficiency function is expressed by the equation

\[ dW = H' dT / dF(T') \]

where F(T) is the derived function of F(T), or dF(T)/dT, and represents the work obtainable per unit of heat per degree fall of temperature in a cycle. The principle in this form is really applicable to all cases, and is independent of any view with regard to the nature of the heat. It simply asserts that the efficiency function F(T') is the same as the efficiency function F(T) of Carnot's cycle, and that the efficiency of any other cycle is less, since its asymptotes coincide with those of the ideal Carnot cycle. Carnot verified this by calculating the values of F(T) at various temperatures from the known properties of vapours and gases, and showed that the efficiency function F(T) is the same in all cases as measured by the heating of an alcohol thermometer, or of a mercury or gas thermometer, from about 1.40 kilogrammetres per kilo-calorie per degree C. at 0° C. to about 1.14 at 100° C., according to the imperfect data available in his time. Applying the above equation to a gas obeying the law p = RT, for which the work done in isothermal expansion from a volume V to a volume v is

\[ W = RT \log v / R \log v \]

whence \( dW = R \log v \, dF(T') \), he deduced the expression for the heat absorbed by a gas in isothermal expansion

\[ H = R \log v / F(T') \]

He also showed that the difference of the specific heats at constant pressure and constant volume, or the ratio of these specific heats, is represented by the expression \( F(T') / F(T) \), and that the specific heats of all gases at the same temperature and pressure, being represented by the expression \( F(T') / F(T) \), he remarks that the law according to which the motive power of heat varies at different points of the thermometer was shown to be the same for all gases, and that the temperature of the various specific heats of gases at different temperatures—a law which experiment has not yet made known to us—will be given by the relation \( F(T') / F(T) \). Mayer (1842) made this assumption in calculating the mechanical equivalent of heat. Joule (1845) was the first to prove it approximately by direct experiment, but did not see his way to verify it, as regards its bearing on the fundamental theory. Holtzmann (1845) by the same assumption deduced the value \( W^2 / F(T') \) for the function F(T), but obtained erroneous results by combining this assumption with the caloric theory. Clausius (1850) applied the same assumption, and deduced the value of F(T), that the law ascribed to the mechanical theory and Joule's experiments, but required that a vapour like steam should deviate more considerably from the gaseous laws than was at that time generally admitted. The values of F(T) calculated previously by Sir W. Thomson (Lord Kelvin) from Regnault's tables of the properties of steam, assuming the gaseous form of water, were not consistent with the fundamental assumption W = RT in isothermal expansion, which is very nearly true for permanent gases, and that F(T) must therefore vary very slowly with the temperature. He deduced the scale of temperature independent of the properties of any particular substance in terms of Carnot's function by making F(T) constant. He now proposed to define absolute temperature as proportional to the reciprocal of Carnot's function, so as to agree as closely as possible with the scale of the gas thermometer. With this definition of temperature T, if the heat H is measured in work units, the expression of Carnot's principle for an infinitesimal cycle of range dT reduces to the result H = dF(T)/dT. Combining this with the first law, for a Carnot cycle of finite range, if \( T' \) is the heat taken in at \( \theta' \), and \( T' \) is the heat rejected at \( \theta' \), the work done in the cycle is equal to the difference \( T' - T \), and we have the simple relations

\[ W(\theta' - \theta) = H' \theta' - H' \theta \]  

5. Thermodynamical Relations.—The most important and most useful of the relations between the thermodynamical properties of a substance may be very simply deduced from a consideration of the indicator diagram by a geometrical method, which is in principle the same as that employed by Regnault. Referring to fig. 2, let BC be a small portion of any isothermal corresponding to the temperature \( \theta' \), and AD the isothermal of the same temperature, and cut off the area ABCD by meeting at E, and EC an isocpetic through E meeting BC in C. Let BA, CD be adiabatics through B and C meeting the isothermal \( \theta' \) in A and D. Then by relations (2) the heat, \( H' \), work done in the isothermal change BC, is to the work, \( W' = H' \theta' - H' \theta \), done in the cycle ABCD in the ratio of \( \theta' \) to \( \theta' - \theta \). If the difference
of temperature \(\theta - \theta^0\) is small, the figure ABCD may be regarded as a parallelogram, and its area \(W\) as equal to the rectangle \(BE \times EC\). This is accurately true in the limit when \(\theta - \theta^0\) is infinitesimal, but in practice it is necessary to measure specific heats, &c., over finite ranges of temperature, and the error involved is generally negligible if the range does not exceed a few degrees. \(BE\) is the increase of \(\phi\) produced by the rise of temperature \(\theta - \theta^0\) if the volume is kept constant. \(EC\) is the expansion \((v^0 - v')\) produced by the same rise of temperature if the pressure is kept constant. Subtracting these symbols in the expression for the area, the relation becomes

\[
H = \theta^0(v^0 - v') + \frac{\partial V}{\partial \theta}(v^0 - v').
\]

This relation may be interpreted in two ways, according as we require the heat absorbed in terms of the change of pressure or volume. The heat \(H\) absorbed at constant pressure (latent heat of expansion) from \(p'\) to \(p^0\) is equal to the diminution of pressure \((p^0 - p')\) multiplied by the absolute temperature and by the increase of temperature \((\theta - \theta^0)\), and by the increase of volume \((v^0 - v')\). The heat \(H\) absorbed at constant volume, and by the increase of pressure per degree \((p^0 - p')(\theta - \theta^0)\), at constant volume. In the notation of the calculus the relations become

\[
dH/dp (\theta \text{ const}) = \partial V/\partial \theta (v \text{ const})
\]

The negative sign is prefixed to \(dH/dp\) because absorption of heat \(+dH\) corresponds to diminution of pressure \(-dp\). The utility of these relations results from the circumstance that the specific heat and expansion coefficients are familiar and easily measured, whereas the latent heat of expansion is difficult to determine.

The most instructive example of the application of these relations (1) and (2) is afforded by the change of state of a substance at constant temperature or pressure. Starting with unit mass of the substance in the first state (e.g. liquid), Possessed of a known volume \(v^0\) at the temperature \(\theta^0\), the heat absorbed in this change is called the latent heat of change of state, and may be represented by the symbol \(L'\). The substance is then cooled to the lower temperature \(\theta'\) along the path CD, keeping it in the saturated state. The heat \(H\) absorbed in this change may be represented by \(s'(\theta')\), where \(s'\) is the specific heat of the substance in the second state at saturation pressure. Finally, the substance is reconverted into the first state at the temperature \(\theta^0\), completing the cycle by the abstraction of a quantity of heat \(L^0\). By the application of the first law, the difference of the quantities of heat absorbed and evolved in this cycle must be equal to the work performed by the area of the cycle, which is equal to \((p^0 - p')(\theta^0 - \theta^0)\) in the limit when the difference of pressure is small. By the application of the second law, relations (2), the same work area is equal to \((\theta - \theta^0)\times L'\). Dividing by \((\theta - \theta^0)\) and writing \(dp/d\theta\) and \(dL/d\theta\) for the derivatives of the relations \((p^0 - p')(\theta^0 - \theta^0)\) and \((L - L^0)(\theta^0 - \theta^0)\), we obtain the identities

\[
is' - s + \frac{dL}{d\theta} = (v^0 - v') dp/d\theta = sL/\theta,
n\]

in which \(dp/d\theta\) is the rate of change of pressure with temperature when the two states are in equilibrium. It is not necessary in this example that \(AB\), \(CD\) should be adiabatic, because the area of volume \(BC\) is finite. The same equations apply to the case of fusion of a solid, if \(L\) is the latest heat of fusion, and \(v', s', v''\) the specific volumes and specific heats of the solid and liquid respectively.

6. Ratio and Difference of Specific Heats.—If we take unit mass of the substance at B, fig. 2, and cool it at constant volume to E, through an interval of temperature \(\theta\), the specific heat \(s\) at constant volume may be written \(h = s(\theta^0 - \theta^0)\), where \(s\) is the specific heat at constant volume. If, starting from E, the same amount of heat \(h\) is restored at constant pressure, we should arrive at the point F on the adiabatic through B, since the substance has been transformed from B to F by a reversible path without loss or gain of heat on the whole. In order to restore the substance to its original temperature \(\theta'\) at constant pressure, it would be necessary to supply a further quantity of heat \(H\), represented by the area between the two adiabatics from FC down to the absolute zero. This quantity of heat \(H\) is the difference between the total heat found in equation (3), but for the small area BFC, or for the small change of state considered in this limit compared with \(H\). The whole quantity of heat required to raise the temperature from \(\theta^0\) to \(\theta'\) at constant pressure along the path EC is \(H + h\), which is equal to \(s(\theta - \theta^0)\), where \(s\) is the specific heat at constant pressure. Since \(h = s(\theta - \theta^0)\), the difference \(\theta - \theta^0\) of constant pressure heats at constant pressure and volume is evidently \(H(\theta - \theta^0)\). Substituting for \(H\) its value from (3), and employing the notation of the calculus, the relation

\[
S = s \text{ or } S = \theta dp/d\theta (v \text{ const})
\]

in which the partial differential coefficients have the same meaning as in (4).

Since the amounts of heat supplied at constant pressure from E to F and from F to C are in the limit proportional to the expansional heats \(s\), these are proportional to the ratio \(EC/EF\). \(EF\) is the change of volume corresponding to a change of pressure \(BE\) when no heat is allowed to escape and the path is the adiabatic \(BC\). \(EC\) is the change of volume for the same change of pressure \(BE\) when the path is the isothermal \(BC\). These changes of volume are directly as the compressibilities, or inversely as the elasticities. If we write \(K\) for the adiabatic elasticity, and \(k\) for the isothermal elasticity, we obtain

\[
S = EC/EF = K/k
\]

The value of the specific heat \(S\) at constant pressure can always be determined by experiments and in practice is one of the most important thermodynamical properties of a substance. The value of the specific heat \(s\) at constant volume can also be measured in a few cases, but it is generally necessary to deduce it from that at constant pressure by means of equation (6). It is often impossible to observe the pressure-coefficient \(dp/d\theta\) directly, but it may be deduced from the isothermal compressibility by means of the geometrically obvious relation, \(BE = (BE/EC)\times EC\). The ratio \(BE/EC\) is independent of the path, and is equal to the reciprocal of the elasticities of the substance. If \(dp/d\theta\) is known, \(S\) may be calculated by equation (4). If \(dp/d\theta\) is not known, \(S\) may be found by substituting in equation (6) the relation \(dp/d\theta = \partial V/\partial \theta\) for the derivative of the expression for the volume. The change of specific heat \(S\) at constant pressure is the change at constant temperature \(dp/d\theta\), or \(dp/d\theta\) at constant temperature, or \(-dp/d\theta\), is readily observed.

The amount of heat absorbed in any small change of state, as from \(E\) to \(G\) in fig. 2, may be found by adding the heat required for the change of temperature at constant volume, \(s\), or at constant pressure, \(s\), the heat absorbed in isothermal expansion as given by relations (4). We thus obtain the expression

\[
H = s + s' + s'' + \left(\frac{dp}{d\theta}\right)\left(\frac{dv}{d\theta}\right)
\]

The first is equivalent to the area \(BFC\), while the second is the area \(BEC\). The two differ by the area \(BEC\), which can be neglected if the change is small. For a finite change it is necessary to represent the path by a series of small steps, and the change of specific heat, which may be calculated by the addition of integration along the path represented by the given relation between \(s\) and \(\theta\) or \(p\) and \(\theta\). If we put \(dH = 0\) in equations (8), we obtain the relations between \(dv\) and \(dp\), or \(dp\) and \(\theta\), under the condition of no heat-supply, i.e. along the adiabatic, which can be integrated, and the heat absorbed in isothermal or isopiestic, and to integrate along each separately. The change of energy at constant volume is small, while the change at constant temperature is \(dp/d\theta\), which may be written

\[
dE/d\theta (v \text{ const}) = s, dE/dv (p \text{ const}) = dp/d\theta.
\]

These must be expressed as functions of \(v\) and \(p\), which is theoretically possible if the values of \(s\), \(p\), and \(dp/d\theta\) are known. Since the expression \(dp/d\theta\) is the partial differential-coefficient of a single function \(E\) of the independent variables \(v\) and \(p\), we shall obtain the same result, namely \(dE/dPdv\), if we differentiate the first with respect to \(v\) and the second with respect to \(\theta\). We thus obtain the relation

\[
\frac{dE}{dv} (p \text{ const}) = \frac{dp}{d\theta} (p \text{ const}).
\]
Deviations measure (8), we the gas. ideally may which (p by is a The issues (16) diminution. the density function where from. energy the we (14) must 8. form pv p. (n) into dv, we (11) change that constant is defined. exponential density function of the is the state defined. both integrating the specific heat cV. In the case the expression achieved. Since dE = dH - p dv, we have evidently for the variation of the total heat from the second expression (12).

\[ \frac{dE}{dp} = \frac{dH}{dp} - p \frac{dv}{dp} \]

This expression shows that the rate of variation of the total heat with temperature at constant pressure is equal to the specific heat at constant pressure. To find the total heat of a substance in any given state defined by the values of p and \( \theta \), starting from any constant pressure and heat content, we must find the total heat required to raise the substance to the final temperature under a constant pressure equal to \( \theta \). For instance, in the boiler of a steam engine the feed water is pumped into the boiler against the final pressure of the steam, and is heated under this constant pressure up to the temperature of the steam. The total heat with which we are actually concerned in the working of a steam engine is as follows. The state equation takes the simple form (8) \( \frac{(p \theta - s)\theta}{p} \) constant, which is obtained by Regnault, which, however, differs from (E+pV) only by a quantity which is inapplicable in ordinary practice. We are assuming that \( F \) is a function of the co-ordinates expressing the state of the system. We obtain the equation of the lines in terms of \( \varphi \) and \( \theta \) is obtained by integrating:

\[ dE = sdp + (\theta dp - \varphi dv) \]  

If, on the other hand, the heat supplied is equal to \( \theta dp \), we see from (11) that \( F \) remains constant. The equation to the lines of constant total heat is found in terms of \( \theta \) and \( \varphi \) by putting \( dp = 0 \) and \( dv = 0 \) (13).

8. Ideal Gases.—An ideal gas is a substance possessing very simple thermodynamic properties to which actual gases and vapours appear to approximate indefinitely at low pressures and high temperatures. It has the characteristic equation \( \rho = \frac{R}{\theta} \), and obeys Boyle's law at all temperatures. The coefficient of expansion at constant pressure is equal to the coefficient of increase of pressure at constant volume. The difference of the specific heats by equation (6) is constant and equal to \( R \). The isothermal elasticity \( -\frac{d\rho}{d\rho} \) is equal to the pressure \( \rho \). The adiabatic elasticity is equal to \( \gamma \rho \), where \( \gamma \) is the ratio \( s/R \) of the specific heats. The heat absorbed in raising the temperature of the specific heat \( \theta \) by \( \varphi \) may be written \( E - \frac{E_0}{\theta} = \frac{E_0}{\theta} \), \( F = \frac{F_0}{\theta} \). In this case the ratio of the specific heats is constant as well as the difference, and the adiabatic elasticity is a constant specific heat, which is at once obtained by integrating the equation for the adiabatic elasticity, \( -\frac{d\rho}{d\rho} = c^2 \).

The specific heats may be any function of the temperature contained in a series for each value of the temperature and that their difference is constant. If we assume that \( s \) is a linear function of \( \theta \), \( s = s_0 + a \theta \), the adiabatic equation takes the form:

\[ \sum \log(\theta / \theta_0) + s_0 \log(\theta / \theta_0) + R \log(\theta / \theta_0) = 0 \]

where \( \theta_0 \), \( \theta_0, \theta_0, \theta_0 \) are any two points on the adiabatic. The corresponding expression for the change of energy or total heat is obtained by adding the term \( s_0 \log(\theta / \theta_0) \) to those already given, thus:

\[ E = E_0 - \sum \log(\theta / \theta_0) + s_0 \log(\theta / \theta_0) + \frac{R}{\theta} \log(\theta / \theta_0) \]

where \( s_0 = s_0 + R \).  

9. Deviations of Actual Gases from the Ideal State.—Since no gas is ideally perfect, it is most important for practical purposes to discuss the deviations of actual gases from the ideal state, and to consider how their properties may be thermodynamically explained and defined. The most natural method of procedure is to observe
devised by Clausius (Phil. Mag., 1880) to represent the behaviour of CO₂ up to the critical point. Experiments by Natanson on CO₂ by similar methods, carried out in 1903, showed a slight increase of the ratio \( \frac{d\theta}{dp} \) at higher pressures, which is otherwise rendered probable by the form of the isothermals as determined by Andrews and Amagat. More recent experiments by J. H. Guinness and J. A. Groddeck (Proc. Roy. Soc., 1900) on steam confirm this type of equation, but give much larger values of the cooling effect than for CO₂, and a more rapid rate of variation with temperature.

The assumption usually made is that the total kinetic energy of the molecules, including possible energy of rotation or vibration if the molecules consist of more than one atom, is proportional to the energy of translation in the case of an ideal gas. In the case of imperfect gases, all the available experimental evidence shows that the specific volume tends towards its ideal value, \( V = \frac{R}{p} \), in the limit, when the pressure is indefinitely reduced, and the molecules are widely separated so as to eliminate the effects of their mutual actions. We may therefore reasonably assume that the limiting values of the specific heats at zero pressure do not vary with the temperature, provided that the molecules are not stable, and there is no dissociation. Denoting by \( s_0 \) these constant limiting values at \( p = 0 \), we may obtain the values at any pressure by integrating the expression (20) and (21) from 0 to \( p \) respectively. We thus obtain

\[
E = E_0 + s_0 \theta - p s_0 \frac{\rho}{\rho_0}.
\]

We have similarly for the total heat \( F = E + p s \),

\[
F = F_0 = s_0 \theta - (s_1 + p e_{c_1} - c_2 p) + p e_{c_1}.
\]

The energy is less than that of an ideal gas by the term \( n p c \). If we imagine that the defect of volume \( c \) is due to the formation of molecular aggregates consisting of two or more single molecules, and if the kinetic energy of translation of any one of these aggregates is equal to that of one of the single molecules, it is clear that some energy must be lost in co-aggregating, but that the proportion lost will be different for different types of molecules and also for different parallel lines. If we consider the effect of having energy of translation only, equivalent to 3 degrees of freedom, combined to form a datomic molecule with 5 degrees of freedom, the co- and cross-aggregates will be much more complicated, and the number of degrees of freedom of the aggregates were limited to 6, or were the same as for single molecules, we should have \( n s_0 R \). The loss of energy could not be greater than this on the simple kinetic theory, unless there were some evolution of latent heat of co-aggregation, due to the work done by the mutual attractions of the co-aggregating molecules.
The expression for the change of entropy between any two states is given by one of the equations of the form of the differential

dS = \frac{dW}{T}

interacting between two states, \(\delta S = dS\), is a function of the

In the case of a solid or a liquid, the latent heat of

isothermal expansion may often be neglected, and if the specific heat has a constant value, we have simply

\(\delta S = \frac{dW}{T}\). If the substance at the temperature \(\theta\) is a change

absorbing latent heat, \(L\), we have merely to add the term \(L/\theta\) to the

above expression. In the case of an ideal gas, \(dp/d\theta\) at constant

volume is \(-R\theta\), or

\(\delta S = -R\theta dp\); thus we obtain the expression for the change of

entropy \(\delta S\) from the state \(\theta_0, p_0\) to the state \(\theta, p\),

\[\delta S = S(\theta, p) - S(\theta_0, p_0) = \int_{\theta_0}^{\theta} \frac{dW}{T}.
\]

In the case of an imperfect gas or a vapour, the above expressions

are frequently employed. \(\delta S\) may be obtained by employing

expression (17) with the value of the specific heat \(S\), from (29), which gives the expression

\[\delta S = \frac{1}{\rho} \frac{dH}{T},\]

the state of a substance may be defined by means of the temperature

and entropy as co-ordinates, instead of employing the pressure

and volume as in the indicator diagram. This method of represen-
tation is applicable to certain kinds of problems, and has been

developed by Macfarlane Gray and other writers in its application to

the gas engine. (See STEAM ENGINE.) Areas on the tempera-
ture-entropy diagram represent processes of the same kind in

the same way as areas on the indicator diagram represent quantities of

work. The \(\theta, S\) diagram is useful in the study of heat waste and

the transfer cannot be reversed without an expenditure of work.

If mechanical work or kinetic energy is directly converted into

heat by friction, reversal of the motion does not restore the energy

so converted. In all such cases there is necessarily, by Carnot's

principle, a loss of efficiency or available energy, accompanied by

an increase of entropy. In cases where it is convenient to

measure the quantity of parts of the gas. If this could be co-ordinated and utilized

without dissipation, the gas might conceivably be restored to its

initial state; but in practice violent local differences of pressure and

temperature are always present, and the energy is converted into heat by viscous eddy friction, and residual differences of

temperature are equalized by diffusion throughout the mass. Even if the expansion is adiabatic, in the sense that it takes place

inside a non-conducting enclosure and no heat is supplied from

external sources, it will not be isentropic, since the heat supplied

by internal friction must be included in reckoning the change

of entropy. Assuming that no heat is supplied from external sources

and no external work is done, the intrinsic energy remains constant

by the first law. The final state of the substance, when equilibrium has

been reached, may be deduced from this condition, if the energy can be expressed in terms of its components. An other

line of constant energy on the diagram does not represent the path of

the transformation, unless it be supposed to be effected in a

series of infinitesimal steps. This condition may be expressed by

\(dE = dW\). An irreversible process permits a more complete experimental investigation is the steady flow of a fluid in a tube already referred to in section to. If the tube is a long fine tube, the flow of fluid is reversible, and the state of the fluid is the same at points where the section of the tube is the same. In practice, however, a small amount of frictional dissipation is accompanied by an increase of entropy and by a fall of pressure. In the limiting case of a long fine tube, the bore of which varies in such a manner that \(U\) is constant, the state of the substance along a line of flow may be represented by the line of constant

total heat, \(d(E+p_v) = 0\); but in the case of a porous plug or small

throttling aperture, the steps of the process cannot be followed, though the final state is the same.

It will be seen later in which the substance absorbs

heat, \(dH\), from external sources, the increase of entropy of the final state is equal to \(dH/\theta\). If the change is not reversible, but the final

state is the same, the change of entropy, \(\delta S\), is the same; but it is

not longer equal to \(dH/\theta\). In all irreversible processes, \(\delta S/\theta\) must be at least as much as it would be

in the case of a reversible cycle. It is found that a cycle more efficient than a

reversible cycle, although it is not always possible to devise a cycle more efficient than a

reversible cycle, is always more difficult. The change of entropy is zero in a

reversible process, but in an irreversible process it is positive, even if the process is not

reversible. The entropy cannot diminish indefinitely, because the increase of entropy is impossible. The entropy tends to a maximum, and the state is one of stable equilibrium when the value of the entropy is the maximum value consistent with the conditions of the problem.

15. Heterogeneous Equilibrium.—In a system, as distinguished from a homogeneous substance, consisting of two or more states or phases, a similar condition of equilibrium applies. In spontaneous irreversible change, if the system is heat-isolated, there must be an increase of entropy. The total entropy of the system is equal to the entropy per unit mass of the substance in each state by the mere fact of adding the products so obtained. The simplest case to consider is that of equilibrium between solid and liquid, or liquid and vapour. This case is treated in general in the works of Boltzmann, and in the original memoirs of Willard Gibbs and others. Since the condition of heat-isolation is impracticable, the condition of maxi-
mum entropy is not, as a rule, directly applicable, and it is neces-
sary to find a more convenient criterion which may be used, even in the external work done, \(dH\) the heat absorbed from external sources, and \(dE\) the increase of intrinsic energy, we have in all cases by the first law of thermodynamics, \(dE = dH + dW\), and hence, by the second law (\(\delta S > 0\), cannot be less than \(dH\), consequently

the difference \(dE-\delta S\) cannot be less than \(dW\). This inequality

holds in all cases, but cannot in general be applied to an irrever-
sible change, because \(\delta S\) is not a perfect differential, and cannot be considered as the work done in the transformation. In the special case, however, in which the transforma-
tion is conducted in an isothermal enclosure, a common condition

considered, by an area on the indicator diagram similar to that repre-
sentating the intrinsic energy, \(E\). The product \(\delta\theta\) may be represented by an area such as \(\theta D\), and the change in the

isothermal \(\delta D\) and the adiabatic \(D'\), bounded by the axes of

pressure and volume. The intrinsic energy, \(E\), is similarly repre-
sented by the area \(D'\) or the area \(D'\) adiabatic to the right of the

isothermal \(\delta D\). The difference \(E - \theta D = \delta \theta D\) to the left of the isomorphic \(\delta D\) under the isothermal \(\theta D\). The increment of this area (or the decrement of the negative area

\(E-\theta D\) at constant temperature represents the external work

obtained from the substance in isothermal expansion, in the same way

that the decrement of the intrinsic energy represents the work done in adiabatic expansion. The function \(J = 1 - \theta D\), has been called the 'free energy' of the substance by Helmholtz, and \(\theta D\) the 'bound energy'. These functions do not, however, represent energy existing in the substance, like the intrinsic energy; but, on the contrary, \(\theta D\) represents heat supplied to, and the decre-
moment of \((E-\theta D)\) represents heat obtainable from, the substance

when the temperature is kept constant. The condition of stable
equilibrium of a system at constant temperature and volume is

represented by the line \(J = 1\). The condition of stable

equilibrium to the case of the state of a mixture. If \(J, J'\) represent the values of the function for unit mass of the substance of specific volumes \(v\) and \(v'\) in the two states at temperature \(\theta\) and pressure \(p\), and if a mass \(m\) is in

the two states \(1-m\) and \(m\) respectively, the volume of the mixture is \(m^p + (1-m)J\). This must be a minimum in the state of equilibrium at constant temperature. Since the volume is constant, we have the condition \(m^p + (1-m)J = 0\). The relations

\[dJ/dv = p - dJ/dv',\]

at constant temperature. Putting \(dJ/dm = 0\) at constant volume, we obtain as the condition of equilibrium of the two states J = \(v' + v = J' + J'\). This may be interpreted as
the equation of the border line giving the relation between \( p \) and \( \sigma \), but is more easily obtained by considering the equilibrium at constant temperature in the case of the constant volume.

(b) The second case, which is of greater practical utility, is that in which the external pressure, \( p \), is kept constant. In this case \( dW = pdv + \sigma d\sigma \), so that, if an external work is done, is known from the initial and final states. In any possible transformation \( d(\theta E - T) \) cannot be less than \( d(p \sigma) \), or the function \( (E-\theta \sigma + p) \) cannot increase. The condition of stable equilibrium, for a number of these cases, which has been called the "thermodynamic potential at constant pressure."

The product \( p\sigma \) for any state such as \( D \) in fig. 1 is represented by the rectangle \( MDEO \), bounded by the isoplastic and the isometric through \( D \). The function \( G \) is represented by the negative of \( \theta DM \) under the isothermal, bounded by the isoplastic DM and the axis of pressure. The increment of \( 2p \) is always greater than that of \( E+\theta \sigma + p \), and this is the reason why it cannot be found without that of \( \phi \), and although the consideration of the properties of the thermodynamic potential cannot in any case lead to results which are not directly deducible from the two fundamental laws, it affords a much more convenient method in abstract thermodynamics for the condition of equilibrium between different phases, or the criterion of the possibility of a transformation. For such purposes, the possibility of a number of numerical evaluation of the functions is of secondary importance, and it is often possible to make qualitative deductions with regard to the general nature of a transformation without any knowledge of the actual form of the function. A more common method of procedure, however, is to infer the general relations of the thermodynamic potential from a consideration of the phenomena of equilibrium.

As it would be impossible within the limits of this article to illustrate or explain adequately the applications which have been made of the principles of thermodynamics, it has been necessary to select such illustrations only as are required for other reasons, or for the purpose of filling the blank spaces between the more important facts of the subject in a way that will be clear to the general reader. The treatment of the second law of thermodynamics, whether from the point of view of the number of possible states, or from the practical point of view, is a matter of great importance, and a discussion of it will be found in the next article. In the present article, the relations between the various thermodynamic processes are considered, and the treatment of the second law of thermodynamics is not included.

### Alphabetic Index of Symbols Employed.

\( \theta \), Thermodynamic or absolute temperature.

\( \phi \), Entropy. Section 13.

\( \sigma \), Volume of molecules of gas. Equation (17).

\( \theta \), Co-aggregation volume per unit mass. Equation (17).

\( \theta \), Base of Naperian logarithms.

\( \theta \), Intrinsic energy per unit mass. Section 2.

\( F \), \( E \), \( p \), T, Total heat. Section 7.

\( G \), \( J \), Thermodynamic potential functions. Section 15.

\( H \), Quantity of heat (in mechanical units). Section 2.

\( k \), \( \beta \), Adiabatic and isothermal elasticities. Equation (7).

\( \theta \), Latent heat of fusion or crystallization. Equation (5).

\( M \), Molecular weight. Section 8.

\( m \), Mass of substance or molecule.

\( \phi \), 

### THERMOELECTRICITY.

1. **Fundamental Phenomena.**

Alessandro Volta (1801) showed that although a separation of the two electricity was produced by the contact of two different metals (Volta Effect), which could be detected by a sensitive electrometer, a continuous current of corresponding magnitude could not be produced in a purely metallic circuit without the interposition of a liquid, because the electromotive force at one junction was exactly balanced by an equal and opposite force at the other. T. J. Seebeck (1822), employing a galvanometer then recently invented, which was more suited for the detection of small electromotive forces, found that a current was produced if the junctions of the two metals were at different temperatures. He explained this effect by supposing that the Volta contact electromotive force varied with the temperature, so that the exact balance was destroyed by unequal heating. The intensity

\[
R \log p = A - B \theta - \left( C - S_0 \right) \theta^2 + \left( D + \theta \right) \theta^3 + \ldots
\]

where \( A, B, C, D, \ldots \) are constants characteristic of the metal and of the temperature. The term \( (\theta \theta - \theta \theta) \) depends on the variation of the specific heat of the liquid may be made very small in the case of water by a proper choice of the constant \( \theta \). It is of the same order as the
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of the current, \( C \), for any given pair of metals, was found to vary directly as the difference of temperature, \( t' - t \), between the hot and cold junctions, and inversely as the resistance, \( R \), of the circuit. We conclude by applying Ohm's law that the electromotive force, \( E \), of the thermocouple may be approximately represented for small differences of temperature by the formula

\[
E = CR \log \left( \frac{t}{t'} \right).
\]

1. Principles. - Thermoelectric current is due to the difference of temperature at two points of a conductor, or junction of two conductors, \( E \), which is always in the direction of the heat flow from the hotter to the colder point.

2. Thermoelectric Power, Series, Inversion.-The limiting value, \( dE/dt \), of the coefficient, \( p \), for an infinitesimal difference, \( dt \), between the junctions is called the Thermoelectric Power of the couple. One metal \( A \) is said to be thermoelectrically positive to another \( B \), if positive electricity flows from \( A \) to \( B \) across the cold junction when the circuit is completed. The opposite convention is sometimes adopted, but the above is the most convenient in practice, as the circuit is generally broken at or near the cold junction for the insertion of the galvanometer. Seebec found that the metals could be arranged in a Thermoelectric Series, in the order of their power when combined with any one metal, such that the power of any thermocouple \( p \), composed of the metals \( A \) and \( B \), was equal to the algebraic difference \( (p' - p') \) of their powers when combined with the standard metal \( C \). The order of the metals in this series was found to be different from that in the corresponding Volta series, and to be considerably altered by variations in purity, hardness, and other physical conditions. J. Cuming shortly afterwards discovered the phenomenon of Thermoelectric Inversion, or the change of the order of the metals in the thermoelectric series at different temperatures. Copper, for instance, is negative to iron at ordinary temperatures, but is positive to it at 300°C or above. The E.M.F. of a copper-iron thermocouple reaches a maximum when the temperature of the hot junction is raised to 170°C, at which temperature the thermoelectric power vanishes and the metals are said to be neutral to one another. Beyond this point the E.M.F. diminishes, vanishes, and changing sign when the temperature of the hot junction is nearly as much above the neutral point as the temperature of the cold junction is below it. Similar phenomena occur in the case of many other couples, and it is found that the thermoelectric power \( p \) is not in general a constant, and that the simple linear formula (1) is applicable only for small differences of temperature. More accurately it may be stated that the thermoelectric force in any given circuit containing a series of different metals is a function of the temperatures of the junctions only, and is independent of the distribution of the temperature at any intermediate points, provided that each of the metals in the series is of uniform quality. This statement admits of the simple mathematical expression

\[
E = \int \frac{dp}{dt} dt + \int \frac{dp}{dt} dt + \cdots.
\]

where \( p', p, \&c. \), are the thermoelectric powers of the metals, and \( t_0, t, t', \&c. \), the temperatures of the junctions. There are some special cases of sufficient practical importance to be separately stated.

3. Homogeneous Circuit. Strain Hysteresis.—In a circuit consisting of a single metal, no current can be produced by variations of temperature, provided that the metal is not thereby strained or altered. This was particularly demonstrated by the experiments of H. G. Magnus. The effects produced by abrupt changes of temperature or section, or by pressing together pieces of the same metal at different temperatures, are probably to be explained as effects of strain. A number of interesting effects of this nature have been investigated by Thomson, F. P. Le Roux, P. G. Tait and others, but the theory has not as yet been fully developed. An interesting example is furnished by an experiment due to F. T. Trouton (Proc. R. S. Dub., 1888). A piece of iron or steel wire in the circuit of a galvanometer is heated in a flame to bright redness at any point. No effect is noticed so long as the flame is stationary, but if the flame be moved slowly in one direction a current is observed, which changes its direction with the direction of motion of the flame. The explanation of this phenomenon is that the metal is transformed at a red heat into another modification, as is proved by simultaneous changes in its magnetic and electrical properties. The change from one state to the other takes place at a higher temperature on heating than on cooling. The junctions of the magnetic and the non-magnetic steel are therefore at different temperatures if the flame is moved, and a current is produced when a piece of different metal was used. If different temperatures had been introduced into the circuit. Other effects of "hysteresis" occur in alloys of iron, which have been studied by W. F. Barrett (Trans. R. S. Dub., January 1900).

4. Law of Successive Temperatures.—The E.M.F. of a given couple between any temperatures \( t \) and \( t' \) is the algebraic sum of the E.M.F. between \( t \) and any other temperature \( t'' \) and the E.M.F. between \( t'' \) and \( t' \). A useful result of this law is that it is sufficient to keep one junction always at some convenient standard temperature, such as 0°C, and to tabulate only the values of the E.M.F. in the circuit corresponding to different temperatures of the other junction.

5. Law of Intermediate Metals.—A thermoelectric circuit may be cut at any point and a wire of some other metal introduced without altering the E.M.F. in the circuit, provided that the two junctions with the metal introduced are kept at the same temperature. This law is commonly applied in connecting a thermocouple to a galvanometer with coils of copper wire, the junctions of the copper wires with the other metals being placed side by side in a vessel of water or otherwise kept at the same temperature. Another way of stating this law is that apparently quite different, is really equivalent in effect, is the following: The E.M.F. of any couple, \( AB \), for any given limits of temperature is the algebraic sum of the E.M.F.'s between the same limits of temperature of the couples BC and CA formed with any other metal \( C \). It is for this reason unnecessary to tabulate the E.M.F.'s of all possible combinations of metals, since the E.M.F. of any couple can be at once deduced by addition from the values given by its components with a single standard metal.

Different observers have chosen different metals as the standard of reference. Tait and J. A. Fleming select lead in accordance with the smallness of the Thomson effect in it, as observed by Le Roux. Noll adopts mercury because it is easily purified, and its physical condition in the liquid state is determinate; there is, however, a discontinuity involved in passing from the liquid to the solid state at a temperature of -40°C, and it cannot be used with all metals, such as lead, on account of the rapidity with which it dissolves them. Both lead and mercury have the disadvantage that they cannot be employed for temperatures much above 300°C. Of all metals, copper is the most generally convenient, as it is electrically connected with all others, and is easily obtained in the annealed state of uniform purity. For high temperature work it is necessary to employ platinum, which would be an ideal standard for all purposes on account of its constancy and insusceptibility, did not the thermoelectric properties of different specimens differ considerably.

6. Thermoelectric Formulas.—On the basis of the principles stated above, the most obvious method of tabulating the observations would be to give the values \( E \) of the E.M.F. between 0°C. and \( t \) for each metal against the standard. This involves no assumptions as to the law of variation of E.M.F. with temperature, but is somewhat cumbersome. In the majority of cases, the observations can be represented within the limits of experimental error by a fairly simple empirical formula, at least for moderate ranges of temperatures. The following formulae are some of those employed for this purpose by different observers:

\[
E = E_0 - E_1 T + \frac{E_2}{T} + \frac{E_3}{T^2} + \frac{E_4}{T^3} + \frac{E_5}{T^4} + \cdots
\]

(Where \( E_0 \) and \( E_1 \) are constants, \( T \) is the temperature, and \( E_2, E_3, E_4, \cdots \) are small.)

(See sect. 15.)


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For moderate ranges of temperature the binomial formula of M. P. Avenarius is generally sufficient, and has been employed by many observers. It is figured by Avenarius (Pogg. Ann., 119, p. 406) as a semicircle, but it is really a parabola with its axis parallel to the axis of E, and its vertex at the point \( t = b/2c \), which gives the neutral temperature. We have also the relations \( dE/dt = b + 2ct \) and \( dE/dt^2 = 2c \). The first relation gives the thermoelectric power \( b \) at any temperature, and is probably the most convenient method of stating results in all cases in which this formula is applicable.

A discussion of some of the exponential formulae is given by S. W. Holman (Phil. Mag., 41, p. 465, June 1896).

7. Experimental Results.—In the following comparative table of the results of different observers the values are referred to lead. Before the time of Tait's researches such data were of little interest or value, on account of insufficient care in securing the purity of the materials tested; but increased facilities in this respect, combined with great improvements in electrical measurements, have put the question on a different footing. The comparison of independent results shows in many cases a remarkable concordance, and the data are becoming of great value for the testing of various theories of the relations between heat and electricity.

**Table I.—Thermoelectric power, \( b = dE/dt \), in microvolts at 50° C. of pure metals with respect to lead.** (The mean change, \( 2c = dE/dt^2 \), of the thermoelectric power per degree C. over the range covered by the experiments, is added in each case.)

<table>
<thead>
<tr>
<th>Metal</th>
<th>Tait (( c^0 ) to 300°).</th>
<th>Steele (( c^0 ) to 100°).</th>
<th>Noll (( c^0 ) to 200°).</th>
<th>Dewar and Fleming (( +100^0 ) to ( +200^0 )).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( b )</td>
<td>( 2c )</td>
<td>( b )</td>
<td>( 2c )</td>
</tr>
<tr>
<td>Al</td>
<td>0.057</td>
<td>+0.039</td>
<td>-0.042</td>
<td>+0.021</td>
</tr>
<tr>
<td>Bi</td>
<td>0.075</td>
<td>+0.039</td>
<td>+0.019</td>
<td>+0.021</td>
</tr>
<tr>
<td>Cd</td>
<td>0.14</td>
<td>-0.008</td>
<td>-0.039</td>
<td>-0.021</td>
</tr>
<tr>
<td>Cu</td>
<td>0.18</td>
<td>+0.008</td>
<td>+0.014</td>
<td>+0.011</td>
</tr>
<tr>
<td>Pb</td>
<td>0.39</td>
<td>+0.008</td>
<td>+0.014</td>
<td>+0.011</td>
</tr>
<tr>
<td>Ni</td>
<td>0.24</td>
<td>-0.024</td>
<td>-0.028</td>
<td>-0.025</td>
</tr>
<tr>
<td>Cu</td>
<td>0.34</td>
<td>-0.015</td>
<td>-0.018</td>
<td>-0.015</td>
</tr>
<tr>
<td>Pb</td>
<td>0.69</td>
<td>-0.015</td>
<td>-0.018</td>
<td>-0.015</td>
</tr>
<tr>
<td>Sn</td>
<td>0.16</td>
<td>+0.005</td>
<td>-0.004</td>
<td>+0.004</td>
</tr>
</tbody>
</table>

Explanation of Table.—The figures marked with an asterisk (*) represent discrepancies which are probably caused by imperfections in the specimens. At the time of Tait's work in 1873 it was difficult, if not impossible, in many cases to procure pure materials. The work of the other three observers dates from 1894-95. The value of the thermoelectric power \( dE/dt \) at 50° C. is taken as the mean value between 0° and 100° C., over which range it can be most accurately determined. The values of \( dE/dt^2 \) are given as well as can be expected, considering the difference of the ranges of temperature and the great variety in the methods of observation adopted; they are calculated assuming the parabolic formula, which is certainly in many cases inadequate. Noll's values apply to the temperature of +100° C., Dewar and Fleming's to that of -100° C., approximately.

In using the above table to find the value of \( E \) or \( dE/dt \) at any temperature or between any limits, denoting by \( b \) the value of \( dE/dt \) at 50° C., and by \( 2c \) the constant value of the second coefficient, we have the following equations:

\[
\frac{dE}{dt} = \frac{b}{2t} - 2c(t - 50), \quad \text{at any temperature } t, \quad \text{Cent.} \quad \ldots \quad (3)
\]

\[
E(\infty) = \left(\frac{b}{2t} + 2c(1 + t - 100)\right) \quad \ldots \quad (4)
\]

for the E.M.F. between any temperature \( t \) and \( t' \).

7. Methods of Observation.—In Tait's observations the E.M.F. was measured by the deflection of a mirror galvanometer, and the temperature by means of a mercury thermometer or an auxiliary thermocouple. He states that the deviations from the formula were "quite within the limits of error introduced by the alternation of the resistance of the circuit with rise of temperature, the deviations of the mercury thermometers from the absolute scale, and the error of estimation of the temperature which gives the long column of mercury not immersed in the hot oil round the junctions." The latter correction may amount to about 10° C. at 350°. Later observers have generally employed a balance method (some modification of the method of Dr. Poggendorff) for measuring the E.M.F. The range of Steele's observations was too small to show any certain deviation from the formula, but he notes capricious changes attributed to change of condition of the wires. Noll employed mercury thermometers, but as he worked over a small range with vapour baths, it is probable that he did not experience any trouble from immersion corrections. He does not record any systematic deviations from the formula. Dewar and Fleming, working at very low temperatures, were compelled to use the platinum thermometer, and expressed their results in terms of the platinum scale. Their observations were probably free from immersion errors, but they record some deviations from the formula which they consider to be beyond the possible limits of error of their work. The writer has reduced their results to the scale of the gas thermometer, assuming the boiling-point of oxygen to be -182.5° C.

**Peltier Effect.**—The discovery by J. C. A. Peltier (1834) that heat is absorbed at the junction of two metals by passing a current through it in the same direction as the current produced by heating it, was recognized by Joule as a clue to the source of the energy of the current by the application of the principles of thermodynamics. Unlike the frictional generation of heat due to the resistance of the conductor, which Joule (1841) proved to be proportional to the square of the current, the Peltier effect is reversible with the current, and being directly proportional to the first power of the current, changes sign when the current is reversed. The effect is most easily shown by connecting a voltaic cell to a thermopile for a short interval, then quickly (by means of a suitable key, such as a Poli commutator with the cross connectors removed) disconnecting the pile from the cell and connecting it to a galvanometer, which will indicate a current in the reverse direction through the pile, and approximately proportional to the original current in intensity, provided that the other conditions of the experiment are constant. It was by an experiment of this kind that Quinquis Lellus (1853) verified the proportionality of the heat absorbed or generated to the first power of the current. It had been observed by Peltier and A. E. Becquerel that the intensity of the effect depended on the thermoelectric power of the junction and was independent of its form or dimensions. The order of the metals in respect of the Peltier effect was found to be the same as the thermoelectric series. But on account of the difficulty of the measurements involved, the verification of the accurate relation between the Peltier effect and thermoelectric power was left to more recent times. If \( C \) is the intensity of the current through a simple thermocouple, the junctions of which are at temperatures \( t \) and \( t' \), a quantity of heat, \( P \times C \), is absorbed by the passage of the current per second at the hot junction, \( t \), and a quantity, \( P \times C \), is evolved at the cold junction, \( t' \). The coefficients, \( P \) and \( P' \), are called coefficients of the Peltier effect, and may be stated in calories or joules per ampere-second. The Peltier coefficient may also be expressed in volts or micro-volts, and may be regarded as the measure of an E.M.F. located...
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at the junction, and transforming heat into electrical energy or vice versa. If $R$ is the whole resistance of the circuit, and $E$ the E.M.F. of the couple, and if the flow of the current does not produce any other thermal effects in the circuit besides the Joule and Peltier effects, we should find by applying the principle of the conservation of energy, i.e. by equating the balance of the heat absorbed by the Peltier effects to the heat generated in the circuit by the Joule effect,

$$(P-R)C = Q + R = EC,$$  
whence $E = P - R$ . . . (5)

If we might also regard the couple as a reversible thermodynamic engine for converting heat into work, we might neglect irreversible effects, such as conduction, which are independent of the current, we should expect to find the ratio of the heat absorbed at the hot junction to the heat evolved at the cold junction, namely, $(P - R)/T$, to be the same as the ratio $T'/T$ of the absolute temperatures of the junctions. This would lead to the conclusion given by R. J. E. Clausius (1853) that the Peltier effect varied directly as the absolute temperature, and that the E.M.F. of the couple should be directly proportional to the difference of temperature between the junctions.

10. Thomson Effect.—Thomson (Lord Kelvin) had already pointed out (Proc. R.S. Edin., 1851) that this conclusion was inconsistent with the known facts of thermoelectric inversion.

(1) The E.M.F. was not a linear function of the temperature difference.

(2) If the Peltier effect was proportional to the thermoelectric power and changed sign with it, as all experiments appeared to indicate, there would be no absorption of heat in the circuit due to the Peltier effect, and therefore no thermal source to account for the energy of the current, in the case in which the hot junction was at or above the neutral temperature. He therefore predicted that there must be a reversible absorption of heat in some other part of the circuit due to the flow of the current through the unequally heated conductors. He succeeded a few years afterwards in verifying this remarkable prediction by the experimental demonstration that a current of positive electricity flowing from hot to cold in iron produced an absorption of heat, as though a positive heat was being released from the metal iron. He also succeeded in showing that a current from hot to cold evolved heat in copper, but the effect was smaller and more difficult to observe than in iron.

The Thomson effect may be readily demonstrated as a lecture experiment by the following method (fig. 1). A piece of wire (No. 28) about 4 cm. long is soldered to one end A, and a thick wire (No. 12), and is heated 100° to 150° C. A steady current from a storage cell adjusted by a suitable rheostat. The experimental wire AB is connected in parallel with about 2 metres of thicker wire (No. 22), which is not appreciably heated. A low-resistance galvanometer is connected by a very fine wire (2 to 3 mils) to the centre C of the experimental wire AB, and also to the middle point D of the parallel wire so as to form a Wheatstone bridge. The balance is adjusted by shunting either AD or BD with a box, S, containing 20 to 100 ohms. All the wires in the quadrilateral must be of the same metal as AB, to avoid accidental thermoelectric effects which would obscure the result. When the current flows from A to B there will be heat absorbed in AC and evolved in CB by the Thomson effect, if the specific heat of electricity in AB is positive as in copper. When the current is reversed, the temperature of AC will be raised and that of CB lowered by the reversal of the effect. This will disturb the resistance balance by an amount which can be measured by the deflection of the galvanometer, or by the change of the Wheatstone bridge, to restore the balance. Owing to the small size of the experimental wire, the method is very quick and sensitive, and the apparatus can be set up in a few minutes when once the experimental quadrilaterals have been done.

11. Thomson's Theory.—Taking account of the Thomson effect, the thermodynamical theory of the couple was satisfactorily completed by Thomson (Trans. R. S. Edin., 1854). If the quantity of heat absorbed and converted into electrical energy, when unit quantity of electricity (one ampere-second) flows from cold to hot through a difference of temperature, $dt$, be represented by $sdt$, the coefficient $s$ is called the specific heat of the couple, and $sdt$ the coefficient of the Thomson effect. Like the Peltier coefficient, it may be measured in degrees or calories per ampere-second per degree, or more conveniently and simply in microvolts per degree.

Consider an elementary couple of two metals A and B for which $s$ has the values $s'$ and $s''$ respectively, with junctions at the temperature $T$ and $T + dT$ (absolute), at which the coefficients of the material are $P$ and $P + dP$. Equating the quantity of heat absorbed to the quantity of electrical energy generated, we have by the first law of thermodynamics the relation

$$dE/dT = dP/dT + (s' - s'').$$

If we apply the second law, regarding the couple as a reversible engine, and considering the irreversible, we obtain

$$(s' - s'')/T = -dP/dT dT/dT$$

Eliminating $(s' - s'')$ we find for the Peltier effect

$$P = -T dP/dT.$$  

Whence we obtain for the difference of the specific heats

$$(s' - s'') = -dP/dT = -T dP/dT.$$  

From these relations we observe that the Peltier effect $P$, and the difference of the Thomson effects $(s' - s'')$, for any two metals can be easily deduced from $dE/dT$ and $dP/dT$ respectively. The signs in the above equations are chosen on the assumption that positive electricity flows from cold to hot in the metal $s$. The signs of the Peltier and Thomson effects will be the same as the signs of the coefficients given in Table 1, if we suppose the metal $s''$ to be lead, and assume that the value of $s'$ may be taken as zero at all temperatures.

12. Experimental Verification of Thomson's Theory.—In order to justify the assumption involved in the application of the second law of thermodynamics to the theory of the thermocouple in the manner above specified, it would be necessary and sufficient, as Thomson pointed out (Phil. Mag. Oct. 1853), to make experiments to verify quantitatively the relation $P/T = dE/dT$ between the Peltier effect and the thermoelectric power. A qualitative relation was known at that time to exist, but no tests of sufficient accuracy had been made. The most accurate measurements of the heat absorption due to the Peltier effect at present available are probably those of H. M. Jahn (Wied. Ann., 34, 1858). He measured the specific resistances and coefficients of absorption in a Bunsen ice calorimeter, and observed the evolution of heat per hour with a current of about 1 ampere in either direction. The Peltier effect was only a small fraction of the total effect, but could be separated from the Joule effect owing to the reversal of the current. The values of $dE/dT$ for the same specimen of metal at $0^\circ$ C. were determined by experiments between $+20^\circ$ C. and $-20^\circ$ C. The results of his observations are contained in the following table, heat absorbed being reckoned positive as in Table II.

<table>
<thead>
<tr>
<th>Metal</th>
<th>$dE/dT$</th>
<th>$P/T$</th>
<th>$dP/dT$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu-Ag</td>
<td>$+0.2$</td>
<td>$-0.45$</td>
<td>$+0.2$</td>
</tr>
<tr>
<td>Cu-Ag</td>
<td>$+0.25$</td>
<td>$-0.33$</td>
<td>$+0.3$</td>
</tr>
<tr>
<td>Cu-Pt</td>
<td>$-0.4$</td>
<td>$-0.27$</td>
<td>$-0.52$</td>
</tr>
<tr>
<td>Cu-Zn</td>
<td>$+1.51$</td>
<td>$-0.33$</td>
<td>$+0.28$</td>
</tr>
<tr>
<td>Cu-Cd</td>
<td>$+2.4$</td>
<td>$-0.61$</td>
<td>$+0.25$</td>
</tr>
<tr>
<td>Cu-Ni</td>
<td>$-0.05$</td>
<td>$+4.58$</td>
<td>$-4.36$</td>
</tr>
</tbody>
</table>

The agreement between the observed and calculated values in the last two columns is as good as can be expected considering the great difficulty of measuring such small quantities of heat. The analogous reversible heat effects which occur at the junction of a metal and an electrolyte were also investigated by Jahn, but he did not succeed in obtaining so complete an agreement with theory in this case."

Fig. 1.—Diagram of Apparatus for Demonstrating the Thomson Effect.
13. Tait's Hypothesis.—From general considerations concerning minimum dissipation of energy (Proc. R. S. Edin., 1867–68), Tait was led to the conclusion that "the thermal and electric conductivities of metals varied inversely as the absolute temperature, and that the specific heat of electricity was directly proportional to the same." Subsequent experiments led him to doubt this conclusion as regards conductivity, but his thermoelectric experiments (Proc. R. S. Edin., December 1879) appeared to be in good agreement with it. If we adopt this hypothesis, and substitute $s = 2\theta T$, where $c$ is a constant, in the fundamental equation (9), we obtain at once $dE/dT = 2(c'c'' - c'c)$, which is immediately integrable, and gives

$$dE/dT = b(2c(T-\theta) - (c'c' - c''c''))$$

(10)

$$E_{sw} = \frac{1}{2}(c''c' - c'c') (2\log(T-\theta) - (c''c' - c'c'))$$

(11)

where $\theta$ is the temperature of the neutral point at which $dE/dT = 0$. This is the equation to a parabola, and is equivalent to the empirical formula of Avenarius, with this difference, that in Tait's formula the constants have all a simple and direct interpretation in relation to the theory. Tait's theory and formula were subsequently assimilated by Avenarius (Pogg. Ann., 149, p. 372, 1879), and are now generally attributed to Avenarius in foreign periodicals.

In accordance with this hypothesis, the curves representing the variations of thermoelectric power, $dE/dT$, with temperature are straight lines, the slope of which for any couple is equal to the difference of the constants $2(c'c'' - c'c)$.) The diagram constructed by Tait on this principle is fully explained and illustrated in many text-books, and has been generally adopted as embodying in a simple form the fundamental phenomena of thermoelectricity.

14. Experimental Verification.—Tait's verification of this hypothesis consisted in showing that the experimental curves of E.M.F. were parabolas in most cases within the limits of error of his observations. He records, however, certain notable divergencies, particularly in the case of iron and nickel, and many others have since come to light from other observers. It should also be remarked that even if the curves were not parabolas, it would always be possible to draw parabolas to agree closely with the observations over a restricted range of temperature. When the question is tested more carefully, either by taking more accurate measurements of temperature, or by extending the observations over a wider range, it is found that there are systematic deviations from the parabolic form of curves, which cannot but be explained by errors of experiment. A more accurate verification of these relations, both at high and low extremes of temperature, has become possible of late years owing to the development of the thermoelectric phenomena and application of the platinum resistance thermometer. (See Thermometry.) The curves in fig. 2 illustrate the differences from the parabolic formula, measured in degrees of temperature, as observed by H. M. Tory (B.A. Report, 1887). The deviations for the copper-iron couple, and for the copper cast-iron couple over the range $0^\circ$ to $200^\circ$, appear to be of the order of $1^\circ C$, and were carefully verified by repeated and independent series of observations. The deviations of the platinum and platinum-rhodium 10 per cent.

**FIG. 2.—Temperature by Thermocouple. Difference from Tait's Formula.**

The effect was calculated by multiplying this difference of temperature by the thermal capacity of either calorimeter, and dividing by the curve of the number of seconds in twenty minutes, and so by twice the difference of temperature (about $20^\circ$) between the ends of the couple $a$ and $b$. The method appears to be open to the objection that the difference of temperature reached in so long an interval would be more or less independent of the thermal.
capacities of the calorimeters, and would also be difficult to measure accurately with a thermocouple under the conditions described. The general results of the work appeared to support Tait's hypothesis that the effect was proportional to the absolute temperature, but direct thermoelectric tests do not appear to have been made on the specimens employed, which would have afforded a valuable confirmation by the comparison of the values of $dE/dT$, as in Jahn's experiments.

17. King's Experiments.—The method employed by the writer, to which the allusion has already been made, consisted in observing the change of distribution of temperature in terms of the resistance along a wire heated by an electric current, when the heating current was reversed. It has been fully described by King (Proc. Amer. Acad., June 1898), who applied it most successfully to the case of copper. Although the effect in copper is so small, he succeeded in obtaining changes of temperature due to the Thomson effect of the order of 1° C., which could be measured with satisfaction, although not with accuracy. He also determined the effect on change of temperature distribution on the rate of generation of heat by the current; and on the external loss of heat by radiation, convection and conduction. It is necessary to take all these conditions carefully into account in calculating the balance due to the Thomson effect. According to King's experiments, the value of the effect

appears to diminish with rise of temperature to a slight extent in copper, but the diminution is so small that he does not regard it as established with certainty. The value found at a temperature of 150° C. was 2.5 microvolts per ampere-second per degree, or $2.5$ microvolts per degree in the case of copper, which agrees very fairly with the value deduced from thermoelectric tests. The value found by Batelli for iron was $-50$ microvolts per degree at 108° C., which appears too small in comparison. These measurements, though subject to some uncertainty on account of the great experimental difficulties, are a very valuable confirmation of the accuracy of Thomson's theory, because they show that the magnitude of the effect is of the required order, but they cannot be said to throw much light upon its cause. A comparison of the results of different observers would also suggest that the law of variation may be different in different metals, although the differences in the values of $dE/dT$ may be due in part to differences of purity or errors of observation. It would appear, for instance, according to the observations of Dewar and Fleming, that the value of $s$ for iron is positive below 150° C., at which point it vanishes. At ordinary temperatures the value is negative, increasing rapidly in the negative direction as the temperature rises. This might be appropriately represented, as already suggested, by a linear formula $s = b - cT$.

18. Potential Diagrams on the Contact Theory.—It is instructive to consider the distribution of potential in a thermoelectric circuit, and its relation to the resultant E.M.F. and to the seat of the E.M.F. In fig. 4, which is given as an illustration, the cold junctions are supposed to be at 0° C. and the hot junction at 108° C., and the variation in $dE/dT$ is taken for the E.M.F., and it is supposed that the coefficient of the Thomson effect is zero in lead, i.e. that there is no E.M.F. and that the potential is uniform throughout the length of the lead wire. Taking the lead-iron couple as an example, the value of $dE/dT$ at the hot junction 100° C. is 10 microvolts per degree, and the value of the Peltier coefficient $P = TdE/dT$ is $+3844$ microvolts. In other words, we may suppose that there is an E.M.F. of that magnitude situated at the junction which causes positive electricity to flow from the lead to the iron. If the circuit is open, as represented in the diagram, there is a resultant E.M.F. of $4000$ volts as soon as it has raised the potential of the iron 3844 microvolts above that of the lead. In the substance of the iron itself there is an E.M.F. due to the Thomson effect of about 10 microvolts per degree tending to drive positive electricity from the iron to the lead on account of the cold junction, and there is a sudden drop of potential due to the Peltier effect of 3844 microvolts. If the circuit is cut at this point, there remains a difference of potential $E = 1184$ microvolts, the resultant E.M.F. of the circuit, tending to drive positive electricity from the iron to the lead at the cold junction. If the circuit is closed, there will be a current $C = E/R$, where $R = R_1 + R_2$, the sum of the resistances of the lead and iron. The flow of the current will produce a fall of potential $E/R$ in the lead from cold to hot, and $E/R$ in the iron from hot to cold, but the potential difference due to the Peltier effect at either junction will not be affected. For simplicity in the diagram, the temperature gradient has been taken as uniform, and the specific heat $c$ constant, but the total P.D. would be the same whatever the gradient.

Similar diagrams are given in fig. 4 for cadmium in which both the specific heat and the Peltier effect are positive, and also for platinum and nickel in which both coefficients are negative. The metals are supposed to be all joined together at the hot junction, and the circuit cut in the lead near the cold junction. The diagram will serve for any selected couple, such as lead-copper, not restricted to combinations with lead. The following table shows the component parts of the E.M.F. in each case:

<table>
<thead>
<tr>
<th>Metal Combination</th>
<th>Voltage (microvolts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron-lead</td>
<td>+3844</td>
</tr>
<tr>
<td>Cadmium-lead</td>
<td>+2389</td>
</tr>
<tr>
<td>Platinum-lead</td>
<td>-1919</td>
</tr>
<tr>
<td>Nickel-lead</td>
<td>-506</td>
</tr>
</tbody>
</table>

The components for any other combination of two are found by taking the algebraic difference of the values with respect to lead.

19. Relation to the Volta Effect.—It is now generally conceded that the relatively large differences of potential observable with an electrometer between metals on open circuit, as discovered by Volta, are due to the chemical affinities of the metals, and have no direct relation to thermoelectric phenomena or to the Peltier effect. The order of the metals in respect of the two effects is quite different. The potential difference, due to the Volta effect in air, has been shown by Thomson (Lord Kelvin) and his pupils to be of the same order of magnitude, if not absolutely the same, as that produced in a dilute electrolyte in which two metallically connected plates (e.g. zinc and copper) are immersed. (On this hypothesis, it may be explained by regarding the air as an electrolyte of infinite specific resistance.) It is also profoundly modified by the state of the exposed surfaces, a coating of oxide on the copper greatly increasing the effect, as it would in a voltaic cell. The Peltier effect and the thermo-E.M.F., on the other hand, do not depend on the state of the surfaces, but only on the state of the substance. An attempt has been made to explain the Volta effect as due to the affinity of the metals for each other, but that would not account for the variation of the effect with the state of the surface, except as affecting the actual surface of contact. It is equally evident that chemical affinity between the metals cannot be the explanation of the Peltier E.M.F. This would necessitate chemical action between the metals when current is passed through it, as in an electrolytic cell, whereas the action appears to be purely thermal, and leads to a consistent theory on that hypothesis. The chemical action between metals in the solid state must be infinitesimal, and could only suffice to produce small charges analogous to those of frictional electricity; it could not maintain a permanent difference of potential at a metallic junction through which a current was passing. Although it is possible that differences of potential larger than the Peltier effect might exist between two metals in contact on open circuit, it is certain that only the effective E.M.F. in practice is the
Peltier effect, and that the difference of potential in the substance of the metals when the circuit is complete cannot be greater than the coefficient $P$. The Peltier effect, it may be objected, measures that part only of the potential difference which depends upon temperature, and can therefore give no information about the absolute potential difference. But the reason for concluding that there is no other effective source of potential difference at the junction besides the Peltier effect, is simply that no other appreciable action takes place at the junction when a current passes except the Peltier generation or absorption of heat.

20. Convection Theory.—The idea of convection of heat by an electric current, and the phrase "specific heat of electricity" were introduced by Thomson as a convenient mode of expressing the phenomena of the Thomson effect. He did not intend to imply that electricity really possessed a positive or negative specific heat, but merely that a quantity of heat was absorbed in a metal when unit quantity of electricity flowed from cold to hot through a difference of temperature of $t^\circ$. The absorption of heat was considered as representing an equivalent conversion of heat energy into electrical energy in the element. The element might thus be regarded as the seat of an E.M.F. $dE=sdT$, where $dT$ is the difference of temperature between its ends. The potential diagrams already given have been drawn on this assumption, that the Thomson effect is not really due to convection of heat by the current, but is the measure of an E.M.F. located in the substance of the conductor. This view with regard to the seat of the E.M.F. has been generally taken by the majority of writers on the subject. It is not, however, necessarily implied in the reasoning or in the equations given by Thomson, which are not founded on any assumptions with regard to the seat of the E.M.F., but only on the balance of heat absorbed and evolved in all the different parts of the circuit. In fact, the equations themselves are open to an entirely different interpretation in this respect from that which is generally given.

Returning again to the equations already given in § 11 for an elementary thermocouple, we have the following equivalent expressions for the E.M.F. $dE$, namely,

$$dE=dp'(t'-t)dT=(P/T)dT=dpT=(p'-p)dT,$$

in which the coefficient, $P$, of the Peltier effect, and the thermoelectric power, $p$, of the couple, may be expressed in terms of the difference of the thermoelectric powers, $p'$ and $p''$, of the separate metals with respect to a neutral standard. So far as these equations are concerned, we might evidently regard the seat of the E.M.F. as located entirely in the conductors themselves, and not at all at the junctions, if $p' (or p''-p)$ is the difference of the E.M.F.s per degree in corresponding elements of the two metals. In this case, however, in order to account for the phenomenon of the Peltier effect at the junctions, it is necessary to suppose that there is a real convection of heat by an electric current, and that the coefficient $P$ or $pT$ is the difference of the quantities of heat carried by unit quantity of electricity in the two metals. On this hypothesis, if we confine our attention to one of the two metals, say $p''$, in which the current is supposed to flow from hot to cold, we observe that $p''dT$ expresses the quantity of heat converted into electrical energy per unit of electricity by an E.M.F. $p''$ per $t^\circ$ located in the element $dT$. It happens that the absolute magnitude of $p''$ cannot be experimentally determined, but this is immaterial, as we are only concerned with differences. The quantity of heat liberated by convection as the current flows from hot to cold is represented in the expression by $dP=d(dT)$. Since $dE=dpT+d{T}p''$, it is clear that the balance of heat liberated in the element is only $Tdp''=s'ddT$, namely, the Thomson effect, and is not the equivalent of the E.M.F. $p'ddT$, because on this theory the absorption of heat is masked by the convection. If $p$ is constant there is no Thomson effect, but it does not follow that there is no E.M.F. located in the element. The Peltier effect, on the other hand, may be ascribed entirely to convection. The quantity of heat $p'T$ is brought up to one side of the junction per unit of electricity, and the quantity of heat $p'T$ taken away on the other. The balance $(p'-p')T$ is evolved at the junction. If, therefore, we are prepared to admit that an electric current can carry heat, the existence of the Peltier effect is no proof that a corresponding E.M.F. is located at the junction, or, in other words, that the conversion of heat into electrical energy occurs at this point of the circuit, or is due to the contact of dissimilar metals. On the contact theory, as generally adopted, the E.M.F. is due entirely to change of substance $(dp'-Tdp)$; on the convection theory, it is due entirely to change of temperature $(dT)$. But the two expressions are equivalent, and give the same results.

21. Potential Diagrams on Convection Theory.—The difference between the two theories is most readily appreciated by drawing the potential diagrams corresponding to the supposed locations of the E.M.F. in each case. The contact theory has been already illustrated in fig. 4. Corresponding diagrams for the same metals on the convection theory are given in fig. 5. In this diagram the metals are supposed to be all joined together and to be at the same time potential at the cold junction at $0^\circ \text{C}$. The ordinate of the curve at any temperature is the difference of potential between any point in the metal and a point in lead at the same temperature. Since there is no contact E.M.F. on this theory, the ordinates also represent the E.M.F. of a thermocouple metal-lead, in which one junction is at $0^\circ \text{C}$ and the other at $t^\circ \text{C}$. For this reason the potential diagrams on the convection theory are more simple and useful than those on the contact theories. The curves of E.M.F. are in fact the most natural and most convenient method of recording the numerical data, more particularly in cases where they do not admit of being adequately represented by a formula. The line of lead is taken to be horizontal in the diagram, because the thermoelectric power, $p$, may be reckoned from any convenient zero. It is not intended to imply that there is no E.M.F. in the metal-lead with change of temperature, but that the value of $p$ in this metal is nearly constant as the Thomson effect is very small. It is very probable that the absolute values of $p$ in different metals are of the same sign and of the same order of magnitude, being large compared with the differences observed. It would be theoretically possible to measure the absolute value in some metal by observing with an electrometer the P.D. between parts of the same metal at different temperatures, but the differences would probably be of the order of only one-hundredth of a volt for a difference of $100^\circ \text{C}$. It would be sufficiently difficult to detect so small a difference under the best conditions. The difficulty would be greatly increased, if not rendered practically insuperable, by the large differences of temperature.

22. Conduction Theory.—In Thomson's theory it is expressly assumed that the reversible thermal effects may be considered separately without reference to conduction. In the conduction theory of W. C. Kohlrausch (Pogg. Ann., 1875, vol. 156, p. 601), the fundamental postulate is that the thermo-E.M.F. is due to the conduction of heat in the metal, which is contrary to Thomson's theory. It is assumed that a flow of heat takes place; but it tends to carry with it a proportional electric current $C=0$. This is interpreted to mean that there is an E.M.F. $dE=akr$ $dT$ $=skdT$, in each element, where $k$ is the thermal conductivity and...
The specific resistance. The "thermoelectric constant," \( \theta \), of Kohlrausch, is evidently the same as the thermoelectric power, \( \phi \), in Thomson's theory. In order to explain the Peltier effect, Kohlrausch has shown that an electric current, \( C \), carries a heat-flow, \( Q = \phi C \), with it, where \( A \) is a constant which can be made equal to unity by a proper choice of units. If \( A \) and \( \theta \) are constant, the Peltier effect at the hot and cold junctions are equal and opposite, and the combination of the two postulates leads to a complication. By the second postulate the flow of the current increases the heat-flow, and this by the first postulate the thermoelectric resistance, which therefore depends on the current. It is difficult to see how this complication can be avoided, unless the first postulate is abandoned, and the heat-flow due to conduction is assumed to be independent of the thermoelectric phenomena. By applying the first law of thermodynamics, Kohlrausch deduces that a quantity of heat, \( QdT \), is absorbed in the element \( dT \) second by the current \( C \). He wrongly identifies this with the Thomson effect, by omitting to allow for the heat carried. He does not make any application of the second law to the theory. If we apply Thomson's condition \( T = \frac{QdT}{\Delta T} = T \phi \), we have \( A = T \). If we also assume the ratio of the current to the heat-flow to be the same in both postulates, we have \( \frac{a}{10} = \theta \), whence \( \theta = \frac{1}{2} |T| \). This condition was applied in 1899 by C. H. J. Liebenow (Wied. Ann., 68, p. 316). It simplifies the theory, and gives a possible relation between the constants, but it does not appear to remove the complication above referred to, which seems to be inseparable from any conduction theory.

23. Thermoelectric Relations.—A number of suggestions have been made as to the possible relations between heat and electricity, and one of this by which an electric current might also be a carrier of heat. The simplest is probably that of W. E. Weber (Wied. Ann., 1875), who regarded electricity as consisting of atoms much smaller than those of matter, and supposed that heat was the kinetic energy of these electric atoms. If we suppose that an electric current in a metal is a flow of negative electric atoms in one direction, the positive electricity associated with the far heavier material atoms remaining practically stationary, and if the atomic heat of electricity is of the same order as that of an equivalent quantity of hydrogen or any other element, the heat carried per ampere-second at \( 0^\circ \)C, namely \( \rho \), would give the order of \( 100 \) or \( 1000 \) of the temperature in order to account for all the observed effects on the convection theory. Others have considered conduction in a metal to be analogous to electrolytic conduction, and the observed effects to be due to "migration of the ions." The majority of these theories are too vague to be profitably discussed in an article like the present, but there can be little doubt that the study of thermoelectricity affords one of the most promising roads to the discovery of the true relations between heat and electricity.

Alphabetical Index of Symbols.

- \( a, b, c = \) Numerical constants in formulae.
- \( C = \) Electric Current.
- \( E = \) E.M.F. = Electromotive Force.
- \( F = \) Force.
- \( G = \) Gravitational Acceleration.
- \( P = \) Coefficient of Peltier Effect.
- \( \phi = dE/dT = \) Thermoelectric Power.
- \( Q = \) Heat-flow due to Conduction.
- \( \theta = \) Electrical Resistance; \( r = \) Specific Resistance.
- \( t = \) Temperature, or Heat, or Coefficient of Thomson Effect.
- \( T = \) Temperature on the Centigrade Scale.
- \( f = \) Temperature on the Absolute Scale.

THERMOMETRY

The present article is to discuss the general principles on which the accurate measurement of temperature depends, and to describe the application of these principles to the construction and use of the most important types of thermometer. Special attention will be devoted to more recent advances in scientific methods of testing thermometers and to the application of electrical and optical methods to the difficult problem of measuring high temperatures. In the article PYROMETER an account will be found of some of the thermoscopic methods employed in the arts for determining high temperatures.

2. Zero: Fundamental Interval.—In all systems of measuring temperature it is necessary (1) to choose a zero or starting-point (from which to reckon), (2) to determine the size of the degree by subdividing the interval between two selected fixed points of the scale (called the "fundamental interval") into a given number of equal parts. The fundamental interval selected is that between the temperature of melting ice and the temperature of condensing steam, under standard atmospheric pressure. On the Centigrade system the fundamental interval is divided into 100 parts, and the melting-point of ice is taken as the zero of the scale. We shall denote temperature reckoned on this system by the letter \( T \), and by the letter \( t \) its value on the fundamental absolute scale of temperature; thus \( T = t + T_0 \). It is often convenient to reckon temperature, expressly excluding the melting-point of ice, but from a theoretical or absolute zero representing the lowest conceivable temperature. We shall denote temperature reckoned in this manner by the letter \( T \) or \( t \), or by affixing the letters \( Abs \). In practice, since the absolute zero is unattainable, the absolute temperature is deduced from the Centigrade temperature by adding a constant quantity, \( T_0 \), representing the interval between the absolute zero and the melting-point of ice; thus \( T = t + T_0 \).

3. Arbitrary Scales.—An arbitrary scale can be constructed by selecting any physical property of a substance which varies regularly with the temperature, such as the volume of a liquid, or the pressure or density of a gas, or the electrical resistance of a metal. Thus if \( V \) denote the volume of a given mass at the temperature \( t \), and if \( V_0, V_i \) represent the volumes of the same mass at the temperatures \( 0^\circ \) and \( 100^\circ \)C, the size of a degree \( C \) on the scale of this arbitrary thermometer is one hundredth part of the fundamental interval, namely \( V = V_0 = 100 \), and the temperature \( t \) at volume \( V \) is the number of these degrees contained in the expansion \( V - V_0 \) between \( 0^\circ \) and \( 1^\circ \)C. We thus arrive at the formula

\[
T = 100(V - V_0)/(V_i - V_0)
\]

which is the general expression for the temperature Centigrade on any such arbitrary scale, provided that we substitute for \( V \) the particular physical property selected as the basis of the scale. If we prefer to reckon temperature from an arbitrary zero defined by the vanishing of \( V \), which may conveniently be called the fundamental zero of the scale considered, we have, putting \( V = 0 \) in equation (1), the numerical values of the fundamental zero \( T_0 \), and of the temperature \( T \) reckoned from this zero.

\[
T_0 = 100 V_0 (V_i - V_0) = V_0
\]

(2)

It is frequently convenient to measure temperature in this manner when dealing with gases, or electrical resistance thermometers.

4. Absolute Scale.—It is necessary for theoretical purposes to reduce all experimental results as far as possible to the absolute scale, defined as explained in HEAT, § 21, on the basis of Carnot's principle, which is independent of the properties of any particular substance. Temperature on this scale measured from the absolute zero will be denoted by the letter \( \theta \). This scale can be most nearly realized in practice by observing the temperature \( T \) on the scale of a gas-thermometer, and making special experiments on the gas to determine how far its scale deviates from that of the thermodynamical engine. In the case of the gases hydrogen and helium, which can exist in the liquid state only at very low temperatures, the deviations from the absolute scale at ordinary temperatures are so small that
they cannot be certainly determined. Thermometers containing these gases are generally taken as the ultimate standards of reference in practical thermometry.

**MERCURIAL THERMOMETER**

5. The most familiar type of thermometer depends on the apparent expansion of a liquid hermetically sealed in a glass bulb attached to a graduated stem of fine bore. Of all liquid-in-glass thermometers those containing mercury are almost invariably selected for scientific purposes, although at first sight mercury would appear to be the least suitable liquid on account of its small coefficient of expansion. The smallness of the expansion necessitates an extremely fine bore for the stem, which introduces errors in consequence of the high surface tension of mercury. The considerable density of the liquid also tends to exaggerate the effects of change of position due to variation of the pressure exerted on the interior of the bulb by the liquid column. These errors are small and fairly regular, and can be corrected within certain limits. A much more serious source of trouble, especially at high temperatures, is the imperfect elasticity of the glass, which causes more or less irregular changes in the volume of the bulb. The effect of these changes on the readings of the thermometer is enhanced by the smallness of the expansion of mercury, and might be reduced by employing a more expansible liquid. It is more likely, however, that the defect will be remedied by the construction of thermometers of fused quartz, which is the most perfectly elastic solid hitherto discovered. For work at low temperatures the range of a mercury thermometer is limited by its freezing-point (−38°C).

These are the serious disadvantages attending the use of mercury, but in other respects it possesses so many advantages over alcohol or other substitutes, that it will in all probability continue to be used almost exclusively in thermometers of this type for scientific work. Among its chief advantages may be reckoned its high boiling-point (357°C), and the absence of evaporation from the top of the thread, which is so serious a source of error with the alcohol thermometer. With mercury the evaporation is almost inappreciable at 100°C, and can in all cases be avoided by exposing the upper parts of the emergent thread to the atmosphere. Although an evacuated mercury thermometer cannot be safely used at temperatures above 300°C, owing to the breaking up of the thread of liquid in the stem, it has been found possible, by filling the upper part of the stem with nitrogen or carbon dioxide under high pressure, to extend the range to 550°C. A more important advantage for accurate work is the fact that mercury does not wet glass, and avoids any possible errors due to adherent films of liquid on the walls of the tube. This greatly facilitates observations, and also renders it possible to calibrate the thermometer after construction, which cannot be satisfactorily accomplished with other liquids. The process of construction and calibration is further facilitated by the fact that mercury does not dissolve air to any appreciable extent. In consequence of the regularity of expansion of mercury at ordinary temperatures, the scale of the mercury thermometer agrees very closely with that of the gas thermometer. The liquid is very easily obtained in a high state of purity by distillation, and has practically no chemical action on glass. In this respect it is superior to the liquid alloy of potassium and sodium, which has been employed in some high-temperature thermometers, but which rapidly reduces to the state of a black deposit. The high conductivity and low specific heat of mercury as compared with most other liquids tend to render the thermometer quick and sensitive in action. Its opacity considerably facilitates accurate reading, and even the smallness of its expansion has one great countervailing advantage, in that the correction for stem-exposure is proportionately reduced. This correction, which (even in the case of mercury) may amount to as much as 40°C at 550°C, is far the most uncertain in its application, and is the most serious objection to the use of the liquid-in-glass thermometer at high temperatures.

6. **Construction**.—The construction of the most accurate type of mercury thermometer has undergone some changes of detail in recent years. The range of the most accurate standards is generally restricted to the fundamental interval. The length of a degree on the stem can be increased to any extent by enlarging the bulb or diminishing the bore of the stem, but it is found in practice that there is no advantage in making the scale more open than one centimetre to the degree C. In standard instruments, due to the number of divisions beyond ten or at most twenty to the degree, enlargement of the stem makes the instrument sluggish, and exaggerates the errors due to imperfect elasticity. Diminishing the bore of the tube increases the errors due to capillary friction. Even one centimetre to the degree is an impracticable scale for thermometers graduated continuously from 0°C to 100°C, owing to the excessive length of the stem. In order to secure so open a scale, it is necessary to limit the range to 35°C, or at most 50°C. The fixed points 0°C and 100°C may still be retained, for purposes of testing and re-use, in the device now commonly employed, of blowing auxiliary bulbs or ampoules on to the stem, the volume of which is carefully adjusted to correspond with the number of degrees that it is desired to suppress.

In the best instruments for work of precision the bulb is not blown on the capillary tube itself, but is formed of a separate piece of tube fused on the stem. It is possible in this manner to secure greater uniformity of strength and regularity of dimensions. The thickness of the glass is generally between half a millimetre and one millimetre. The advantage in point of cost is not gained by making the glass thin is more than counterbalanced by increased fragility and liability to distortion. The best form of bulb is cylindrical, of the same external diameter as the stem. The bore of the stem should also be cylindrical, and not oval or flattened, in order to diminish errors due to capillarity, and to secure the greatest possible uniformity of section. The glass should be clear, and not backed with opal, both to admit of reading from either side, and to minimize risk of bending or distortion. In the commoner sorts of thermometers, which are intended for rough purposes and to be read without the application of minute corrections, it is not unusual to divide the tube into divisions of equal volume by a preliminary calibration. In the more accurate instruments it is preferable to divide the tube into divisions of equal length, as this can be more accurately effected. The corrections to be applied to the readings to allow for inequalities of bore can be most satisfactorily determined in the case of mercury thermometers by calibrating the tube after the instrument is completed (see CALIBRATION). This correction is known as the “calibration correction.” Instead of being separately determined it may be included in the scale correction by comparison with a standard instrument, such as a platinum-resistance thermometer.

7. **Corrections**.—The corrections to be applied to the readings of a mercury thermometer, in addition to the calibration correction, may be summarized under the following heads: (i), Zero. (ii) Fundamental Interval. (iii) Internal and External Pressure. (iv) Stem Exposure. (v) Scale Correction, including Poggendorff’s correction.

(i) The changes of zero are of two kinds. (a) **Semical rise of zero** due to gradual recovery from changes or strain acquired by the bulb during the process of manufacture. This process may be hastened and subsequent changes practically eliminated by annealing the bulb after manufacture, and allowing it to cool slowly from a high temperature, after each exposure to a high temperature, followed by a slow recovery which may last for days or weeks. The best thermometers of this kind show a depression of zero amounting to about one-tenth of 1°C. (b) **Temperature displacement** of zero after each exposure to a high temperature, followed by a slow recovery which may last for days or weeks. The best thermometers of this kind show a depression of zero amounting to about one-tenth of 1°C.
THERMOMETRY

C. taken high the reduced the these for reading more fig. equivalent in h is necessary small. tested for is matter some C., precision also rising C. separate

thermometer. pressure boiler elevated formula and glass, zero reached procedure MERCURIAL

FIG. 1.-HYSPOMETER.

steam point. If \( n \) be the interval in degrees of the scale between the zero observation and if \( h \) be the temperature of the steam, the fundamental interval for the thermometer is 100 \( n/h \), provided that \( h \) is nearly 100° C. Since all the readings of a thermometer have to be corrected for the error of the fundamental interval, by multiplying by \( h \) for the fundamental interval thus observed and multiplying by 100, it is a matter of some convenience in practice to have the instrument graduated so that the difference between the readings in ice and at 100° C. is very nearly 100° of the stem. The correction \( b \) then be expressed as a small percentage independently of the other corrections. The method of determining the fundamental interval above described applies to all kinds of thermometers except that it is not generally necessary to observe the zero after the steam temperature of the stem \( t \) should be expressed in the scale of the thermometer tested, if the scale differs appreciably from that of Regnault.

(III) Pressure Correction. The corrections for variations of internal and external pressure on the bulb are of some importance in absolute thermometry, but can be applied with considerable certainty at moderate temperatures. The correction for pressure is assumed to be proportional to the change of pressure, and to be independent of the temperature. It is generally determined by enclosing the thermometer to be tested in a vessel of water, and observing the change of reading on exhausting or readmitting the air. The correction is generally between one and two thousands of a degree per centimetre of mercury change of pressure. It is convenient to reduce the corrections to a pressure of 760 mm. of mercury. The correction for internal pressure is greater than that for external pressure by the difference between the steam pressure and the atmospheric pressure, and may be calculated from it by assuming this relation. If \( b_1 \), \( b_2 \) are the external and internal coefficients, expressed in degrees of temperature per centimetre of mercury, we have the relation

\[ b = b_1 - b_2 \times 0.00105 \text{, degrees per cm. of mercury} \]

(6)

The coefficient of internal pressure can also be determined by taking readings in the horizontal and vertical positions when the thermometer is at some steady temperature such as that of ice or steam. The reading of the thermometer is generally reduced to an external pressure of one standard atmosphere, and to an internal pressure corresponding to the bore of the bulb. It is possible to include the internal pressure correction in the scale correction, if the thermometer is always read in the vertical position. In addition to the variations of internal pressure due to the column of mercury in the stem, there are variations due to capillarity. The internal pressure is greater when the mercury is rising than when it is falling, and the reading is depressed to an extent dependent on the fineness of the bore and the thinness of the walls of the bulb. The capillary pressure does not depend only on the bore of the tube, but also apparently to an even greater extent on the state of the walls of the tube. The least trace of dirt on the bore of the mercury stops the expansion or contraction of the mercury and causes the bubble to have an appreciable size. It is seldom found that the mercury runs equally easily in all parts of the stem. These variations of capillary pressure are somewhat capricious, and set a limit to the degree of accuracy attainable with the mercury thermometer. A good thermometer is expressed as the difference of reading of a good thermometer between a rising and a falling meniscus may amount to five or ten thousandths of a degree. The difference may be reduced by continuous tapping, but it is generally best to take readings always on a rising column, especially as the variations in the angle of contact, and therefore in the capillary pressure, appear to be much smaller for the rising meniscus. In ordinary work the zero reading and the steam reading would both generally correspond to a falling meniscus; the former necessarily, the latter on account of the phenomenon of the temporary depression of zero, which causes the thermometer to read higher during the first moment the pressure in the stem is increased by the rise of the bulb has reached its limit. It is easy to secure a rising meniscus at the steam point by momentarily cooling the thermometer. At the zero point the meniscus generally begins to rise after five or ten minutes. The question, however, is not of much importance, as the error, if any, is regular, and the correction for capillarity is necessarily uncertain.

(IV) Stem-Exposure Correction. When the bulb of a mercury thermometer is immersed in water at a temperature \( t \), and a part of the column of mercury having a length of \( n \) degrees is exposed to a lower temperature \( s \), the reading of the thermometer will be

\[ T = T_s + n \frac{C_s}{C} \]

For the first few degrees, the correction \( T_s \) is given by the tables, and for higher temperatures it is

\[ T_s = T_s + n \frac{C_s}{C} \]


<table>
<thead>
<tr>
<th>Pressure (corrected)</th>
<th>Steam temp. = 100° C.</th>
<th>790</th>
<th>780</th>
<th>770</th>
<th>760</th>
<th>750</th>
<th>740</th>
<th>730</th>
<th>720</th>
<th>710</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam temp. = 100° C. + 100</td>
<td>+1083</td>
<td>+726</td>
<td>+365</td>
<td>1190</td>
<td>+542</td>
<td>-1200</td>
<td>-1502</td>
<td>-1885</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Approximate formula \( dh = 0.0067 \cdot (H - 760) - 0.00020 \cdot (H - 760)^2 \)

(5)

If the barometer has a brass scale correct at \( o \)° C., and \( H \) be the reading in millimetres, the correction for temperature is made approximately by subtracting 0.000163 \( H \) mm.

If \( L \) is the latitude and \( M \) the height of the station in metres above the sea-level, the correction is made by subtracting (0.0026 \( L \) + 0.000002) \( M \) H mm.

The zero of the thermometer is observed immediately after the

TABLE I.-Temperature of Steam at pressures from 790 to 710 mm.
THERMOMETRY

lower by a\(a x_{(L-H)}\) degrees (nearly) than it would have been if the whole of the mercury and stem had been at the temperature \(T\).

The factor \(a\) in this expression is the apparent coefficient of expansion of mercury in glass, and varies from -0.00150 to -0.00165 for different mercury glasses. It is customary to correct for this in order to have an absolute scale of temperature. It is usual to observe \(h\) by means of an auxiliary "stem-thermometer" with its bulb placed near the middle of the emergent column \(h\). Occasionally stem-thermometers with long thin bulbs are employed to avoid the reading of the large emergent column. Owing to conduction along the stem of the thermometer, and to heated vapours near the bath, the mean temperature determined by the thermometer is always less than the true mean temperature. Consequently, an arbitrary reduction is often made in the value taken for \(h\) or \(a\), but this cannot be regarded as satisfactory for work of precision. The only practical method of reducing the correction is to use the number of degrees \(h\) exposed, or, in other words, to work with thermometers of "limited range." Each of these thermometers must then be corrected by comparison with a standard thermometer free from stem-exposure correction, such as a platinum-resistance thermometer. To secure results of any value the correction must be determined at each point under the actual conditions of observation under which the thermometer is to be used. In work of the highest precision it is usual to calibrate the thermometer to cover a range of 300\(^\circ\), as this is the only method of securing an open scale and reasonable accuracy as regards stem-exposure.

To quote the opinion of C. E. Guillaume, one of the leading authorities on mercurial thermometers, "...the corrections are considerable and it cannot generally be determined with sufficient approximation for measurements of precision. The mercury thermometer should then be replaced by other instruments, among which those based on the third law of the electrical resistance of metals hold the first rank."

(V) Scale Correction.—The correction required to reduce the readings of the thermometer to the normal scale may appropriately be called the "scale correction." One of the chief advantages of the mercurial thermometer for scientific purposes is that its scale agrees very closely with the thermodynamical scale. The scale corrections of the standard French thermometers of verre dur have been very carefully determined over the range 0\(^\circ\) to 80\(^\circ\) C. by P. Chappuis using a constant-volume gas thermometer containing hydrogen (at an initial pressure of one metre of mercury at 0\(^\circ\) C) as the representative of the normal scale. His observations between 0\(^\circ\) and 80\(^\circ\) C are represented by the quartic equation

\[ \Delta t = \frac{f(100)}{(61.590 + 47351 \cdot t - 0.001157 \cdot t^2) 	imes 10^{-6}} \]

where \(\Delta t\) and \(t\) represent temperature on the scales of the hydrogen and mercury thermometers respectively. The verre dur mark of thermometers reads 0-1\(^\circ\) C. above the hydrogen thermometer at 40\(^\circ\) C. where the difference of the scales is a maximum. The scale corrections of the Jena-glass thermometers, deduced by comparison with the French verre dur, appear to be practically of the same magnitude, but these thermometers are of much smaller size than the former on either side of the mean. It may be questioned whether it is possible to construct mercury thermometers with scales agreeing more closely that this, owing to inevitable variations in the quality and composition of the glass. According to Guillaume the correction of a French cristal thermometer \(t_*\) differs from that of the standard verre dur thermometer \(t\) by \(0-25\) and 50\(^\circ\) C, according to the cubic formula

\[ \Delta t = \frac{f(100)}{(12.600 - 0.03101) 	imes 10^{-6}} \]

According to scale corrections published elsewhere in the writer in 1893-1894, the scale of an English flat-glass thermometer, compared with a platinum thermometer, does not differ from that of the constant-pressure air thermometer by more than one or two hundredths of a degree between 0\(^\circ\) and 100\(^\circ\) C. But for the comparison of the scales to be of any value, it would be necessary to study a large number of such thermometers. It is possible to obtain much more consistent results if the thermometers are not heated above 50\(^\circ\) C.

The comparisons of the verre dur thermometers with the normal scale at the International Bureau at Paris have not as yet extended beyond 150\(^\circ\) C. The most important observations on the mercury thermometer above these limits appear to be those of Regnault. The later observations of J. M. Crafts were confined to French thermometers of cristal dur (Comptes Rendus, 1882, 95, p. 863). He found the following deviations from the hydrogen scale

\[ L_{0-50} = 150^\circ \left[ 200^\circ - 230^\circ + 250^\circ - 300^\circ ight] + 25^\circ - 27^\circ \]

The correction changes sign at about 230\(^\circ\) C., owing to the rapid increase in the expansion of mercury. Between 0\(^\circ\) and 150\(^\circ\) C. it would appear that the empirical formula of expansion of glass increases more rapidly than that of mercury.

Poggendorff's Correction.—It should be observed that, since in the construction of a mercury thermometer the tube is divided or calibrated so as to read in divisions of equal volume when the whole of the tube is at one temperature, the degrees do not at any rate of matter of fact correspond to equal increments of the apparent expansion of mercury. The scale does not therefore agree in practice with the theoretical formula (1) for the scale of the expansion of mercury, since the expansion is measured in a tube which itself is expanding. A similar argument applies to the method of the weight thermometer, in which the overfill is measured by weight. Even if the expansion of mercury and glass were both uniform, as measured on the thermodynamical scale, the scale of the mercury thermometer, as ordinarily calibrated, would not agree with the thermodynamical scale. The difference can be easily calculated if the actual expansion of mercury and glass is known.

The correction is known as Poggendorff's, but is generally included in the scale correction, and is not applied separately. It has the effect of making the thermometer read higher at temperatures between 0\(^\circ\) and 100\(^\circ\) than it would if the divisions of the stem did not expand as the temperature rose. The amount of the correction for verre dur is given by Guillaume

\[ t = \frac{p - 0}{(43.920 + 0.02400) 	imes 10^{-6}} \]

The value of this correction is between -0.65 and -0.86 at 50\(^\circ\) C.

GAS THERMOMETRY

8. The deviations of the gas thermometer from the absolute scale are so small that this instrument is now universally regarded as the ultimate standard in thermometry. It had, in fact, already been adopted for this purpose by Regnault and others, on a priori considerations, before the absolute scale itself had been invented. Although the indications of a gas thermometer are not absolutely independent of the changes of volume of the envelope or bulb in which the gas is contained, the effect of any uncertainty in this respect is minimized by the relatively large expansibility of the gas. The capricious changes of volume of the bulb, which are so great a difficulty in mercurial thermometry, are twenty times less important in the case of the gas thermometer. As additional reasons for the choice we have the great simplicity of the laws of gases, and the approximate equality of expansion and close agreement of the thermometric scales of all gases, provided that they are above their critical temperatures. Subject to this condition, at moderate pressures and provided that they are not dissociated or decomposed, all gases satisfy approximately the laws of Boyle and Charles. These two laws are combined in the characteristic equation of the gaseous state, viz., \( p = R T \), in which \( p \) is the pressure and \( T \) the volume of unit mass of the gas in question, and \( R \) is a constant which varies inversely as the molecular weight of the gas, and is approximately equal to the difference of the specific heats.

9. Practical Conditions.—In practice it is not convenient to deal with unit mass, but with an arbitrary mass \( M \) occupying a fixed volume \( V \), so that the specific volume \( V/M \) is in fact necessary to measure the pressure \( p \) in terms of mercury columns and not in absolute units. The numerical value of the constant \( R \) is adjusted to suit these conditions, but is of no consequence in thermometry, as we are concerned with ratios and differences only. The equation may be written in the form \( T = pV/RM \), but in order to satisfy the essential condition that \( T \) shall be a definite function of the temperature in the case of a gas which does not satisfy Boyle's law exactly, it is necessary to limit
Thermometry

The application of the equation to special cases which lead to definite, but not necessarily identical, thermometric scales. There are three special cases of practical importance, corresponding to three essentially distinct experimental methods.

(i.) **Volumetric Method** (constant-pressure).—In this method, \( V \) is variable and \( p \) and \( M \) are constant. This method was employed by Gay-Lussac, and is typified in the ideal thermometer with reservoir of variable capacity designed by Lord Kelvin (Encyc. Brit., ed. ix., vol. xi. p. 575, fig. 10). It corresponds to the method ordinarily employed in the common liquid-in-glass thermometer, but is not satisfactory in practice, owing to the difficulty of making a bulb of variable and measurable volume the whole of which can be exposed to the temperature of the surrounding air. The mercury makes contact with another point fixed in the upper end of the barometer tube. The distance between the two contact-points, giving the pressure of the gas in the thermometer, is deduced from the reading of a vernier fixed relatively to the upper contact-point. This method of reading the pressure is probably more accurate than the method of the cathetometer, which is usually employed, but has the disadvantage of requiring a double adjustment.

(ii.) **Manometric Method** (constant-volume or density).—In this method \( p \) is variable and \( V \) and \( M \) are constant. Variations of temperature are observed and measured by observing the corresponding variations of pressure with a mercury manometer, keeping a constant mass, \( M \), of gas enclosed in a volume, \( V \), which is constant except for the unavoidable but small expansion of the material of which the bulb is made.

(iii.) **Gravimetric Method** (constant-pressure).—In this method \( M \) is variable and \( p \) and \( V \) are constant. This method is generally confounded with (i), under the name of the constant-pressure method, but it really corrects to the other method of the weight thermometer, or the "overflow" method, and is quite distinct from an experimental standpoint, although it leads to the same thermometric scale. In applying this method, the weight \( M \) of the vapour itself may be measured, as in Regnault’s mercury-vapour thermometer, or in Deville and Troost’s iodine-vapour thermometer. The best method of measuring the overflow is that of weighing mercury displaced by the gas. The mass of the overflow may also be estimated by observing its volume in a graduated tube, but this method is much less accurate.

In practice, in addition to the above, there are mixed methods in which both \( p \) and \( V \) or \( M \) are variable, such as those employed by Rudberg or Becquerel; but these are unsatisfactory for precision, as not leading to a sufficiently definite thermometric scale. There is also a variation of the constant-volume method (ii.), in which the pressure is measured by the volumetric compression of an equal mass of gas kept at a constant temperature, instead of by a manometer. This method is experimentally similar to (iii.), and gives the same equations, but a different thermometric scale from either (ii.) or (iii.). It will be considered with method (iii.), as the apparatus required is the same, and it is very closely allied to the instrument. We shall consider in detail methods (ii.) and (iii.) only, as they are the most important for accurate work.

10. **Construction of Apparatus.**—The manometric or constant-volume method was selected by Regnault as the standard, and has been most generally adopted since his time. His apparatus has not been modified except in points of detail. A description of his instrument will be found in most text-books on heat.

A simple and convenient form of the instrument for general use is Jolly’s (described in Poggendorff’s Joubelband, p. 82, 1874), and is represented in fig. 3. The two vertical tubes of the manometer are connected by an india-rubber tube properly strengthened by a cotton covering, and they can be made to slide vertically up and down a wooden pillar which supports them; they are provided with clamps for fixing them in any position and a tangent screw for fine adjustment. The connexion between the bulb and the manometer is made by means of a three-way tap. The scale of the instrument is engraved on the back of a strip of plane mirror before silvering, and the divisions are carried sufficiently far across the scale for the reflections of the two surfaces of the mercury to be seen. Each division may be accurately read and an accurate reading obtained without the necessity of using a cathetometer. In order to allow for the expansion of the glass of the reservoir a weight-thermometer bulb is supplied with the instrument, made from another kind of glass, and the relative expansion of the mercury and the glass can thus be determined by the observer himself. The volume of the air-bulb and that of the capillary tube and the small portion of the manometer tube above the small beak of glass, the point of which serves as the fiducial mark, are determined by the instru-

ment-makers. The improvements introduced by Chappuis, of the Bureau des Mètres, in the construction of the constant-volume hydrogen thermometer selected by the committee for the determination of the normal scale, are described in the textbooks (e.g. Watson’s Physics). The most important is the combination of the manometer with a small manometer tube and a single scale, thus reducing the number of readings required. By making the mercury in the branch of the manometer communicating with the bulb of the gas thermometer is adjusted in the usual manner up to a fixed contact-point, so as to reduced the contained gas to a constant volume. Simultaneously the barometer branch of the manometer is adjusted so that the mercury in the manometer makes contact with another point fixed in the upper end of the barometer tube. The distance between the two contact-points, giving the pressure of the gas in the thermometer, is deduced from the reading of a vernier fixed relatively to the upper contact-point. This method of reading the pressure is probably more accurate than the method of the cathetometer which is usually employed, but has the disadvantage of requiring a double adjustment.

11. **Pressure Correction.**—In the practical application of the manometric method there are certain corrections peculiar to the method, of which account must be taken in work of precision. The volume of the bulb is not accurately constant, but varies with change of pressure and temperature. The thermal expansion of the bulb is common to all methods, and will be considered in detail later. The pressure correction is small, and is determined in the same manner as for a mercury thermometer. The value so determined, however, does not apply strictly except at the temperature to which it refers. If the pressure-coefficient were constant at all temperatures and equal to \( e \), the pressure correction, \( dl \), at any point \( t \) of the scale would be obtainable from the simple formula

\[
\Delta t = (\rho_p - 100)/T_0
\]

where \( \rho_p \) is the initial pressure at the temperature \( T_0 \). But as the coefficient probably varies in an unknown manner, the correction is somewhat troublesome, especially at high temperatures. Another very necessary but comparatively small correction is the reduction of the manometer readings to allow for the varying temperatures of the mercury and scale. Since it is generally impracticable to immerse the manometer in a liquid bath to secure certainty and uniformity of temperature, the temperature must be estimated from the readings of mercury thermometers suspended in mercury tubes or in the air near the manometer. It is therefore necessary to work in a room specially designed to secure great constancy of temperature, and to screen the manometer with the utmost care from the source of heat in the instrument. Regnault considered that the limit of accuracy of correction was one-tenth of a millimetre of mercury, but it is probably possible to measure to one-hundredth as a mean of several readings under the best conditions, at ordinary temperatures.

12. **Steam-Exposure.**—In all gas thermometers it is necessary in practice that the part of the gas in contact with the mercury or other liquid in the manometer should not be heated, but kept at nearly constant temperature. The space above the mercury, together with the exposed portion of the capillary tube connecting the manometer with the thermometer bulb, may be called the "dead space." If the volume of the dead space is kept as nearly as possible constant by adjusting the mercury always up to a fixed mark, the quantity of air in this space varies nearly in direct proportion to the pressure, i.e. in proportion to the temperature of the thermometric bulb.
at constant volume. This necessitates the application of a stem-exposure correction, the value of which is approximately given by the formula
\[ dT = \frac{r}{100(T_0)} \]
where \( r \) is the ratio of the volume of the dead space to the volume of the thermometric bulb, and \( T_0 \) is the mean temperature of the dead space, which is supposed to be constant. The magnitude of the correction is proportional to the ratio \( r \), and increases very rapidly at high temperatures. If the dead space is 1 per cent. of the bulb, the correction will amount to only one-tenth of a degree at 50°C, but reaches 5° at 445°C, and 30° at 1000°C. Overflow of the mercury is prevented in the manometer by placing a liquid which wets the tube, as shown in fig. 4, by placing side by side with the tube AB, containing the bulb B to the manometer A, an exact duplicate CD, closed at the end D, and containing liquid in the limb C, which is of the same size as the branch A of the manometer and in direct communication with it. The tube CD, which is called the compensating tube, contains a constant mass of gas under exactly similar conditions of volume and temperature to the tube AB. If therefore the volume of the liquid is always adjusted to be the same in both tubes AB and CD, the mass of gas contained in the tube CD will also be constant, and is automatically eliminated from the equation, as they contain differences only.

14. **Gravimetric Method.**—In the writer's opinion, the gravimetric or overflow method, although it has seldom been adopted, and is not generally regarded as the most accurate, is much to be preferred to the manometric method, especially for work at high temperatures. It is free from the uncertain corrections above enumerated as being peculiar to the manometric method. The apparatus is much simpler to manipulate and less costly to construct. If the pressure is kept constant and equal to the external atmospheric pressure, there is no strain of the bulb, which is particularly important at high temperatures. There is no dead space correction so long as the temperature of the dead space is kept constant. The troublesome operation of reading and adjusting the mercury columns of the manometer is replaced by the simpler and more accurate operation of weighing the mercury displaced, which can be performed at leisure. The uncertain correction for the temperature of the mercury in the manometer is entirely avoided.

The objections which led Regnault to prefer the constant-volume thermometer are frequently quoted, and are generally accepted as entirely conclusive, but it is very easy to construct the constant-pressure or gravimetric instrument in such a manner as to escape the objections which he urges against it. Briefly stated, his objections are as follows: (1) Any error in the observation of the temperature of the gas in the overflow space produces a considerable error in the temperature deduced, when the volume of the overflow is large. This source of error is very simply avoided by keeping the whole of the overflow in melting ice, an expedient which also considerably simplifies the equations. It happened that Regnault's form of thermometer could not be treated in this manner, because he had to observe the level of the mercury in order to measure the pressure and the volume. It is much better, however, to use a separate gauge, containing oil or sulphuric acid, for observing small changes of pressure. The use of ice also eliminates the correction for the variation of density of the mercury by which the overflow is measured. (2) Regnault's second objection was that an error in the reading of the pressure, or in reading the thermometer, was more serious at high temperatures in the case of the constant-pressure thermometer than in the constant-volume method. Owing to the incessant variations in the pressure of the atmosphere, and in the temperature of the mercury columns, he did not feel able to rely on the pressure readings (depending on observations of four mercury surfaces with the cathetometer) to less than a tenth of a millimetre of mercury, which experience showed to be about the limit of accuracy of his observations. This would be equivalent to an error of 0.036° in the constant-volume thermometer at any point on the scale, but with the constant-pressure thermometer the error would be largely greater. (3) The mercury absorbs heat, and the temperature of the mass of mercury in the manometer tube is not the same as that of the free mercury, which experiences a change of temperature. For instance, when the pressure is increased by an amount sufficient to cause the mercury to rise 1 cm in the manometer, the manometer tube walls are raised several centimetres, and the temperature of the mercury in the manometer tube is consequently less than that of the free mercury, since the free mercury is prevented from descending to this lower temperature by the manometer tube walls. This objection is really unsound, because the ideal condition to be aimed at is to keep the **proportional error** of the thermometer. That the proportional error diminishes with rise of temperature, in the case of the constant-volume thermometer, is really of no advantage, because we can never hope to be able to measure high temperatures with greater proportionate accuracy than ordinary temperatures. The great increase of pressure at high temperatures in the manometric method is really a serious objection, because it becomes necessary to work with much lower initial pressures, which implies an inaccuracy of a constant at ordinary temperatures, and in the determination of the initial pressure and the fundamental interval.

15. **Compensated Differential Gas Thermometer.**—The chief advantage of the gravimetric method, which Regnault and others appear to have missed, is that it is possible to make the measurements altogether independent of the atmospheric pressure and of the observation of mercury columns. This is accomplished by using, as a standard of constant pressure, a bulb S, fig. 5, containing a constant mass of gas in melting ice, side by side with the bulb M, in which the volumes of the overflow are measured. The pressure in the thermometric bulb T is adjusted to equality with the standard by means of a delicate oil-gauge G of small bore, in which the difference of pressure is observed by means of a cathetometer microscope. This kind of gauge permits the rapid observation of small changes of pressure, and is far more accurate and delicate than the mercury manometer. The fundamental measurement of the volume of the overflow in terms of the weight of mercury displaced at 0°C involves a single weighing made at leisure, and requires no temperature correction. The accuracy obtainable at ordinary temperatures in this measurement is about ten times as great as that attainable under the best conditions with the mercury manometer. At higher temperatures the relative accuracy diminishes in proportion to the absolute temperature, or the error of determination increases according to the formula
\[ \frac{dT}{T} = \frac{w}{w_T} \]
where \( w \) is the weight of the overflow and \( dw \) the error. This diminution of the sensitiveness of the method at high temperatures is commonly urged as a serious objection to the method, but the objection is really without weight in practice, as the possible accuracy of measurement is limited by other conditions. So far as the weighing alone is concerned, the method is sensitive to one-hundredth of a degree at 100°C, which is far beyond the order of accuracy attainable in the application of the other corrections.

16. **Method of Using the Instrument.**—A form of gas thermometer constructed on the principles above laid down, with the
addition of a duplicate set of connecting tubes C for the elimination of the stem-expansion correction by the method of automatic compensation already explained, is shown in fig. 5 (Proc. R. S. vol. 59, p. 243; Preston’s Heat, p. 133).

In setting up the instrument, after cleaning, and drying and calibrating the bulbs and connecting tubes, the masses of gas on the two sides are adjusted as nearly as possible to equality, in order that any changes of temperature in the two sets of connecting tubes may compensate each other. This is effected with all the bulbs in melting ice, by adjusting the quantities of mercury in the bulbs M and S and equalizing the pressures. The bulb T is then heated in steam to determine the fundamental interval. A weight \( w \) of mercury is removed from the overflow bulb M in order to equalize the pressures again. If \( W \) is the weight of the mercury at \( 0^\circ \) C. which would be required to fill the bulb T at \( 0^\circ \) C., and if \( W-W_i \) is the weight of mercury at \( 0^\circ \) C. which would be required to fill a volume equal to that of the bulb in steam at \( t_i \), we have the following equation for determining the coefficient of expansion \( a \), or the fundamental zero \( T_a \):

\[
d_i = \frac{W}{T_a} = \frac{(w_i + dW_i)(W - w_i)}{T_i}.
\]

Similarly if \( w \) is the overflow when the bulb is at any other temperature \( t \), and the expansion of the bulb is \( dW \), we have a precisely similar equation for determining \( t \) in terms of \( T_a \), but with \( t_i \) and \( w_i \) and \( dW \) substituted for \( t_i \) and \( w_i \) and \( dW_i \). In practice, if the pressures are not adjusted to exact equality, or if the volumes of the connecting tubes do not exactly compensate, it is only necessary to include in \( w \) a small correction \( dw \), equivalent to the observed difference, which need never exceed one part in ten thousand.

It is possible to employ the same apparatus at constant volume as well as at constant pressure, but the manipulation is not quite so simple, in consequence of the change of pressure. Instead of removing mercury from the overflow bulb M in connexion with the thermometric bulb, mercury is introduced from a higher level into the standard bulb S so as to raise its pressure to equality with that of T at constant volume. The equations of the method are precisely the same as those already given, except that \( w \) now signifies the “inflow” weight introduced into the bulb S, instead of the overflow weight from M. It is necessary, however, to take account of the pressure-coefficient of the bulb T, and it is much more important to have the masses of gas on the two sides of the apparatus equal than in the other case. The thermometric scale obtained in this method differs slightly from the scale of the manometric method, on account of the deviation of the gas compressed at \( 0^\circ \) C. from Boyle’s law, but it is easy to take account of this with certainty.

A correction to which the same apparatus may be put is the accurate comparison of the scales of two different gases at constant volume by a differential method. It is usual to effect this comparison indirectly, by comparing the gas thermometers separately with a mercury thermometer, or other secondary standard. It is done by using a pair of bulbs like M and S simultaneously in the same bath, and measuring the small difference of pressure with an oil gauge, a higher order of accuracy may be attained in the measurement of the small differences than by the method of indirect comparison. For instance, in the curves representing the difference between the nitrogen and hydrogen scales (fig. 1), as found by Chappuis by comparison of the nitrogen and hydrogen thermometers with the mercury thermometer, it is probable that the contrary flexure of the curve between 70° and 100° C. is due to a minute error of observation, which is quite as likely to be caused by the increasing aberrations of the mercury thermometer. These temperatures as by the difficulties of the manometric method. It may be taken as an axiom in all such cases that it is better to make use of a very small difference to deduce it from the much more laborious observations of the separate magnitudes concerned.

17. Expansion Correction.—In the use of the mercury thermometer we are content to overlook the modification of the scale due to the expansion of the envelope, which is known as Poggendorff’s correction, or rather to include it in the scale correction. In the case of the gas thermometer it is necessary to determine the expansion correction separately, as our object is to arrive at the closest approximation possible to the absolute scale. It is a common mistake to imagine that if the rate of expansion of the bulb were uniform, the scale of the apparent expansion of the gas would be the same as the scale of the real expansion—in other words, that the correction for the expansion of the bulb would affect the value of the coefficient of expansion \( t/T_a \) only, and would be without effect on the value of the temperature \( t \) deduced. A result of this kind would be produced by a constant error in the initial pressure on the manometric method, or by a constant error in the initial volume on the volumetric method, or by a constant error in the fundamental interval on any method, but not by a constant error in the coefficient of expansion of the bulb, which would produce a modification of the scale exactly analogous to Poggendorff’s correction. The correction to be applied to the value of \( t \) in any case to allow for any systematic error or variation in the data is easily found by differentiating the formula for t with respect to the variable considered. Another method, which is in some respects more instructive, is the following:

Let \( T \) be the function of the temperature which is taken as the basis of the scale considered, then we have the value of \( t \) given by the general formula (1), already quoted in § 3. Let \( dT \) be the correction to be added to the observed value of \( T \) to allow for any systematic change or error in the measurement of any of the data on which the value of \( T \) depends, and let \( dt \) be the corresponding correction produced in the value of \( t \), substituting in formula (1) we have:

\[
dt = 100(T - T_a + dT - dT_a)(T_i - T_a + dT - dT_i)/100.
\]

It is frequently simpler to express the correction in this manner, rather than by differentiating the general formula.

In the special case of the gas thermometer the value of \( T \) is given by the formula

\[
T = \frac{pV}{RM} = \frac{pV}{(M_2 - M_3)},
\]

where \( p \) is the observed pressure at any temperature \( T \), \( V \) the volume of the thermometric bulb, and \( M \) the mass of gas remaining in the bulb. The quantity \( M \) cannot be directly observed, but is deduced by subtracting from the whole mass of gas \( M_3 \) contained in the apparatus the mass \( M_2 \) which is contained in the dead space and overflow bulb. In applying these formulae to deduce the effect of the expansion of the bulb, we observe that if \( dV \) is the expansion from \( 0^\circ \) C. and \( V_0 \) the volume at \( 0^\circ \) C., we may write

\[
V = V_0 + dV, \quad T = \frac{p(V + dV)/R}{M} = \frac{(pV_0/R)(1 + dV/V_0)}{M},
\]

whence we obtain approximately

\[
dT = TdV/V_0.
\]

If the coefficient of expansion of the bulb is constant and equal to the fundamental coefficient \( f \) (the mean coefficient between \( 0^\circ \) and \( 100^\circ \) C.), we may write \( dV/V_0 = f; \) and if we substitute this value in the general expression (14) for \( dt \) we obtain

\[
dt = dT(T - T_0) = f(T - 100).
\]

Provided that the correction can be expressed as a rational integral function of \( t \), it is evident that it must contain the factors \( t \) and \( (t - 100) \), since by hypothesis the scale must be correct at the fixed points \( 0^\circ \) and \( 100^\circ \) C., and the correction must vanish at these points. It is clear from the above that the scale of the gas thermometer is not independent of the expansion of the bulb even in the simple case where the coefficient is constant. The correction is by no means unimportant. In the case of an average glass or
platinum reservoir, for which \( f \) may be taken as 0-000025 nearly, the correction amounts to 0-00625 at 50° C, to 3-833 at 445° C, and to 82-8 at 828° C.

The value of the fundamental coefficient \( f \) can be determined with much greater accuracy than the coefficient over any other range of temperature. The most satisfactory method is to use the bulb of the thermometer as a primary standard and deduce from the expansion of the glass the absolute expansion of mercury as determined by Regnault. Unfortunately the reductions of Regnault have been attacked and the results differ by much as 0-00018153 from 0-000182010 Broch, to 0-00018253 Wüller. The extreme departure represents an uncertainty of 0-00000037, and it is probable that the uncertainties involved in this assumption are greater in the case of glass or porcelain bulbs, on account of the difficulty of perfect annealing, than in the case of metallic bulbs.

Except for small ranges of temperature, the assumption of a constant coefficient of expansion is not sufficiently exact. It is therefore usual to assume that the coefficient is a linear function of the temperature, the equation being expressed in the form \( \frac{dV}{V} = (a + b)T \), where \( a \) is the coefficient of expansion at zero, and \( b \) the correction, which in general will not exceed 0-0015. The uncertainty is of the same order as the uncertainty of the absolute expansion of the bulb, as mentioned above.

It will be observed that the term involving \( b \) becomes of considerable importance at high temperatures. Unfortunately, it cannot be determined with the same accuracy as \( f \), because the conditions of observation at the fixed points are much more perfect than at other temperatures. Provided that the scale of the observations is such that the range of the observations for the determination of the expansi on is co-extensive with the range of the temperature measurements for which the correction is required, the assumption will not greatly exceed 0-00018153 from 0-000182010 Broch, to 0-00018253 Wüller. The extreme departure represents an uncertainty of 0-00000037, and it is probable that the uncertainties involved in this assumption are greater in the case of glass or porcelain bulbs, on account of the difficulty of perfect annealing, than in the case of metallic bulbs.

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Values of the Corrections.— If we take for the gas hydrogen the values 2 c = 1.5 c.c. at 0° C., b = 0.5 c.c., with the index n = 1.5, which was determined by Joule and Thomson, and for helium the values \( a = 3.03 \times 10^{-5} \) and \( b = 0.08 \) c.c., with the index \( n = 1 \), which was determined by others, we obtain for the absolute zero the correction \( \theta_0 - T_0 \) in this case amounting to nearly 1°. The agreement is very good considering the difficulty of determining the small deviations \( c = d = e = f = g = h = i = j = k = l = m = n = o = p = q = r = s = t = u = v = w = x = y = z = 0 \) of the perfect gas law. The experimental values agree with the calculated ones to within the limits of experimental error. The value of the index \( n = 1.5 \) has been taken as the best one for diatomic gases, but this does not satisfy either the observations on the cooling effect or those on the compressibility so well as \( n = 1 \), although it makes comparatively little difference to the value of the absolute zero. The value deduced from Travers’s observation of the pressure-coefficient of helium is 273.13, taking \( n = 1.5 \), which is the probable value of the index for a monatomic gas. The application of the method to the condensible gas carbonic acid is interesting as a test of the method (although the gas itself is not suited for thermometry), because its deviations from the ideal state are large and have been carefully studied. The observations of Joule and Thomson on the cooling effect give \( c = 3.76 \) c.c., \( b = 0.08 \) c.c., \( n = 2 \), provided that allowance is made for the variation of the specific heat with temperature as determined by Berthelot. These values of the index \( n \) are very close, and the correction \( \theta_0 - T_0 \) for the absolute zero, the values of the corrections \( \theta_0 - T_0 \) being 4.6° and 5.8° respectively.

The values of the scale correction \( dt \) deduced from these formulae agree with those experimentally determined by Chappuis in the case of carbonic acid within the limits of agreement of the observations themselves. The calculated values for nitrogen and hydrogen give rather smaller differences than those found experimentally, but the differences themselves are of the same order as the experimental errors. The deviations of hydrogen and helium from the absolute scale are large and have been carefully studied. The observations of Joule and Thomson on the cooling effect give \( c = 3.76 \) c.c., \( b = 0.08 \) c.c., \( n = 2 \), provided that allowance is made for the variation of the specific heat with temperature as determined by the specific heat of nitrogen. These values of the index \( n \) are very close, and the correction \( \theta_0 - T_0 \) for the absolute zero, the values of the corrections \( \theta_0 - T_0 \) being 4.6° and 5.8° respectively.

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19. Limitations.— In the application of the gas thermometer to the measurement of high temperatures certain difficulties are encountered which materially limit the range of measurement and the degree of accuracy attainable. The principal objections are due to the following causes: (a) the changes in the volume of the bulb; (b) leakage, occlusion and porosity; (c) chemical change and dissociation. The difficulties arise partly from defects in the materials available for the bulb, and partly from the small mass of gas enclosed. The troubles due to irregular changes of volume of glass bulbs, which affect the mercury thermometer at ordinary temperatures, become so exaggerated at higher points of the scale as to be a serious source of trouble in gas thermometry in spite of the twentyfold larger expansion. For instance, the volume of a glass bulb will be diminished by one-quarter to one-half of 1 per cent. The first time it is heated to the boiling temperature of boiling sulphur (445° C.). This would not matter so much if the volume then remained constant. Unfortunately, the volume continues to change, especially in the case of hard glass, each time it is heated, by amounts which cannot be predicted, and which are too large to neglect. The most accurate method of taking account of these variations in a series of observations, without recalibrating and refilling and cleaning the bulb, is to assume the known constant value of the coefficient of expansion of the gas, and to calculate the volume of the bulb at any time by taking observations in ice and steam (Phil. Trans. A, 1891, p. 124, p. 125). These changes take place with porcelan at higher temperatures.

Metallic bulbs are far more perfect than glass bulbs in this respect. It is probable that silica bulbs would be the most perfect. The writer suggested the use of this material (in the Journ. Iron and Steel Inst. for 1892), but failed to construct bulbs of sufficient size. W. A. Shenstone, however, subsequently succeeded, and there seems to be a good prospect that this difficulty will soon be minimized. The difficulties of leakage and porosity occur chiefly with porcelain bulbs, especially if they are not perfectly glazed inside. A similar difficulty occurs with metallic bulbs of platinum or platinum-iridium, in the case of hydrogen, which passes freely through the metal by occlusion at high temperatures. The difficulty can be avoided by substituting either nitrogen or preferably argon or helium as the thermometric material at high temperatures. With many kinds of glass and porcelain the chemical action of hydrogen begins to be appreciable at temperatures as low as 200° or 300° C. In any case, if metallic bulbs are used, it is absolutely necessary to protect them from furnace gases which may contain hydrogen. This can be effected either by enclosing the bulb in a tube of porcelain, or by using some method of electrical heating which cannot give rise to the presence of hydrogen. At very high temperatures it is probable that the dissociation of diatomic gases like nitrogen might begin to be appreciable before the limit of resistance of the bulb itself was reached. It would probably be better, for this reason, to use the monatomic and extremely inert gases argon or helium.

20. Other Methods.— Many attempts have been made to overcome the difficulties of gas pyrometry by adopting other methods of measurement. Among the most interesting may be mentioned: (i) The variation in the wave-length of sound. The objection to this method is the difficulty of accurately observing the wave-length, and of correcting for the expansion of the material of the tubes in which it is measured. There is the further objection that the velocity varies as the square root of the absolute temperature. (ii) A similar method, but more promising, is the variation of the refractivity of a gas, which can be measured with great accuracy by an interference method. Here again there is difficulty in determining the exact length of the heated column of gas, and in maintaining the temperature uniform throughout a long column at high temperatures. These difficulties have been ingeniously met by D. Berthelot (Comptes Rendus, 1895, 120, p. 831). But the method is not easy to apply, and the degree of accuracy attainable is probably inferior to the bulb methods. (iii) Methods depending on the diffusion and transpiration of gases through fine orifices and tubes have been put in practice by Barus and by the writer. The method of transpiration, when the resistance of the tube through which the current of gas is passed is measured on the Wilson thermometer (Science, p. 219 of March 1890), is extremely delicate, and the apparatus may be made very small and sensitive, but the method cannot be used for extrapolation at high temperatures until the law of increase of resistance has been determined with certainty. This may be successfully accomplished in the near future, but the law is apparently not so simple as is usually supposed.

On account of these and similar difficulties, the limit of gas thermometry at the present time must be placed at 1500° C., or even lower, and the accuracy with which temperatures near 1000° C. are known does not probably exceed 2° C. Although measurements can be made with greater consistency of this by means of electrical pyrometers, the absolute values corresponding to those temperatures must remain uncertain to this extent, inasmuch as they depend on observations made with the gas thermometer.

Electrical Thermometry

21. The convenience of the mercurial thermometer lies in the fact that it is complete in itself, and can be read without subsidiary appliances beyond a magnifying glass. Its weakness lies in the very limited range of each single instrument, and in the troublesome and often uncertain corrections which must be applied to its readings in all work of precision. Electrical
thermometers have the disadvantage of requiring auxiliary apparatus, such as galvanometers and resistances, the use of which involves some electrical training. But they far surpass the mercurial thermometer in point of range, delicacy and adaptability, and can be applied to many investigations in which ordinary thermometers are quite useless.

There are two kinds of electrical thermometers, which depend on different sensitivities by setting the physical properties of metals: (1) The Thermocouple, or Thermopile, which depends on the production of a thermoelectric force when the junctions of different metals in an electric circuit are at different temperatures; and (2) the Electrical Resistance Thermometer, the action of which depends on the fact that the resistance of a pure metal to the passage of an electric current increases very considerably when the temperature is raised. The theory of the thermocouple is discussed in the article THERMOELECTRICITY, as it possesses many points of interest, and has been studied by many skilful experimentalists. The electrical resistance thermometer is of more recent origin; but although the theory has been less fully developed, the practice of the method bids fair to surpass all others in the variety and accuracy of its applications.

In order to secure the widest possible range and the greatest constancy, in either variety of electrical thermometer, advantage is taken of the great stability and insusceptibility characteristic of the metals of the platinum group. Other metals are occasionally used in work at low temperatures with thermocouples for the sake of obtaining a larger electromotive force, but different sensitivities are attended by considerable uncertainty of reduction, unless the range is greatly restricted.

22. Applications of the Thermocouple.—The principal uses of the thermocouple in thermometry are for measuring high temperatures, and for measuring small differences of temperature, more particularly when the temperature is required to be measured at a point, or in a very small space. The electromotive force of the couple depends only on the temperature at the plane of junction of the two metals, which can be very exactly located. A typical instance of a measurement to which the thermocouple is peculiarly suited, is the determination of the cyclical variations of temperature at accurately measured depths from one-tenth to one-hundredth of an inch in the metal of the cylinder of a heat engine, the interior surface of which is exposed to cyclical variations of temperature in the working of the engine.\textsuperscript{1} The exact depth of the plane of junction can be measured without difficulty to the thousandth of an inch. The insertion of the wire makes the least possible disturbance of the continuity of the metal. There is no lag, as the thermometer itself is part of the metal. The instantaneous value of the temperature at any particular point of the stroke can be measured in the most satisfactory manner by passing a current through the thermocouple at the desired point. A further advantage is gained by measuring only the difference of temperature between two junctions of a thermocouple at different depths, instead of the whole interval from some fixed point. None of these advantages could be secured by the use of any ordinary thermometer; some depend on the fact that the method is electrical, but some are peculiar to the thermocouple, and could not be otherwise attained.

On the other hand, the thermocouple is not well suited for thermometry on account of the smallness of the electromotive force, which is of the order of ten microvolts only per degree for the most constant couples. By the use of very delicate galvanometers it is possible to read to the hundredth or even in special cases to the thousandth of a degree on this small difference, but unfortunately it is not possible to eliminate accidental thermal effects in other parts of the circuit due to small differences of temperature and material. These accidental effects seldom amount to less than one or two microvolts even in the best work, and limit the accuracy attainable in temperature determination to within less than a degree with a single platinum thermocouple. This limit can be surpassed by using couples of greater thermoelectric power and less permanence, or by using a pile or series of couples, but in either case it is doubtful whether the advantage gained in power is not balanced by loss of simplicity and constancy.

A method of avoiding these effects, which the writer has found to be of great use in delicate thermoelectric researches, is to make the whole circuit, including all the terminals and even the slide-wires, of pure copper, and to use in the thermocouples, and other alloys most commonly used for resistances and slide-wires, are particularly to be avoided, on account of their great thermoelectric power when connected to copper. Manganin and platinum-silver are the least objectionable, but the improvement effected by substituting copper is very marked. It is clear that this objection to the use of the couple does not apply so strongly to high temperatures, because the electromotive force of the couple itself is greater, and the accuracy attainable is limited by other considerations.

23. The Resistance Thermometer.—In practice the resistance thermometer is almost invariably made of platinum, since there is very seldom any advantage to be gained by the substitution of baser metals. The instrument is for this reason often referred to simply as the "platinum thermometer." It is important that the platinum should be pure, both for the sake of uniformity and also because the change of electrical resistance with temperature is greatly diminished by impurities. The observation of the fundamental coefficient, which is $-0.0390$ (or rather larger than the coefficient of expansion of a gas) for the purest metal hitherto obtained, is one of the most delicate tests of the purity of the metal. In addition to the constancy and insusceptibility of the metal, a special advantage which is secured by the use of platinum is the close agreement of the thermal scale with the platinum scale of temperature, as defined by the formula

$$pt = 100(R - R_0)/(R_1 - R_0), \quad (24)$$

in which the symbol $pt$ stands for the temperature on the platinum scale centigrade, and $R_0$, $R_1$, and $R_4$ are the observed resistances of the thermometer at the temperatures $pt$, $100^\circ$ and $0^\circ$ C, respectively. A platinum thermometer is generally arranged to read directly in degrees of temperature on the platinum scale, just as a mercury thermometer is graduated in degrees of the mercury scale. The reduction to the scale of the gas thermometer is most conveniently effected by the difference formula

$$t - pt = d(t - 100)/10,000, \quad (25)$$

in which $d$ is a constant, called the difference-coefficient, the value of which for pure platinum is about 1.50, but varies slightly for different specimens. This formula was first given by T. Hall, Trans. Amer. Inst. Elect. Eng. 1893, vol. viii. p. 226; Cullender and Nicolson, Proc. Inst. C. E. vol. cxxxi. p. 1.


\end{footnote}
the comparison of platinum thermometers with the constant-volume nitrogen thermometer by Harker and Chapuis (Phil. Trans. A. 1900), working at the International Bureau at Sèvres, over the range 0° to 650° C. It has also been shown to satisfy very closely the observations on the variation of electrical resistance of other metals over wide ranges of temperature. Although the theoretical explanation of the formula has not yet been given, owing to our ignorance of the true nature of electrical contact and of the calculated constitution of metals, it may be regarded from an empirical point of view as being one of the most accurately established of all thermometric formulae. It will be observed that it also represents the simplest possible type of divergence from the thermodynamical scale.

24. Methods and Apparatus.—The methods of electrical thermometry may be roughly classified under two heads as (1) deflection methods, in which the temperature is deduced from the observed deflection of a galvanometer; and (2) balance methods, in which the resistance or the electromotive force is balanced against a known adjustable resistance or potential difference. The former methods are most suitable for rough work and rapid reading, the latter for accurate measurements. In the practice of the deflection method it is customary to use a movable-coil galvanometer, the sensitiveness of which can be varied by varying the resistance in circuit, or by varying the stiffness of the suspension. The accuracy attainable is of the order of one-half of 1 per cent. on the deflection, and is limited by variations of resistance of the galvanometer, and by the imperfection of the suspension. In any case the scale of the galvanometer should be calibrated for the resistance used.

In this kind of work the thermocouple has the advantage over the resistance thermometer in that the latter requires an auxiliary battery to supply the current; but in many cases this is no disadvantage, because it permits a greater latitude of adjustment, and makes it possible to obtain greater power than with the thermocouple.

In cases where it is desired to obtain greater accuracy without abandoning the quickness of reading which is the principal advantage of the deflection method, it is possible to combine the two, by balancing the part of the potential difference by means of a potentiometer and using the galvanometer for the small changes only. In cases where the greatest accuracy is required, a very sensitive galvanometer should be used, and the whole of the potential difference should be balanced as nearly as possible, leaving very little to depend on the deflection of the galvanometer. The degree of sensitiveness and accuracy obtainable depends primarily on the delicacy of the galvanometer, on the power available, and on the steadiness of the conditions of experiment. For thermometry of precision the resistance thermometer possesses three very great advantages over the thermocouple: (1) The power available, owing to the use of a battery, is much greater; (2) it is possible completely to eliminate the errors due to accidental thermal effects by reversing the battery; (3) the Wheatstone bridge method can be employed in place of the potentiometer, so that the constancy of the battery is immaterial, and it is not necessary to use a standard cell. The conditions to be satisfied in the attainment of the greatest possible accuracy in the measurement of temperature by this method differ somewhat from those which obtain in ordinary measurements of resistance, so that a special type of apparatus has been evolved for the purpose, a brief description of which will be given.

25. Compensated Bridge Apparatus.—It is necessary that the thermometer should be connected to the measuring apparatus by wires or "leads" of considerable length, generally at least two or three metres, in order to avoid exposing the galvanometer and resistance of the wires or other delicate parts of the apparatus, to changes of temperature. The resistance of that part of the leads which is exposed to variations of temperature necessarily changes, and would give rise to serious errors if it were not determined or compensated. The method now generally adopted in accurate work is to compensate the variations of resistance of the leads by an exactly similar pair of dummy leads called the "compensator" and connected as shown diagrammatically in fig. 6. The battery, consisting of a single cell, with wires and reversing key in circuit, is connected to terminals AB of the two equal resistance coils AG, GB, which form the ratio arms of the balance. These coils must be carefully tested for electrical resistance-coefficient, and placed in close proximity to each other so as to be immersed at the same temperature. If they are interwound on the same reel, they must be carefully insulated from each other. In parallel circuit with the ratio coils are connected the compensator CC' and the balancing resistances CE, on one side of the bridge-wire EF, and the compensating resistances FP and the pyrometer and leads PRP' on the other side. The galvanometer is connected to the point G between the ratio coils, and to the sliding contact on the bridge-wire. Since the ratio coils are always equal, the changes of resistance on either side of D are eliminated, and do not affect the balance. Thus the changes of the ratio and leads are balanced by the equal changes of the compensator leads CC' on the other side. As a further refinement, which is of some importance in delicate work, the ends of the compensator leads are connected by a short piece of the same wire as the pyrometer coil. For instance, in observing the variations of temperature of the steam in the cylinder of a steam engine at different points of the stroke with a very delicate thermometer made of wire one-thousandth of an inch in diameter (Proc. Inst. C. E., vol. cxxx., fig. 16, p. 23), the ends of the fine wire attached to the thick leads could not follow the rapid variations of temperature, and it was found necessary to adopt this arrangement. To eliminate the effect of conduction along the leads in the case of the ends of the fine wire coil. The balancing resistances CE are made of some alloy such as manganin or platinum-silver, the resistance of which varies very little with change of temperature. Platinum-silver is probably the best material, as it can be perfectly annealed at a red heat without risk of burning, and is then extremely constant. Unless the box can be kept at an absolutely constant and uniform temperature, which is not impossible but often impracticable, it is necessary to allow for the change of resistance of the balancing coils CE due to change in the temperature of the box. The temperature of the coils cannot be accurately determined with a mercury thermometer unless they are immersed in oil, but it is shown in that case it is necessary to know the temperature-coefficient of each individual coil. A more convenient and accurate method, which eliminates the correction automatically, is to compensate each individual coil of the balancing coils CE by a corresponding compensating coil at FP on the other side of the bridge-wire. The compensating coils are made of platinum, also annealed at a red heat, and each is placed in the box in close proximity to the coil it is intended to compensate. Each balancing coil and its compensator are tested together at various temperatures between 10° and 30° C., and are adjusted until their difference remains a rheostat to the extent that they are in the case of the box. This method of compensation was applied by the writer in 1887, but has not been generally adopted on account of the labour involved in adjusting the coils. The absolute values of these resistances are immaterial, but it is necessary to know the relative values with the greatest possible accuracy. For this reason it is preferable to arrange the resistances in the binary scale, in order to reduce to the smallest possible resistance, or to the sum of all the smaller resistances, the two smallest resistances being made equal. This arrangement permits the greatest accuracy of comparison in the simplest manner with the fewest observations. The bridge-wire EF provides a continuous scale for reading small changes of resistance. Any change of resistance of the pyrometer coil necessitates the movement of the balance point D through an equivalent resistance along the bridge-wire. As the bridge-wire EF provides a continuous scale this can be properly adjusted, by means of a shunt shown in parallel with it in fig. 5, to be an exact submultiple of...
the smallest resistance coil. It is usual also to adjust the resistances of the thermometers so that their fundamental intervals are convenient multiples of this unit, generally either 100, 200, 500, or 1000°. The minimum size of the metal wire in the platinum of the balancing resistances enable the scale to be indefinitely extended. Thus the instrument possesses the great advantage over the mercury thermometer that the most open scale may be easily secured, by allowing the wire to be of double length, and without restricting the range of any thermometer.

26. Errors and Corrections.—It is most instructive to consider the effects of deflections and corrections involved in platinum-resistance thermometers, as they are essentially the same lines as those on which the corresponding errors of the mercury thermometer have already been treated.

1. The changes of zero of the mercury thermometer arise chiefly from the variations of the temperature of the fluid in the bulb of the thermometer and of the inflection of the stem. With the perfect elasticity of the containing tube. In platinum thermometry the containing tube has nothing to do with the reading, and the effect of any possible strain on the wire of the thermometer is minimized by its small dimensions and by the large temperature-coefficient of increase of resistance, which is more than twenty times greater than the coefficient of apparent expansion of mercury in the bulb of the thermometer. It is a complication of the use of a platinum thermometer should be practically negligible, provided that the wire is not strained and contaminated with impurities. It is probable that with ordinary care the changes of zero due to condensation of water, or its evaporation, are not greater than the limit of accuracy of observation, due to other causes at the extreme limit of the range considered.

2. Temperature.—If the thermometer must be regarded as a delicate instrument and be handled with long-continued care. The resistance of the wire will be diminished by using a thermometer, and may be over time; and it is very likely to be greater than the error of the instrument, unless it be well fitted and kept very clean. Mercury cups with large copper terminals, well amalgamated, as used with standard resistance coils, are probably the simplest and most satisfactory method of calibrating the instrument. Accidental thermoelectric effects in the circuit are a possible source of error, as with the thermometer, but they are always very small if the thermometer is properly constructed and is never very important owing to the large error.

3. Pressure.—In every case of thermometer a sufficient safety factor is used, and by reversing the battery. The heating effect of the current through the thermometer is often negligible, but should be measured and allowed for in accurate work. With a current of 0.1 ampere the rise of temperature should not exceed 10° or 12° of a degree. With a delicate galvanometer it is possible to read to the tenth-thousandth of a degree with a current of only 0.002 ampere, in which case the heating effect is generally less than 1/100 of a degree. It can be observed by directing the light from one cell to two, thus doubling the current through the thermometer, and quadrupling the heating effect. The correction is then applied by subtracting one-third of the difference and adding one-third to the correction of one and two cells from the reading with one cell. The correction is always very small, if a reasonably sensitive galvanometer is used, and is frequently negligible, especially in differential work, which is one of the most fruitful applications of the platinum thermometer.

1. Construction of Thermometers.—One of the chief advantages of the platinum thermometer for research work is the endless variety of forms in which it may be made, to suit the particular exigencies of each experiment. It is practically suited for observing the average temperature throughout a length or space, which is so often required in physical experiments. For this reason the wire may be disposed in a straight length, or in a spiral, along the space in question. Again, in observing the temperature of a gas, the platinum wire, on account of its small mass and extremely low rate of heating, is well adapted to any mercury thermometer. The commonest form of platinum thermometer (fig. 7), and the most convenient for laboratory work, is a ½ in. to 2 in. long, wound on a cross of thin mica, and enclosed in a tube, about ½ to 1 in. in diameter, of glass or porcelain according to the temperature for which it is required. The pyrometer contains the conductor, which is placed in the place by passing through mica disks fitting the tube, which serve also to prevent convection currents up and down the tube. The protecting tube of glass or porcelain is fitted with a wooden head A carrying four insulated terminals, PP', CC', to which the pyrometer

27. Electrical Precautions.—The platinum thermometer is so far superior to the mercury thermometer in all the points above enumerated that, if there were no other difficulties, no one would ever think of using the latter, especially in the fields of electrical work. It is essential to obtain the best results. The manipulation and adjustment of a delicate galvanometer present formidable difficulties to the non-electrical observer. Bad contacts, faulty connections, and defective insulation, are not likely to trouble the practised electrician, but present endless possibilities of error to the tyro. A thousand-fold a degree with a current of only 0.002 ampere, in which case the heating effect is generally less than 1/100 of a degree. It can be observed by directing the light from one cell to two, thus doubling the current through the thermometer, and quadrupling the heating effect. The correction is then applied by subtracting one-third of the difference and adding one-third to the correction of one and two cells from the reading with one cell. The correction is always very small, if a reasonably sensitive galvanometer is used, and is frequently negligible, especially in differential work, which is one of the most fruitful applications of the platinum thermometer.
and compensator leads are respectively connected, and which serves the purpose. The instrument of the highest precision these terminals are often omitted, and the leads are directly soldered to a flexible cable in order to avoid possible errors from thermoelectric effects and changes of resistance. The wire may be stranded, but in general the protecting tube must be of porcelain, and the leads of platinum throughout the length of part of the tube which is exposed to high temperatures. The leads must be separate, but if the wire is stranded, the length of the protecting tube is often 5 to 10 ft. In the latter case it is usual to protect the porcelain tubes with an external steel tube, which may be removed for delicate measurements.

In measuring the linear expansion it is a great advantage to employ a thermometer with a bulb or sensitive portion equal in length to the bar or column under test, so as to obtain the mean temperature of the whole length. In measuring the linear expansion of a standard metre or yard, a fine platinum wire enclosed in a glass capillary, or otherwise insulated, is employed, its length being equal to that of the bar.

The same method has been applied by Callendar (Phil. Trans. A, 1887) and Bedford (Phil. Mag., 1898) to the expansion of glass and porcelain at high temperatures, employing a fine wire supported along the axis of the tube under test. An equivalent method, applicable to the expansion of the material itself, is employed by inserting a strip of a platinum tube which is heated by an electric current. This is a very rapid and convenient process, since the mean temperature is not less than 15°. J. J. Joly's melsdometer, which consists of an electrically heated strip for observing the melting-points of metals or other substances in small fragments. If employed in the temperature of a long column of mercury, as in the method of equilibrating columns for determining the absolute expansion of mercury, a platinum thermometer with a bulb equal in length to the column may similarly be employed. In practice this has been employed only on account of the linear instrument is very important because it is practically impossible to ensure perfect uniformity of temperature in a vertical column, 6 ft. or more in length, at high temperatures.

29. Thermocouples.—Where quickness of reading is essential, the mercury thermometer, or the tube form of electric thermometer, is unsuitable. In cases where the thermometer has to be immersed in a conducting liquid or solution, the fine wire forming the bulb may be insulated by enclosing it in a coiled capillary. This method has been employed by Callendar and Barnes and by Jaeger, but the instrument is necessarily fragile, and requires careful manipulation. The radiator may be employed as a null instrument, or the fine wire may be employed with great advantage. This is particularly important in the case of gases owing to the extreme sensitiveness thus obtained and the almost complete immunity from radiation errors. Callendar has used a platinum wire in the form of a flat grid of bare wire mounted on a mica and ebonite frame have been employed by H. Brown (Proc. R. S., 1905, B 76, p. 124) for measuring the temperature of the atmosphere when exposed through a window. They have also employed a thermometer for observing the air-temperature for meteorological purposes in Egypt and Spain with very satisfactory results (Proc. R. S., 1905, A 77, p. 7). The fine wire, owing to its small size and bright metallic surface, very rapidly acquires the temperature of the air, and is very little affected by radiation from surrounding objects, which is one of the chief difficulties in the employment of mercurial thermometers for the observation of the temperature of the air.

For the observation of rapidly varying temperatures, such as those occurring in the cylinder of a gas- or steam-engine, an electrical thermometer is more suitable, but the very fine platinum wire of which any satisfactory instrument is essentially the only available instrument. The temperature at any particular moment may be obtained by setting a mechanical contact-maker to close the circuit at the desired point. The sensitive platinum wire is fixed to the contact-maker in a direction in which it may be moved from half an inch to an inch long, connected by suitable leads to the measuring apparatus as employed by Burstall (Phil. Mag., October 1905) in the gas-engine, and Callendar and Nicolson (Proc. Inst. Mech. Engrs., 1909). Thermocouples of this general character cannot be satisfactorily measured in a gas-engine in this manner, because the radiation error at high temperatures is excessive unless the wire is very fine. The method has been employed by Callendar and Dalby as a dynamical valve (Proc. R. S., A 80, p. 57) for exposing the thermometer only during the admission and compression strokes, and also by Callendar and Lord Rosse (Proc. R. A. Acad., 1896) for the determination of the low temperature sensitivity by an indicator diagram. B. Hopkinsion (Proc. R. S., A 77, p. 387) succeeded in following the course of an explosion in a closed vessel by means of a similar thermometer connected to a galvanometer of short period giving a continuous record on a moving photo-electric galvanometer. The device of Lord Rosse 1200° C. in about 3 of a second, which illustrates the order of sensibility attainable with a fine wire of this size. O. R. Llummer and E. Pringsheim, in their measurements of the ratio of the rate of heat conducts of gold and platinum. In order to sudden expansion, employed a very thin strip of foil with the object of securing greater sensibility. This was a somewhat delicate arrangement, because the fine wire is liable to be injured by air currents, and because the sensibility is not as a matter of fact appreciably improved, whereas the radiation error is increased in direct proportion to the surface exposed. The very thin wire of Nilsson and his assistant, in an improved galvanometer, has been employed for observing rapidly varying temperatures is that the ends of the loop close to the thick leads are affected by conduction of heat to or from the leads, and cannot follow the rapid variations of temperature. This objection may, however, be completely met by first employing the compensating leads with a short length of the same fine wire. The effect is then ended by observing the difference of resistance between two loops of different lengths. Thermocouples of very fine wire have also been employed for similar measurements, but they are more difficult to make than the simple loop of one wire, and the sensibility attainable is much less, owing to the small E.M.F. of a single thermocouple.
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The rise of temperature of the grid when exposed to radiation is measured by its increase of resistance in the usual manner. In order to compensate for changes of temperature of the surrounding air the balancing resistance is made adjustable. Two grids are employed, one of which is placed far from the source of radiation, the other first but screened from radiation. The foil should be as thin as possible consistent with strength, in order to secure the maximum sensitivity. For spectroscopic work a single strip or linear heater is employed. For all other work it is usually necessary to absorb the whole radiation admitted through a given area, two grids are placed with the strips of one behind the interspaces of the other.

Absolute Measurement of Radiation.—In many cases the object is not to secure the maximum degree of sensitiveness, but an absolute measurement of the intensity of the radiant energy, it being sufficient to determine the resistance. For this purpose some form of radiation thermometer is generally employed, but the method of procedure is modified. The earlier methods as exemplified in C. S. M. Pouillé’s pyrheliometer, or L. G. Viélo’s actinometer, consisted in observing the rate of rise of temperature of a small calorimeter, or thermometer of known thermal capacity, when exposed to a given area of the radiation to be measured. To secure greater sensitivity F. P. Crova substituted a copper disk with an attached thermocouple for the calorimeter thermometer. The method is very simple and direct, but has the disadvantage that the correction for external losses is not certain. The conditions are steady and the observation depends on rate of change of temperature. For this reason static methods, depending on the steady temperature finally attained, in which the rate of heating is determined, have come more prominently into favour in recent years. In K. J. Ångström’s pyrheliometer (Acta Soc. Upsala, 1893) two similar blackened disks, one of which is adjusted so that the radiations on the two sides are equal, are employed. In a suitable case in such a manner that either may be exposed to the radiation to be measured while the other is simultaneously heated by an electric current. Attached to the backs of the disks are thermocouples which, from the difference of the resistance and area of the strip, by observing the current required to balance the radiation, the instrument is very quick and sensitive in action, and the method is free from any uncertainty with respect to loss of heat, except that it is the same for the two similar strips at the same temperature. The accuracy of the method is limited chiefly by the measurement of the resistance and width of the strips, and by the difficulty of securing exact similarity and permanence in the attachment of the junctions of the thermocouple. Small differences in this respect may be eliminated by interchanging the strips, but there remain outstanding differences in the resistance of the different instruments of the same make which often exceed 5 per cent.

An electric method proposed by F. Kurilbaum (Wied. Ann., 1895, 65, p. 748) consists in determining the rise of temperature of a bolometer grid by employing a network of bolometer strips as in the pattern of a Wheatstone bridge. The chief source of uncertainty mentioned by Kurilbaum lies in possible differences between the effects of radiation and current-heating near the ends of the strips, the area so affected representing a large proportion of the total area. In Ångström’s method this is not so important because the temperature indicated by the couple is that near the middle of the strip. In the case of the bolometer this end-effect may be compensated, as explained by Callen (Phil. Mag., 1877 A, 46, p. 613). In the same manner as for sensitive thermometers, by employing two similar bolometers with strips of different lengths.

An important defect of all the methods so far considered is that the blackness of the strip is that of the same metal as the one with which the receiving surface is coated. The error is probably small, of the order of 1 or 2 per cent., but is difficult to determine accurately, and varies to some extent with the quality of the metal. The use of molybdenum or tungsten, with their high absorption of great wave-length than for visible rays. If we assume that the loss of heat by conduction and convection is independent of the nature of the material, the error may be small. A second method is the following method. Two bolometer strips, one bright and the other black, but otherwise exactly similar, are simultaneously exposed to the radiation to be measured, and are traversed by the same electric current. The strip will only be hotter than the bright, but the rise of temperature of the bright strip due to the current will be greater than that of the black strip because its emissive power is lower. If the current is adjusted until the temperatures of the two strips are equal the losses by convection and conduction will be equal, and also the rate of generation of heat by the current in each strip. The rise of temperature must therefore be such that each strip loses as much heat by radiation to the cold calorimeter as it gains by the current in each strip to be measured. Assuming Kirchhoff’s law, the ratio of the emissive to the absorptive power is the same for all bodies at the same temperature, and is equal to the emissive power of a perfectly black body (so-called Planck body, or the gas thermometer) divided by the temperature to which it is heated. This is attained, will be the same as that of a perfectly black strip under the same conditions of exposure. The electric current in this method is determined by the rise of temperature, and the result is obtained in terms of the observed rise of temperature and the radiation constant for a black body. The method works well for a source at 1000° C.; but, for a high temperature source, in one of the measuring instruments the temperature of the strips may differ appreciably from their emissive powers.

Another electric compensation method of special interest is the method of the "Peltier cross." A small disk of copper is supported by two thermocouples connected by a cross. One of the couples serves to measure the rise of temperature, while the other is traversed by an electric current, which may be employed to measure the radiation by the heat absorption due to the Peltier effect. The advantage of this method is that the Peltier effect is easily determined from an observation of the thermoelectric power (see THERMOELECTRICITY) in absolute measure, and that it is proportional to the radiant energy falling on the heating current, by conduction from the supporting wires, and changes of temperature in the surrounding case, are readily compensated by mounting two similar disks side by side. Small differences between the heating currents may be measured with reversal of the current, so that the irradiated disk is cooled on the other disk heated by the Peltier effect. The current is adjustable to make the rise of temperature of the two equal, as indicated by the second couple connecting the disks.

The method is about equal in sensitiveness to that of Ångström, but it is easier to secure conditions of exact similarity and to measure the loss of heat by conduction, radiation, and convection, namely, the area of the hole through which the radiation is admitted, and the coefficient of the Peltier effect. The uncertainty due to imperfect blackness of the disks may be eliminated by using two such disks which are exactly the same, or whose temperature may be increased by using thermopiles in place of single couples.

33. Optical or Radiation Pyrometers.—Since the intensity of radiation increases very rapidly with the temperature of the source of heat, it is used for measuring temperature, assuming that the laws connecting radiation and temperature are known. The advantage of this method is that the measurement may be made from a distance, without exposing any part of the measuring apparatus to the destructive action of high temperatures. Apart from the difficulty of calibrating the measuring apparatus to give temperature in degrees Centigrade, the chief objection to the application of the method is the emissive power of the source of radiation. The methods principally employed may be divided into two classes:—(1) Radiation methods, depending on the measurement of the intensity of the black body or the bolometer; (2) optical or photometric methods, depending on the colour or luminous intensity of the radiation as compared with a standard.

Of the radiation methods the simplest in theory and practice depends on observing the total intensity of radiation, which varies as the fourth power of the absolute temperature according to the Stefan-Boltzmann law (see HEAT) for a perfectly black body or full radiator. In applying this method it is necessary to allow for the emissive power of the source, in case this does not radiate as a black body. Thus the emissive power of polished platinum at 1000° A. is only 10 per cent., and that of hot iron oxide about 49 per cent., of that of a black body; and the percentage varies quite differently for different bodies with change of temperature, and also (as shown by Callen, ibid., 77 A, p. 46), the observed radiance of a source with the increasing temperature is not proportional to the fourth power, as above supposed for the measurement. Owing to the rapid increase of radiation with temperature the error due to departure from black body radiation is not so serious as might be imagined at first sight. If the object we are to determine is already at a temperature which was estimated by the radiation formula, assuming the constant for a perfectly black body, the error for red light would be about 12°, for green about 100°, and for blue about 75°. Such errors may be compensated by means of an auxiliary thermometer. The temperature is known from previous experiments, but it is preferable to observe, whenever possible, the radiation from the interior of a body which approximates very closely to that of a black body (see HEAT).

Radiation pyrometers of this type are generally calibrated by the method of sighting on the interior of an electric furnace containing a glass thermometer, and the temperature is measured. The gas thermomter has been employed for verifying the law of radiation up to 1500° C., but the difficulties of obtaining accurate results with the gas-thermometer increase so
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rapidly above 1200° C. that it is questionable whether any advantage is gained by using it beyond this point. The law of radiation has been so closely verified by observations at lower temperatures that the uncertainty involved in applying it at higher temperatures, in the case of a black body is probably less than the uncertainty of the thermometer itself, and much less than the uncertainty of extrapolating an empirical formula for a thermocouple. Thus L. F. C. Holborn and W. Wien (Wied. Ann., 1895, 46, 303) have extrapolated their thermoelectric formula, found the value 1500° C. for the melting-point of palladium, and 1550° C. for the melting-point of gold, from values of 1535° C. for the calorimetric method, and Callendar and Eumorfopoulos (Phil. Mag., 1899, 48) found 1550° C. and 1550° C. by the methods of the expansion and the change of resistance of platinum respectively. By a later thermoelectric extrapolation Holborn and Henning (Berlin Akad., 1905, 12, p. 311) found 1555° C. for the melting-point of palladium, and 1710° C. for that of platinum, values which were strikingly confirmed by J. A. Harker at the National Physical Laboratory, and by Waidner and Burgess at the Bureau of Standards, U.S.A. Holborn and Valentin employing an optical method, in 1905, 1907, 22, p. 1) found 1562° C. and 1783° C. for palladium and platinum respectively. There can be little doubt that the extrapolation of the parabolic formula for the thermocouple at these temperatures is quite untrustworthy (see Thermoelectricity) and that the values given by the electrical resistance method, or by the laws of radiation, are more likely to be correct. Assuming that the total radiation varies as the fourth power of the absolute temperature, a radiation pyrometer can be calibrated for observing the temperature of a black body, as the melting-point of gold, 1662° C. If a black body is employed as the source; and its indications will probably be accurate at higher temperatures, and with some restriction. If the pyrometer is sighted on the interior of a furnace through a small observation hole it will indicate the temperature of the furnace correctly, provided that the temperature is uniform. But it must be remembered that this condition does not generally exist in large furnaces. Suppose, for instance, that there is a temperature gradient in the molten metal on the hearth of a furnace viewed through a thick layer of furnace gases, which are probably at a much higher temperature. It is evident that the radiation from the intervening flame may be much greater than that from the metal, and may introduce serious errors. The same objection applies with greater force to optical pyrometers, as the luminous radiation from gases may be of a high multiplicity. If, on the other hand, it is required to observe the temperature of metal in a ladle before casting, the surface of the metal must be cleared of scum, and it is necessary to know the emissive power of the metal or oxide exposed.

For scientific measurements of temperature by the radiation method, the thermopile, or bolometer, or radiomicrobeter, previously calibrated by exposure to a black body at a known temperature, is directly connected at a known distance to a known area of the source of radiation. The required result may then be deduced in terms of the area and the distance. The use of extraneous optical appliances is avoided as far as possible on account of selective absorption. For practical purposes, in order to avoid trouble some calculations and measurements, an optical arrangement is employed, either lens or mirror, in order to form an image of the source on the receiving surface. Fig. 8 illustrates Fény's mirror pyrometer, in which a mirror M, focused by the pinion P, forms an image of the source on a disk, supported by wires of constantan and silver forming a thermocouple, connected by the brass strips D and R to the terminals b, b'. Observation hole in the wall of the furnace is sighted through the eyepiece O, and is made to overlap the disk slightly. The rise of temperature of the junction is assumed to be proportional to the intensity of radiation, and is indicated by the deflexion of a delicate galvanometer connected to the terminals b, b'. A lens may be substituted for the mirror at high temperatures, but it is necessary to allow for the selective absorption of the lens, and to a less extent for that of the mirror, by a special calibration of the scale.

Assuming Wien's laws for the distribution of energy in the spectrum (see Heat), the temperature of a black body may also be obtained by solving for the wavelength corresponding to maximum intensity in the normal spectrum, which varies linearly as the absolute temperature, or (2) the maximum intensity itself, which varies as the fifth power of the absolute temperature, or (3) the intensity of the radiation of a definite color temperature, or of radiation or colour, which varies as an exponential function, the exact form of which is somewhat uncertain. Methods (1) and (2) are the most trustworthy optical pyrometers, and most the methods of observing by the intensity of monochromatic light forms the basis in theory of the most trustworthy optical pyrometers.

34. Optical or Photometric Pyrometers.—The change of colour of a heated body from red to white with rise of temperature, and the dependence of intrinsic intensity on the temperature, accompaning the change, are among the most familiar methods of estimating high temperatures. For many processes eye estimation suffices, but a much greater degree of accuracy may be secured by the employment of suitable photometers. In Mesuré and Nouël's pyrometric telescope, the estimation of temperature depends on observing the rotation of a quartz polarimeter required to reduce the colour of radiation to a standard tint. It has the advantage of requiring no auxiliary apparatus, but to the naked eye, and of comparison, its indications are not very precise. In the majority of photometric pyrometers, a standard of comparison for the intensity of black body radiation, either a heated body, or an electric glow-lamp, is employed. The optical pyrometer of H. Le Chatelier (Comptes Rendus, 1892, 114, p. 214) was one of the earliest, and has served as a model for subsequent inventors. The standard of comparison of this pyrometer is a black body, the temperature of which is adjusted in the usual manner and viewed in the same field as the image of the source. The two halves of the field are adjusted for equality of brightness, by means of a cat's eye diaphragm and absorption glasses, and are viewed through a red filter giving nearly monochromatic radiation in order to avoid the difficulty of comparing lights of different colours. Assuming Wien's law, the logarithm of the intensity of the radiation of a black body is a linear function of the reciprocal of the absolute temperature, and the instrument can be graduated by observing two temperatures; but it is generally graduated at several points by comparison with temperatures observed by means of a thermocouple.

The Wanner Pyrometer (Phys. Zeits., 1902, p. 112) is a modification of Konig's spectrophotometer, in which the two halves of the field, corresponding to the source and the standard of comparison, are illuminated with monochromatic red light polarized in planes at right angles to each other. The two halves may be observed alternately, and the circle of which is graduated to read in degrees of temperature. The instrument has a somewhat restricted range of maximum sensitivity, and cannot be used below 1200° C. owing to the great loss of light in the complicated optical system. It cannot be sighted directly on the object, since no image is formed as in the Le Chatelier or Fény instruments, but the methods of securing monochromatic light by a direct vision method (see page 810) and of adjusting the instrument of the analyser, are capable of great precision, and lead to simple theoretical formulae for the ratio of the intensities in terms of Wanner's law.

The Fény Absorption Pyrometer (Journ. Phys., 1904, p. 32) differs from Le Chatelier's only in minor details, such as the replacement of the cat's eye diaphragm by a pair of absorbing glass wedges. The principles of its action and the method of calibration are the same. The pyrometers of Morse, and of L. F. C. Holborn and F. Kuribaum depend on the employment of a glow lamp filament as standard of comparison, the current through which is adjusted to maintain the intrinsic brilliance of the filament equal to that of the source. When this adjustment is made the filament becomes invisible against the image of the source as background, and the temperature of the source may be determined from an observation of the filament required. The filament is either observed, but the lamps remain fairly constant provided that they are not overheated. To avoid this, the source is screened by absorption glasses (which also require calibration) in observing high temperatures. Except at low temperatures the comparison is made by placing a red glass before the eye-piece. At low temperatures a special advantage of the glow-lamp as a standard of comparison is that the red glass is immersed, and thus prevents the minimum temperature occurring, or will register the temperature at a particular time or place. A recording instrument is one constructed to give a continuous record of the temperature, and requires a revolving drum or some equivalent clockwork mechanism.
thermopylae—théroigne de méricourt

for recording the time. The most familiar types of registering thermometers are modifications of the common liquid-in-glass thermometer.

John Rutherford's maximum, invented before 1790, was an ordinary mercurial thermometer placed horizontally; the column provided with a steel wire was laid under the point reached and was drawn down again to the liquid by a magnet when the instrument had to be reset. It is little used now. The Bunsen maximum, invented by Bunsen and made by constructing a section near the bulb, past which the mercury easily expands but cannot return when the temperature falls, since the column breaks at the narrowed point when the fluid in the bulb begins to contract. The instrument is provided with a fresh observed point at the end of the portion of the column back down the tube. The clinical thermometers used by physicians are instruments of this type, and are made with a fairly open scale to read only in the neighbourhood of the patient's rectum or elsewhere the temperature of the body. A Walford maximum a portion of the mercury is separated from the rest by a minute bubble of air. It is placed horizontally and as the temperature rises the detached portion of the column is pushed forward but is not withdrawn when the main column retreats towards the bulb in cooling. It is set for a new observation by bringing it into a vertical position and tapping it slightly. By reducing the length of the index and the bore of the stem this thermometer may be made suitable for use in any position without altering its register.

The minimum thermometer in most common use is that of Phillips and Co. patented in 1790. It is a spirit thermometer, preferably filled with amyl alcohol, to reduce risk of distillation, in the column of which a small porcelain index is included. The instrument is clean and, being graduated, is kept in a horizontal and, when not in use, is drawn back through surface tension by the end of the column. When the temperature rises the liquid flows past the index, which is left at the lowest point attained. To prepare the instrument for use, it is inverted until the index is brought opposite the end of the column. The Six's combined maximum and minimum thermometer (Phil. Trans., 1782) consists of a U-tube, the bend of which is filled with mercury. One leg contains spirit above the mercury and terminates in a bulb also full of spirit. The other leg also contains a column of spirit above the mercury, but terminates in a bulb containing air and vapour of spirit without any increase of pressure in the arm where the bulb expands; the mercury in consequence is pushed round the bend and rises to a greater or less extent in the other leg, carrying before it a steel index which thus marks the maximum temperature. The spirit in the arm of the thermometer moves back carrying with it a second index which marks the minimum temperature. The instrument is set by drawing down the two indices upon the two ends of the mercury column by the means of a magnet.

With a mercury thermometer a continuous record of temperature can only be obtained by the aid of photography, a method which has been used for many years at some meteorological observatories, but which cannot be generally employed on account of the expense and the elaborate nature of the apparatus required. The commonest type of recording thermometer works on the principle of an expansion thermometer. The bulb of a bent, curved metallic tube filled with liquid, the expansion of which with rise of temperature tends to straighten the tube. The movements are recorded on a revolving drum by a pen carried at the end of a link fixed to the tube, or the bulb, or the index of instruments employed for rough work, but it has a very limited range and is unsuitable for accurate work on account of want of sensitiveness and of great liability to change of zero, owing to imperfect elasticity of the metal tube. For accurate work, especially at high temperatures, electrical thermometers possess many advantages, and are often the only instruments available. They are comparatively free from change of zero over long periods, and the thermometer or pyrometer itself may be placed in a furnace or elsewhere at a considerable distance from the registering apparatus. The principal types are the thermocouple and the platinum resistance thermometer, which may be employed for registering purposes, without altering the thermometer itself, by connexion to a suitable recording mechanism. The methods in use for recording the indications of electrical thermometers may be classified as in § 24 under the headings of (1) deflexion methods and (2) balance methods. Deflexion methods, in which the deflexion of the galvanometer is recorded, are more suitable for rough work, and less applicable to accurate measurements. The most delicate and most generally applicable method of recording the deflexions of a mirror galvanometer is by photographing the movements of the spot of light on a moving film. Almost any required sensitiveness may be obtained, but the record cannot be inspected at any time without removal and development. Since the forces actuating the needle of the galvanometer are small, it is necessary to set off a pen or marking point directly to the end of the pointer for recording a continuous trace on a revolving drum, because the errors due to friction with the recording sheet would be excessive. This difficulty has been avoided in many electrical instruments by depressing the pointer so as to mark the paper only at regular intervals. By this means the instrument can be divided into parts, and the record thus obtained is discontinuous, but is sufficient for many purposes. For accurate measurement, or for obtaining an open scale over a particular range of temperature, the instrument is employed by means of a form of balance method as already explained in § 24.

36. Electric Recorder, Balance Method.—The application of the electric balance to thermometry is of great advantage for noting changes of resistance or electromotive force has been effected by employing a galvanometer of the movable coil type as a relay. The deflexion of the galvanometer to right or left, according as the resistance of E.M.F. increases, or diminishes, is magnified by one or other of a pair of motors for moving the contact point on the bridge wire and the recording pen on the drum in the corresponding direction. A continuous record free from friction error may be obtained. The galvanometer does not actuate the pen directly. With an electrical resistance thermometer it is possible in this way to obtain continuous pen-and-ink records on a scale of an inch or more to the degree, reading a few parts practically free from zero error over any desired range from −200° to +1500° C.

With a thermocouple, employing the potentiometer method, the same apparatus can be used with advantage, but it is not possible to obtain a record.

The attainment of sufficient delicacy in the relay mechanism turns on the employment of a rotating or vibrating contact in a manner similar to that employed with the magnetic balance recorder type. This was first successfully effected by Callendar (Trans. R. S. Canad., 1897) for records of radiation and temperature, and by Selfridge for submarine telegraphy by S. G. Brown and by A. Muirhead. The Callendar's electrical recorder, as arranged for temperature measurements, is described and illustrated in Engineering, May 26, 1899, and in a pamphlet on Electric Records, 1902, published by Selfridge. These recording instruments of both types are now coming into extensive use for industrial purposes in the measurement of furnace temperatures, &c., for which they are particularly suitable, because the recording apparatus can be placed at any distance from the furnaces which may be considered most convenient, and can be connected to any one of a set of furnaces in succession whenever it is desired to obtain a record.

Authorities.—There is no special work on the subject of thermometry in English, but most of the principles and methods are described in text-books on heat, of which Preston's Theory of Heat has been very extensively used for the purposes of the present work. In Tutton's Electrical Thermometry the reader should consult the original papers, the most important of which have been cited. The greater part of the recent work on the subject will be found in the publications of the Bureau International des Poids et Mesures (Paris), of the Reichsanstalt (Berlin), of the Bureau of Standards, U.S.A. (Washington), and of the National Physical Laboratory (London). (H. L. C.)

Thermopylae (Gr. θερμόπυλη, hot, and πυλή, gate), a Greek pass leading from Locris into Thessaly between Mount Oeta and the sea (Maiiac Gulf). It is chiefly famous for the heroic defence made by Leonidas, the Spartan king, with 300 Spartan soldiers against the Persian army of Xerxes advancing upon Greece. For details of the campaign see History (and authorities there quoted). In I. C. 63 B.C. Brennus and the Gauls were checked for several months by a Greek army under the Athenian Calippus, and in 191 Antiochus of Syria vainly attempted to hold the pass against the Romans under M'. Aelius Gabrio. In the time of Leonidas the pass was a narrow track (probably about 14 yds. wide) under the cliff. In modern times the deposits of the Spercheios have widened it to a breadth of 1½ to 3 m. broad. The hot springs from which the pass derived its name still exist close to the foot of the hill. There is one large spring used as a bath and four smaller ones, and the water, which is of a bluish green colour and contains lime, salt, calcium and sodium, is said to produce good effects in cases of scrofula, sciatica and rheumatism. The accommodation for bathers is, however, quite inadequate.

For the topography see Grundy, Great Persian War, p. 279-291.

Théroigne de Méricourt, Anne Joseph (1752–1817), a Frenchwoman who was a striking figure in the Revolution, was born at Marcourt (from a corruption of which name she took her usual designation), a small town in Luxembourg, on the banks of the Ourthe, on the 13th of August 1752. She was the daughter of a well-to-do farmer, Peter Théroigne. She
appears to have been well educated, having been brought up in the convent of Robermont; she was quick-witted, strikingly handsome in appearance and intensely passionate in temper; and she had a vigorous eloquence, which she used with great effect upon the mobs of Paris during that short space of her life (1789–93) which alone is of historical interest. The story of her having been betrayed by a young seigneur, and having in consequence devoted her life to avenge her wrongs upon aristocrats, a story which is told by Lamartine and others, is unfounded, the truth being that she left her home on account of a quarrel with her stepmother. In her capacity as a singer she received rapturous applause in Paris in 1785, and in Genoa in 1788, where she was a concert singer. In 1789 she returned to Paris. On the outbreak of the Revolution, she was surrounded by a coterie of well-known men, chief of whom were Pétion and Desmoulins; but she did not play the rôle which legend has assigned her. She took no part in the taking of the Bastille nor in the days of the 3rd and 6th of October, when the women of Paris brought the king and queen from Versailles. In 1790 she had a political salon and spoke once at the club of the Cordeliers. The same year she left Paris to take up residence in London. In 1792, she was back in Paris in 1792, crowned of course with fresh laurels because of her captivity, and resumed her influence. In the clubs of Paris her voice was often heard, and even in the National Assembly she would violently interrupt the expression of any moderating views. Known henceforth as "la belle Lilu," she appeared in public dressed in a riding habit, a plume in her hat, a pistol in her belt and a sword dangling at her side, and excited the mob by violent harangues. Associated with the Girondists and the enemies of Robespierre, she became in fact the "Fury of the Gironde." She commanded in person the 3rd corps of the so-called army of the faubourgs on the 20th of June 1792, and again won the gratitude of the people. She shares a heavy responsibility for her connexion with the riots of the 10th of August. A certain contributor to the journal, the Journal des Apôtres, Suleau by name, earned her hatred by associating her name, for the sake of the play upon the word, with a deputy named Populus, whom she had never seen. On the 10th of August, just after she had watched approvingly the massacre of certain of the national guard in the Place Vendôme, Suleau was pointed out to her. She sprang at him, dragged him among the infuriated mob, and he was stabbed to death in an instant. She took no part in the massacres of September, and, moderating her conduct, became less popular from 1793. Towards the end of May the Jacobin women seized her, stripped her naked, and flogged her in the public garden of the Tulleries. The following year she became mad, a fate not surprising when one considers her career. She was removed to a private house, thence in 1800 to La Salpêtrière for a month, and thence to a place of confinement called the Petites Maisons, where she remained—a raving maniac—until 1807. She was then again removed to La Salpêtrière, where she died, never having recovered her reason, on the 9th of June 1817.

See M. Pellet, Étude historique et biographique sur Théorie de Mercour (1886); L. Lacour, Les Origines du féminisme contemporain. Trois femmes de la Révolution (Paris, 1906); Vincent de Rave, La Vraie Théorie de Mercour (Paris, 1903); E. and J. de Gouv-
court, Portraits intimes du XVIIIe siècle (2 vols., 1857–58); and the play Théorie de Mercour of M. Paul Hervieu, produced at the Théâtre Sarah Bernhardt in 1902.

**THERSITES**

THERSITES, the ugliest man in the Greek camp before Troy, celebrated for his biting tongue. The special objects of his attack were the leaders of the army, and Homer (Iliad, ii. 212) tells how he was chastised by Odysseus for daring to abuse the commander-in-chief. According to a later story, Achilles, after he had slain the Amazonian queen Penthesilea, bitterly lamented her death; for this he was reviled by THERSITES, who even insulted the body of the dead queen. Achilles thereupon slew THERSITES with a blow of his fist (Quint. Smyrn. i. 722). There was a play by Chaeremon called Achilles the Thersites-slayer, probably a satyric drama, the materials of which were taken from the *Antiopeia of Arctinus.*

**THESAURUS**

The word "Thesaurus" in English is derived from the Greek word *Thesaurus,* which means "treasure house," and it is often used to refer to a collection of information or knowledge on a particular subject. It can also refer to a collection of works of art or artifacts. The term is commonly used in the context of a dictionary or lexicon, as being a "treasure house" or store of knowledge.

**Thesaurus**, the great hero of Attic legend, son of Aegeus, king of Athens, and Aethra, daughter of Pittheus, king of Troezen. Thus through his father he was descended from Erechtheus and the original stock of Attica; through his mother he came of the Asiatic house of Pelops. The legend relates that Aegeus, being childless, went to Pittheus, who contrived that Aegeus should have intercourse with his daughter Aethra, and that in due time Aethra brought forth Theseus. It was given out that the child's father was Poseidon, the god of Troezen, and that Aethra raised a temple to Athena Apaturia, at which Troezenian maidens used to dedicate their griddles before marriage. For his tutor and guardian young Thesaurus had one Cnannias, to whom, down to Pindar's time, the Athenians were wont to sacrifice a black ram on the eve of the festival of Theseus. On passing out of boyhood Theseus was sent by his mother to Athens. He encountered many adventures on the way. First he met and slew Periphetes, surnamed Corynetes (Clubman). At the isthmus of Corinth dwelt Sinis, called the Fine-Bender, because he killed his victims by tearing them asunder between two pine-trees. Thesaurus hoisted the Fine-Bender on his own pine-tree. Next Theseus defeated the Crommyonian sow (or boar). Then he flung over a cliff the wicked Sciron, who used to kick his guests into the sea, while perforce they washed their feet. In Eleusis Theseus wrestled with Cercyon and killed him. A little farther on he slew Procrustes, who fitted all comers to his only bed: if his guest was too short for the bed, he stretched him out; if he was too long, he cut him down to the requisite length. As he passed through the streets of Athens, his curls and long garment reaching to his ankles drew on him the derision of some masons, who were putting on the roof of the new temple of Apollo Delphinios: "Why," they asked, "was there such a pretty girl out alone?" In reply Theseus took his trollops out of their cart and flung them higher than the roof of the temple. He found his father married to Medea, who had fled from Corinth. Being a witch, she knew Theseus before his father did, and tried to persuade Aegeus to poison his son; but Aegeus recognized him by his sword and took him to his arms. Theseus was now declared heir to the throne, and the Pallantids, who had hoped to succeed to the childless king, conspired against Theseus, but he crushed the conspiracy. He then attacked the fire-breathing bull of Marathon and brought it alive to Athens, drove the Crommyonian sow (or boar) from the fields of Delphi, and looked down on the house of the Cretan Minotaur (g.r.), whom Theseus slew by the aid of Ariadne (g.r.). While Theseus was in Crete, Minos, 1

1 The story of Theseus is a strange mixture of (mostly fictitious) political tradition, of associations in myth invented to explain otherwise unknown acts of ritual and of a cycle of tales of adventure analogous to the story of the labours of Hercules. All the passages in the Iliad and Odyssey in which his name or allusions to his legend occur are regarded with more or less probability as spurious (but see O. Gropius, Gr. Myth., i. p. 581).

2 The sons of Pallas, the brother of Aegeus.
Theseus wished to see whether Theseus was really the son of Poseidon, flung his ring into the sea. Theseus dived and brought it up, together with a golden crown, the gift of Amphitrite. On the return voyage the ship touched at Naxos, and there Theseus abandoned Ariadne. He landed also at Delos, and there he and his comrades danced the crane dance, the complicated movements of which were meant to imitate the windings of the Labyrinth. In historical times this dance was still danced by the Delians round a horned altar. Theseus had promised Antiope, if he returned successful, the black sail with which the fatal ship always put to sea should be exchanged for a white one. But he forgot his promise; and when Aegeus from the Acropolis at Athens descried the black sail out at sea, he flung himself from the rock and died. Hence at the festival which commemorated the return of Theseus there was always weeping and lamentation. Theseus now carried out a political revolution in Attica by abolishing the semi-independent powers of the separate townships and concentrating those powers at Athens, and he instituted the festival of the Panathenaea, as a symbol of the unity of the Attic race. Further, according to tradition, he instituted the three classes or castes of the eumatrids (nobles), geomori (husbandmen), and demiurgi (artisans). He extended the territory of Attica as far as the isthmus of Corinth.

He was the first to celebrate in their full pomp the Isthmian games in honour of Poseidon; for the games previously instituted by Hercules in honour of Melicertes had been celebrated by night, and had partaken of the nature of mysteries rather than of a festival. Of Theseus’s adventures with the Amazons there were different accounts. According to some, he sailed with Hercules to the Euxine, and there he won the Athenian Antiope as the meed of valour; others said that he sailed on his own account, and captured Antiope by stratagem. Thereafter the Amazons attacked Athens. Antiope fell fighting on the side of Theseus, and her tomb was pointed out on the south side of the acropolis. By Antiope Theseus had a son, Hippolytus. On the death of Antiope, Theseus married Phaedra. She fell in love with her stepson Hippolytus, who, resisting her advances, was accused by her to Theseus of having attempted her virtue. Theseus in a rage imprecated on his son the wrath of Poseidon. His prayer was answered: Hippolytus was cast into the sea, a bull leaped out of the waves terrified his horses, and he was thrown and killed. This tragic story is the subject of one of the extant plays of Euripides.

The famous friendship between Theseus and Pirithous, king of the Lapiths, originated thus. Hearing of the strength and courage of Theseus, Pirithous desired to put them to the test. Accordingly he drove away from Marathon some cows which belonged to Theseus. The latter pursued, but when he came up with the robber the two heroes were so filled with admiration of each other that they swore brotherhood. At the marriage of Pirithous to Hippodamia (or Deidamia) a fight broke out between the Lapiths and Centaurs, in which the Lapiths, assisted by Theseus, were victorious, and drove the

Centaurs out of the country. Theseus and Pirithous now carried off Helen from Sparta, and when they drew lots for her she fell to the lot of Theseus, who took her to Aphidnae, and left her in charge of his mother Aethra and his friend Aphidnus. He now descended to the lower world with Pirithous, to help his friend to carry off Proserpine. But the two were caught and confined in Hades till Hercules came and released Theseus. When Theseus returned to Athens he found that a sedition had been stirred up by Menestheus, a descendant of Erechtheus, one of the old kings of Athens, and Thisbe, younger sister of Chiranthus. Theseus in despair sent his children to Euboea, and after solemnly cursing the Athenians sailed away to the island of Scyros, where he had ancestral estates. But Lycomedes, king of Scyros, took him up to a high place, and killed him by casting him into the sea. Long afterwards, at the battle of Marathon (490 B.C.), many of the Athenians fancied they saw the phantom of Theseus, in full armour, charging at their head against the Persians. When the Persian war was over the Delphic oracle bade the Athenians fetch the bones of Theseus from Scyros, and lay them in Attic earth. It fell to Gimon’s lot in 490 B.C. to discover the hero’s grave at Scyros and bring back his bones to Athens. They were deposited in the heart of Athens, and henceforth escaped slaves and all persons in peril sought and found sanctuary at the grave of him who in his life had been a champion of the oppressed. His chief festival, called Theseia, was on the 8th of the month Pyaneposin (October 21st), but the 8th day of every other month was also sacred to him.

Whatever we may think of the historical reality of Theseus, his legend almost certainly contains recollections of historical events, e.g. the areswode, whether by this we understand the political centralization of Attica at Athens or a local union of previously separate settlements on the site of Athens. The birth of Theseus, then points towards the year 1260 B.C. With this agrees the legend of the contest between Athena and Poseidon for supremacy on the acropolis of Athens, for Theseus is intimately connected with Poseidon, the great Ionian god. As the father of Theseus, has been identified by some modern scholars with Poseidon.

The well-preserved Doric temple to the north of the acropolis at Athens, commonly known as the Theseum, was long supposed to be the sanctuary in which the bones of Theseus repose. But archaeologists have generally abandoned this conjecture. There were several (according to Philochorus, four) temples or shrines of Theseus, of which one stood nominally at Athens, and all scholars have found one of them in the neighbourhood of Peiraeus.

Our chief authority for the legend of Theseus is the life by Plistrollerch, which is a compilation from earlier writers; see also G. Gillot, "Theseus", in "Reisen alterthumer", t. (1892), pp. 305-306; A. Baumeister, "Denkmäler des klassischen Alterthums", ill. (1888).

There is a modern Greek folk-tale which preserves some features of the legend of Theseus and the Minotaur, but for the Minotaur has been substituted a seven-headed snake. See Bernhard Schmidt, "Griechische Märchen, Sagen und Volkslieder" (1877), p. 118 sq.

Among modern monographs on Theseus may be mentioned:

A. Schulz, "De Theseo" (Breslau; 1874); Th. Kaesel, "De Thesei Synkloismo" (Dillingen, 1882); E. Prigge, "De Thesei rebus gatis" (1883); O. Wolf, "Zur Theseumage" (Darmst. 1892); see also O. Gruppe, "Griechische Mythologie", i. pp. 581-608; J. E. Harrison, "Mythology and Monuments of Ancient Athens" (1890); "Der Theseische Synkloismo", in C. F. Hermann's "Lichtbruch der Einehen Wandel des Staatensystems", i. (1892), pp. 305-306; A. Baumeister, "Denkmäler des klassischen Alterthums", ill. (1888).

THESMOPHORIA, an ancient Greek festival, celebrated by women only in honour of Demeter Oerodaphos. At Athens, Abyd, and perhaps Sparta, it lasted three days. At Athens the festival took place on the 11th, 12th and 13th of the month.

The Athenian festival in October, popularly supposed to commemorate the return of Theseus from Crete, is interesting, as some of its features are identical with those of harvest-festivals still observed in the north of Europe. Thus the Athenians at each autumn reaper’s festival baked loaves of bread, &c., which was carried in procession and hung over the door of the house, where it was kept for a year, is the Erntemai (Harvest-may) of Germany. See W. Mannhardt, "Antike Wald- und Feld-Kulte" (1877), p. 212 sq.

See Erläuternder Text to the "Karten von Attika" (Berlin, 1881), p. 37 sq.
The Thesmophoria (24th, 25th and 26th October), the first day being called Anodos (ascent), or, according to others, Kathodos (descent), the second Nesteia (fast), and the third Kalligeneia (fair-born). If to these days we add the Thesmophoria, which were celebrated on the 10th at Halimus, a township on the coast near Athens, the festival lasted four days. If we further add the festival of the Stenia, which took place on the 9th, the whole festival lasted five days. The Stenia are said by Philostratus (Life of Apollonius of Tyana, viii. 34), 16th century, that the women sat on the ground and fasted. As to what place on the Kalligeneia we have no information. Nor can we define the time or nature of the secret ceremony called the "pursuit," or the "Chalidchian pursuit," and the sacrifice called the "penalty." 16 During the Thesmophoria (and for nine days previously, if Ovid, Met., x. 434, is right, and refers to the Thesmophoria) the women abstained from intercourse with their husbands, and to fortify themselves stove their beds with Agnus castus and other plants. The women of Milethus stove their beds with pine branches, and the same custom is observed by Demeter. Whether unmarried women were admitted to the festival seems doubtful; in Lucian's time it would appear that they were. 18 The women of each deme (township) elected two married women of their number to preside over them at the festival; and every married man in the township who possessed property to the value of three talents had to provide a feast for the women on behalf of his wife. 19 During the festival the women seem to have been lodged by twos in tents or huts, probably erected within the sacred precincts of the Thesmophoria. They were not allowed to eat the seeds of the pomegranate or to wear garlands of flowers. Prisoners were released at the festival, 20 and during the Nesteia the law-courts were closed and the senate did not meet. 21 Aristophanes' play on the festival sheds little light on the mode of its celebration. At Thebes the Thesmophoria were celebrated in summer on the acropolis (Cadmeia); at Eretria during the Thesmophoria the women cooked their meat, not at fires, but by the heat of the sun, and they did not invoke Kalligeneia (which seems to mean that they did not celebrate the last day of the festival); at Syracuse during the festival, cakes, called mylloi, made of sesame and honey in the shape of pudenda melobeleia, were handed round. 22 Agrigentum, Ephebus and Dryme, in Phocis, had also their Thesmophoria. 19

The above was nearly all that was known about the Thesmophoria down to 1870. In that year E. Rohde published in his 'Die Festen des Kynoge', 248 sq., the name of Lucian (Dial. Meret., ii. 1), which he discovered in the Vatican MS. Palatinus 73, and which furnishes some curious details about the festival. It also furnishes some corrupt passages of Clemens Alexandrinus and Pausanias, the true history of which had been divined by Lobec (Agaephamus, p. 828). The substance of the scholion is this. When Persephone was carried off by Pluto, a swineherd called Eubules was herding his swine at the spot, and his herd was engulfed in the chasm down which Pluto had vanished with Persephone. Accordingly at the Thesmophoria it was customary, in memory of Eubules, to fling pigs into the chasms of Demeter and Persephone.('These "chasms" may have been natural caverns or perhaps vaults. The scholiast speaks of them also as adyta and megaras'). 23 In these adyta or megaras there were supposed to be serpents, which guarded the adyta and consumed all the flesh of the pigs that were thrown in. The decayed remains of the flesh were afterwards fetched by women called 'drawers' (anuletai), who, after observing rules of ceremonial purity for three days, descended into the caverns, and, frightening away the serpents by clapping their hands, brought up the remains and placed them on the altars. 23 Whoever got a portion of this decayed flesh and sowed it with the seed of the

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1 [Or, mother of a fair daughter, i.e. Persephone.] Schol. on Aristoph., Thesmophoriae, 80 and 875: Diog. Laërt., ix. 43: Hesychius, s.v. προγλυπος (the reading here is uncertain) and ἄγνως: Aleiphron, iii. 39; Athenaeus, vii. 307 f. Plutarch (Vit. Demet., 30) states that the Nesteia took place on the 16th of Pyanepos, but in this he stands alone.

2 Schol. on Aristoph., Thesm., 80; Photius, Lex., s.v. θεσμομορφος χήμων ὅ (where Naber should not have altered the MS. reading ὅ into ὅ).

3 Thesmophoria at Halimus is mentioned by Pausanias (i. 31, 1).

4 Plut., Solon, 5; for this passage probably refers to the Thesmophoria of Halimus (see Expl. l. c. Text to the Karten von Altika, i. 1 sq.) The Thesmophoria at Halimus is mentioned by Pausanias (i. 31, 1).

5 For Plutarch, Arist., Thesm., 875, suppose that the day was so called because the women ascended to the Thesmophoria, which (according to the scholiast) stood on a height. But no ancient writer mentions a procession from Halimus. For Thesmophoria, see note on scholiast, Eubuleus, Conviv., on the Schol. ad ill. 6. For the statement that at one part of the festival (commonly assumed, by the writers who accept the statement, to be the Anodos) the women carried on their heads the "books of the law," we have only the authority of the scholiast on Theocritus, iv. 25, who displays his ignorance by describing the women as virgins (see below), and saying that they went in procession to Eleusis. The statement may therefore be dismissed as an etymological fiction. Aristophanes, Eccles., 222, is no evidence for the book-carrying.

7 The Boeotian festival of Demeter, which was held at about the same time as the Athenian Thesmophoria, and at which the megaras (see below) were opened, is distinctly stated by Plutarch (De Is. et Osir., 69) to have been a mourning for the descent (Kathodos) of Persephone.

8 Plut., Dem., 34; De Is. et Osir., 69.

9 [It was a day of holiday and rejoicing.]

10 Hesychius, s.v. διογλυπος [perhaps the pursuit of Persephone]; Such pursuit was common at Syracuse, as is shown in Sophocles, Trag. 7, 15: Aelian, Nat. An., ii. 34: Pausanias, i. 24, 4; viii. 53, 3; Diodorus, i. 91: Lobeck, Agaephamus (1829), p. 676; Marquardt, Staatsverwaltung, 2nd ed. (1885), ii. 375.

THESPIAE, an ancient Greek city of Boeotia. It stood on level ground commanded by the low range of hills which runs eastward from the foot of Mount Helicon to Thebes. The deity most worshiped at Thespiae, according to Pausanias, was Eros, whose primitive image was an unwarrought stone. The town contained many works of art, among them the Eros of Praxiteles, dedicated by Phryne in her native place; it was one of the most famous statues in the ancient world, and drew crowds of people to Thespiae. It was carried off to Rome by Caligula, restored by Claudius, and again carried off by Nero. There was also a bronze statue of Eros by Lysippus. The Thespians also worshipped the Muses, and celebrated a festival in their honour in the sacred grove on Mount Helicon. Remains of what was probably the ancient citadel are still to be seen, consisting of an oblong or oval line of fortification, solidly and regularly built. The adjacent ground to the east and south is covered with foundations, bearing witness to the extent of the temple area. The village Thespia on higher ground, was thought by Ulrichs to be probably the site of the ancient Cereus. In 1882 there were discovered, about 1200 yds. east of Eremonakastro, on the road to Arkopodi (Leuctra), the remains of a polyantrion, including a colossal stone lion. The tomb dates from the 5th century B.C., and is probably that of the Thespians who fell at Plataea, for those who fell at Thermopylae were buried on the field.

History.—Thespiae figures chiefly in history as an enemy of Thebes, whose centralizing policy it had all the more to fear because of the proximity of the two towns. During the Persian invasion of 480 B.C. it stood almost alone among Boeotian cities in rejecting the example of treason set by the Thebans, and served the national cause with splendid devotion. Seven hundred Thespians accompanied Leonidas to Thermopylae and of their own free will shared his last stand and destruction. The remaining inhabitants, after seeing their city burnt down by Xerxes, furnished a force of 1800 men to the confederate Greek army at Plataea. In 424 B.C. the contingent which the Thespians had been compelled to furnish sustained heavy losses at Delium, and in the next year the Thespians took part in this temporary enfeeblement to accuse their neighbours of desertion. After the battle of Plataea, the Thespians were evidently no more able to maintain their independence than the Thebans. In 414 B.C. they interfered again to suppress a democratic rising. In the Corinthian war Thespiae sided with Sparta, and between 379 and 372 repeatedly served the Spartans as a base against Thebes. In the latter year they were reduced by the Thebans and compelled to send a contingent to Leuctra (371). It was probably shortly after this battle that the Thebans used their new predominance to destroy Thespiae and drive its people into exile. The town was rebuilt at some later time. In 171 B.C., true to its policy of opposing Thebes, it sought the friendship of Rome. It is subsequently mentioned by Strabo as a place of some size, and by Pliny as a free city.


THESPIS (6th cent. B.C.), Greek poet, of Icaria, in Attica, generally considered the inventor of tragedy, flourished in the time of the Peisistratidae. According to Diogenes Laërtius (iii. 56), he introduced for the first time in the old dithyrambic choruses a person distinct from the chorus, who sang together with the leader, and was hence called ἐποχής ("answerer").

2 According to another explanation, he was so called from repeating of another—what the poet or composer.
His claim to be regarded as the inventor of tragedy in the true sense of the term depends upon the extent to which this person was really an "actor" (see Drama). Suidas gives the titles (of doubtful authenticity) of several of his plays (not confined to the legends of Dionysus, but embracing the whole body of heroic legends), but the fragments quoted in various writers as from Thespis are probably forgeries by Heracleides of Pontus. The statement of Horace (Ars Poetica, 276) that Thespis went round Attica with a cart, on which his plays were acted, is due to confusion between the origin of tragedy and comedy, and a reminiscence of the scurrilous jests which it was customary to utter from a waggon (σκόμματα εἰς ἄμφις) at certain religious festivals. A. and M. Croiset (History of Greek Literature, Eng. tr., 1904), who attach more importance to the part played by Thespis in the development of tragedy, accept the testimony of Horace. According to them, Thespis, actor and manager, transported his apparatus on a cart to the deme in which he intended to produce his drama, formed and trained a chorus, and gave a representation in public.

See Drama; and W. Christ, Griechische Litteraturgeschichte (1898).

**Thessalonians, Epistles to the**, two books of the New Testament. The Christian community in Thessalonica (mod. Salonica) was founded by Paul, Silvanus and Timothy, shortly before the visit to Athens and Corinth. The Gospel preached covered not only the general Christian convictions as to monotheism, belief in Jesus as Messiah Lord, and the impending judgment, but also the specifically Pauline doctrine of the indwelling Christ or Spirit, the earnest of acquittal at the Day of the Lord and of life with Christ for ever. It is the same Gospel as that preached in Galatia, in spite of the fact that the word "justification" does not appear in the Thessalonian letters (cf. 2 Thess. i. 11 f.). The converts, mainly Gentiles and chiefly manual labourers (many of whom, according to the episcopalian narrative of Acts xvii., had already associated more or less loosely to Judaism), suffered persecution from the beginning at the hands of their fellow-countrymen. Some of them, moreover, owing partly to this persecution, but mainly to the belief that the Lord was soon to return, gave up work, thus creating most of the difficulties with which Paul, in these letters, has to cope.

Forced to leave Thessalonica after a brief sojourn (how long is uncertain), Paul hastened to Athens, from which place he sent Timothy back to Thessalonica, being himself unable to go, much as he longed to see his converts. From Athens, Paul went on to Corinth, where Timothy joined him, bringing good news about the Thessalonian converts, especially about their endurance under affliction, and bringing likewise, as Rendel Harris has suggested, a letter from the Corinthians. Of this letter the opening paragraph only is worthy of notice. The sudden departure of Paul, and his failure to return, had been misinterpreted. Some were insinuating that Paul had preached with intent to deceive and as a pretext to cover impure designs (1 Thess. ii. 5); some, perhaps the same people, disregarding Paul's injunction (2 Thess. iii. 10), had remained idle, and had fallen into drunken habits (1 Thess. v. 7), having been tempted to revert to the impure worship of the heathen gods (1 Thess. iv. 3 f.), and, in their lack of funds, had demanded, speaking in the spirit (cf. Didachê xi. 12), money from the church officers, thus disturbing the peace of the church, and causing the soberer mind to question the validity of spiritual gifts (1 Thess. iv. 12 f., v. 12 f.).

Paul's reply, the First Epistle to the Thessalonians, written from Corinth in A.D. 53 or 48, is as tactful as Philemon and as personal as Galatians. In the first three chapters, he reviews his relation to the church from the beginning, commending highly the reception accorded to the Gospel and its messengers, and meeting the insinuations already alluded to by reminding the readers that, although as an apostle he was entitled not only to special respect but to an honorarium, yet he earned his living and loved them as a father. As to his failure to return, he explained that it was not his own fault. He wanted to go back but Satan hindered him. Even now, as he writes, he is praying that they may soon see them face to face. After the prayer, he takes up the points in which they had shown want of faith. To those who are tempted by the heathen worship, he points out that Christian consecration is something ethical, to be won only in the power of the consecrating Spirit. Respect for one's wife is an antidote to this enticement, and marriage with purity becomes better safeguard against adultery. Passing on to other points, he urges that there would be no sham in love of the brethren, if the idlers would work and mind their own business (1 Thess. iv. 1-12). There is no advantage in the Parousia of the living over the dead, for both simultaneously will meet the Lord. The desire for more accurate information about times and seasons is unnecessary, for their present knowledge is accurate enough, viz. that the day is to come suddenly and it is a day of destruction for the wicked. The main thing for them is to be prepared for that day (1 Thess. iv. 13-17). With the specific situation still in mind, he adds his final injunctions. Respect your presiding officers, purposely called "the labourers," and let there be peace. Warn the idlers, encourage those who are impatient of the Parousia, and cling to those tempted by the heathen worship. In spite of the temptation to avenge your persecutors, be patient with them, return good for evil, exemplifying to all what is the Christian good. In spite of affliction, let there be joy, prayer and Thanksgiving (1 Thess. v. 14-18).

The charismata are to be respected, and at the same time esteemed (ibid. 19-22). A prayer for complete consecration, a charge that all should bear the letter read (apparently the leaders were tempted to neglect the idlers and the idlers had threatened not to listen to any epistolary communication from Paul), and a benediction bring the letter to an end (ibid. 23-28).

Such a letter, dominated as it is by the spirit of the Paul we know and fitting nicely the recoverable situation, is unquestionably genuine, and few there be who deny it.

What effect this letter had, it is impossible fully to say. Apparently, it did not quell the excitement for which the idlers were largely responsible. Paul's discussion of the relation of the Second Epistle. On the Parousia seems insufficient. His refusal to go further into times and seasons than the statement "the day comes as a thief in the night," is made the point of departure for the idlers to assert, on the basis of alleged spiritual utterances, corroboration to the dismay of the leaders, by a reference to an anonymous letter reckoned to the account of Paul, that "the day is present." The troubled leaders send post-haste a letter to Corinth stating the situation and asking definite opinions as to the Parousia and the assembling of the saints. Paul is grievously disturbed, both because the first letter, in his judgment, had a dangerous tendency to the future life in Christ, and because the second letter seemed insufficient. A short interval has elapsed, to be reckoned in weeks, when Paul, with the first letter distinctly in mind and with a vivid recollection of his oral teaching on mooted points, hastens with Silvanus and Timothy to write the Second Epistle.

In one long sentence of prayer and thanksgiving (2 Thess. i. 3-12), he insists tactfully that their religious-ethical growth makes it his bounden duty to thank God, in spite of their written remurrer, compels him indeed of his own motion to boast of their faith and endurance, qualities which are the life of the Divine purposes; as to account them worthy of the kingdom for which they, as they wrote, as well as he, are suffering. Suddenly remembering a Pharisaic Psalm, not unlike in proportion to one of the Psalms of Solomon, and admirably adapted to his present purpose, namely, of contrast of the fate of the wicked with that of the righteous at the Parousia, he quotes it, making a few Christian touches in his own style (2 Thess. i. 6-10). Whereupon he prays, as they too prayed in their letter, that God would deem them worthy of the calling, and ensure them of the acquisition at the last day, by giving them in the power of the Spirit that presents life in the Spirit of guidance to the future life in Christ. Then, disregarding the request for more information about the assembling, of which, he thinks, he had spoken sufficiently in his first letter,
he addresses himself to the other question of the "when" of the Parousia, supplementing what was said in the first letter, but adding nothing to what he had already said orally in their presence, and stoutly disclaiming all authority whatever for the statement "the day is present." Briefly and allusively, in language which has nothing specifically Christian in it, he follows the familiar story. The day does not come until the final revolt in heaven and until the lawless one (the man of lawlessness, the son of Perdition) is revealed, which revelation cannot happen, until the controlling or restraining thing or person is removed. Then, however, the tool of Satan will appear, but the Lord will destroy him with the breath of his mouth and annihilate him with the majesty of his presence (2 Thess. i. 1-12).

Following the formal order of the First Epistle, he again thanks God that his converts are chosen to salvation and prays that they may have strength and obey his orders oral or written. Even with a "finality," as in the first letter, he is not quite through, for the second point of the letter remains to be treated—"the idlers." These, he says, must remember both his example (he was never guilty of begging) and his precept ("if any man will not work let him not eat"). They must work quietly and eat their own food. Those who refuse to heed his written orders are to be noted. The test of the genuineness of his letters is his autograph greeting (2 Thess. ii. 13—iii. 18).

The letter meets the known situation excellently. The new material, compared with the First Epistle, is the supplementary discussion of the time of the Parousia (2 Thess. i. 1 ff.) and the fuller treatment of the idlers (2 Thess. iii. 1 ff.), the points about which the leaders sought advice. The style is Pauline even in the adaptation of Jewish apocalyptic material to Christian purposes. Indeed, the outline of the letter is strikingly similar to that of the First Epistle, and many phrases hold over. At the same time there is a freedom of style suggesting not the imitator but the same author. And above all, especially in the treatment of the idlers, the letter reveals a knowledge of the situation which is even more explicit than that of the First Epistle. On such grounds together with the excellent external attestation it is probable, as recent writers hold (e.g. Zahn, Wohlenberg, Harnack, Jülicher, Findlay, Askwith, Charles, Bacon, McGiffert, Moffatt, Milligan, et al.), that the letter is Paul's.

The objection to the Pauline authorship felt by the Tübingen school may, for brevity's sake, be here disregarded. The modern difficulties, expressed mainly by recent German scholars (e.g. Wrede and Holtzmann and others), centre not in the un-Pauline language or in the lack of the personal element, but in the eschatology and the over-Pauline character of the language. As to the first objection, it is realized that in the section i. 1-12 is scarcely an interpolation, since it is one of the two main reasons for the letter; that the material of the section is a distinct allusion to, if not a direct quotation of, a definite bit of Jewish apocalyptic, even if we do not connect it, as Bousset does, with a so-called Antichrist legend; that the alleged inconsistency between the eschatology of the First and the Second Epistle does not exist, for in the first letter Paul says not that the day is present, but that the day, when it comes, comes suddenly "as a thief in the night," while in the second letter he expressly denies the statement attributed to him, namely, that the day is imminent. Wrede, in his brilliant argument against the genuineness of the letter (Die Echtheit des zweiten Thessalonicherbriefes, 1905), inclines to admit that the argument from eschatology is secondary.

As to the second objection, the over-Pauline character of the letter, an objection used with rigour by McGiffert (whose article on these letters in the Ency. Biblica is the most satisfactory discussion known to the present writer), and renewed independently by Wrede, it is to be admitted that the similarity of the second to the first letter is striking, particularly in the formal arrangement of the material. At the same time, however, differences, both in arrangement and in the content of the reminiscences, are not to be overlooked, as McGiffert and after him Wernle (Göth. gel. Anz., 1905, pp. 347-52) have both rightly maintained. Again there should be no disparagement of the new material such as is to be found in Holtzmann's acute discussion (Z. N. T. W., 1901, pp. 97-108). On the whole, the perplexing situation seems to be met on the assumption that Paul writes the Second Epistle either with a letter from Thessalonica before him, which itself suggested the main points of his own epistle, or with a copy or a summary of that epistle before him (cf. Zahn and McGiffert).

The alternative is forgery, as Holtzmann, Wrede and Hollmann (Z. N. T. W., 1904, pp. 28-38) actually hold. The difficulty with this hypothesis is that it does not explain so many facts as the hypothesis of Pauline authorship. As it is improbable that the forger would write during the lifetime of Paul, the date has to be put either shortly after his death, or with Wrede at the end of the century. But this late date creates the insuperable difficulty that iii. 1 ff. gives a more explicit account of the original situation in Thessalonica touching the idlers than does the First Epistle. The purpose moreover of the forgery could not be to discredit the First Epistle as un-Pauline, for the alleged trouble is that the Second Epistle is too Pauline. Hence the purpose is to correct the statements of the First Epistle. If, however, there is no inconsistency between the two letters on the score of eschatology, what is the forger's purpose? The teaching about premonitory signs is not new to Thessalonica, but is assumed as known, hence the allusive character of the second chapter. The statements in ii. 2 and iii. 17 are easily explicable on the hypothesis that the idlers found an anonymous letter and attributed it to Paul, especially when they thought, perhaps in good faith, that the Spirit had indicated that the day is present. Finally, the forger handles Paul's style with miraculous knowledge, not only reproducing phrases from the first letter, but knowing how to amend them to present purposes with singular naturalness. When it comes to putting Christian touches to a Jewish fragment, the touches turn out to be uniquely Pauline, although they are not obviously Pauline (e.g. i. 6-10 'ἐν πυρῷ,' "obey the Gospel thus as was believed"). And even with the thought of Paul, he is curiously at home. So certain is he of the substance of Paul's thought, that he can reproduce it in a concise sentence without recourse to the word "justification" (e.g. i. 11). On the whole, then, the situation created by the literary relation of the two letters is best met by the hypothesis that Paul is the author of the Second Epistle.

In addition to the literature mentioned under Colossians, Epistle to the, and the special literature already named in this letter, attention should be made to the commentaries on these letters by Ellicott (1888), Jowett (1859), Eadie (1877), Hutchinson (1883), Lightfoot (Notes, 1895), Drummond (1889), Findlay (1892 and 1904), Milligan (1908), and Moffatt (1908); and by Schmidt (1885), Zimmer (1884-93), Schmiedel (1892), Zückler (1894), Bornemann (1894), B. Weiss (1896) and Wohlenberg (1903).

**THESSALY**, a district of northern Greece, between Macedonia and the more purely Hellenic countries towards the south, and between the upland region of Epirus and the Aegean Sea. It forms an irregular square, extending for about sixty miles in each direction, and this area, which is for the most part level, is enclosed by well-marked boundaries—by the Cambunian mountains on the north, by the mountains of Pieria on the north-east, by Mount Ossa on the south, and on its western side runs the massive chain of Pindus, which is the backbone of this part of Greece, and towards the east Ossa and Pelion stand in a continuous line; at the north-eastern angle is Olympus, the keystone of the whole mountain system. The elevation of some of the summits in these ranges is considerable, for three of the peaks of Pindus are over 5000 ft., and Olympus, Ossa and Pelion reach respectively the height of 9790, 6398 and 5350 ft. The country that is contained within these limits is drained by a single river, the Peneius, which, together with the water of its numerous confluent, passes into the sea through the Valley of the Tempe.

On the north side of Thessaly there was an important pass from Petra in Pieria by the western side of Olympus, debouching on the
plain northward of Larissa; it was by this that Xerxes entered, and we learn from Herodotus (vii. 173) that, when the Greeks discovered the existence of this passage, they gave up all thoughts of defending Tempe. On the side of Epirus the main line of communication from Thessaly lay to the north of Mount Lacmon, and descended the upper valley of the Peneus to Aeginium in the north-west angle of Thessaly. This was the road of the Thessalians, and the battle of Parnassus was fought by them on this line. Another pass through the Pindus chain was that of Gomphi, farther south, by means of which there was communication with the Ambracian Gulf. The great southern pass was that of Coela, which led to the plain of Megaritis and Thermopylae. The passes of sections which open out into one another, divided by ranges of hills, the principal of these were called Upper and Lower Thessaly, the former was in the central, the latter in the western districts, which contains the higher course of the Peneus and all those of its tributaries that flow from the south—the Enipeus, the Apidanus, the Onocoron and the Pamisos; while the latter, which runs eastward to the foot of Ossa and Pelion, is inundated in parts at certain seasons of the year by the Peneus, the flood-water from which forms the lake Nessos, and, when that is full, escapes again and pours itself out to the lake of Boeotia. The chief city of the latter of these districts is Tricarta; and there were separate districts, one another by a long spur, which runs southwards from the Cambian Mountains on the western side of that city. Again, when Thessaly descends to the plains of Copais and Oropus, there is a plain, containing a small lake, which was formerly called Xynias, intervenes, and a line of low hills has to be crossed before the town of Thaumaki is reached, which, from its commanding position overlooking the plain, has been described by Livy in the following remarkable passage:—

"When the traveller, in passing through the rugged districts of Thessaly, where the roads are entangled in the windings of the valleys, arrives at this city, on a sudden an immense level expanse, resembling a vast sea, is outspread before him in such a manner that the eye cannot easily reach the limit of the plains extended beneath,'" (xvii. 4). To the north-east of this, where a portion of the great plain begins to run up into the mountains, the Plain of Pharsalia is formed, which is intersected by the river Enipeus; and still farther in the same direction is the scene of another great battle. It intervenes between the plains of Thessaly and those of the Thessalian districts, of which Pelasgiaeae the lower plain of the Peneus, and Hestiaeotis and Thessaliotis respectively the northern and the southern portions of the upper plains; while the fourth Phitioiates, which lies towards the south-east, was geographically distinct from the rest of the country, being separated from it by a watershed. The determining feature of this is the Pagasaeus Sinus (Gulf of Volo), a landlocked basin, extending from Pagoae at its head to Apethae at its narrow outlet, where the chain of Pelion, turning at right angles to its axis at the end of Magnesia, throws out a projecting line of broken ridges, while on the opposite side, the spurs of the Olympus range the whole line of the coast, of great importance. It was the birthplace of Greek navigation, for this seems to be implied in the story of the Argonauts, who started from here in the expedition to the land of the Hyperboreans. From it the great Achilles came, and, according to Thucydides (i. 3), it was the early home of the Hellenic race. The site of Iolcos, the centre of so many poetic legends, is at no great distance from the modern Volo. Near that town also, at a later period, Demetrius Poliorcetes founded the city of Demetrias, which was called by Philip V. of Macedon one of the three fetters of Greece, Chalcis and Corinth being the other two.

The history of Thessaly is closely connected with its geography. The fertility of the land offered a temptation to invaders, who carried their impulses all over the Thessalian plains. It was this motive which first induced the Thessalians to leave their home in Epirus and descend into this district, and from this movement arose the expulsion of the Boeotians from Arne, and the settlement in the country subsequently called Boeotia; while another wave of the same tide drove the Dorians also southward, whose migrations changed the face of the Peloponnesus. Again, this rich soil was the natural home of a powerful aristocracy, such as the families of the Aleuadai of Larissa and the Scopaei of Cramnon; and the absence of external defence was a temptation to the four zones of cities, which might have fostered the spirit of freedom and democracy. The plains, also, were suited to the breeding of horses, and consequently the force in which the Thessalian nation was strong was cavalry, a kind of troops which has usually been associated with oligarchy. The wealth and the semi-Hellenic character of the people—for in race, as in geographical position, the Thessalians held an intermediate place between the non-Hellenic Macedonians and the Greeks of pure blood—caused them to be wanting in patriotism, so that at the time of the Persian wars we find the Aleuadai making common cause with the enemies of Greece. When they were united they were a formidable power, but, like other half-organized communities, they seldom combined for long together, and consequently they influenced but little the fortunes of the Greeks.

For several centuries during the middle ages Rumanian immigrants formed so large a part of the population of Thessaly that that district was called by the Byzantine writers Great Wallachia (Μεγάλη Βαλαχία): the Jewish traveller, Benjamin of Tudela, who visited this region in the middle of the 12th century, describes them as then occupying it. At the present day only a few colonies of that race remain, the principal of which are found on the western side of Olympus and in some of the gorges of Pindus. The Turkish inhabitants were settled in the larger towns, and here and there in the country districts, the most important colony being those called Koniarites, who were brought from Konia in Asia Minor shortly before the taking of Constantinople, and planted under the south-west angle of Olympus. The Greeks, however, form the majority of the population, and are either native born or of recent origin. In the country belonged to the Ottomans, Greek was employed as the official language. In accordance with the provisions of the Berlin treaty, Thessaly was ceded to the Greeks by the Porte in 1881, and became a portion of the Hellenic kingdom. Since that time the prosperity of the province has greatly increased. The port of Volo, which is almost the only outlet of the trade of the whole district, has become an important town of 23,000 inhabitants, and daily communication by steamers now exists between it and Athens. The interior of the country has also been opened up by means of railways. One line runs north-westwards from Volo by way of Velestino (the ancient Phocis) to Larissa, which is situated on the Salambria (Peneus), and has a population of 18,000 souls, including 2000 Jews. The Greeks, Turks and Jews here occupy different quarters of the city, but most of the Turkish inhabitants have now quitted the country, so that only four of the numerous mosques remain in use. From Velestino another line branches off to the west by Pharsala (Pharsalos), Domokos (Thaumaki), Karditsa, and Trikala (Trika), to Kalabaka (Aeginion), where the upper valley of the Salambria is enters in the neighborhood of the last-named place, where the Cambanian chain of mountains descends in steep precipices to the plain, the Meteora ("mid-air") monasteries (see METEORA).


THETFORD, a market town and municipal borough of England, mostly in the south-western parliamentary division of Norfolk, but partly in the Stowmarket division of Suffolk, 91 m. N.N.E. from London by the Great Eastern railway. Pope (1901) 4,513; and 1,769 in 1861. The town lies in a level, fertile country at the junction of the river Thet with the Little Ouse. In the time of Edward III. the town had twenty churches and eight monasteries. There are now three churches—St Peter's, St Cuthbert's and St Mary's—principally of Perpendicular flint work; of these St Mary's, on the Suffolk side, is the largest. There are a few monastic remains, the chief being two gate-houses. The most important relic of antiquity is the Castle Hill, a mound 1000 ft. in circumference and 100 ft. in height. The grammar school was founded in 1610. In King Street is the shanck-house occupied as a hunting-lodge by Queen Elizabeth and James I. The chief public buildings are a gild hall and a mechanics' institute; there are several charities. Brewing and tanning are carried on; and there are also manure and chemical works, brick- and lime-kilns, flour-mills and agricultural implement works, engineering works and iron foundries. The Little Ouse is navigable for barges down to
the Great Ouse. Thetford is a suffragan bishopric in the diocese of Norwich. The town is governed by a mayor, 4 aldermen, and 12 councillors. Area, 7,096 acres.

Early antiquaries identified Thetford (Theodoford, Tetford, Teford) with Sitomagus, but modern research shows that there is no conclusive evidence of a permanent settlement before the coming of the Angles. Tradition tells that Uffa, who probably threw up the earthworks called the Castle Hill, established the capital of East Anglia here about 575. Thetford owned a royal mint in the 9th century and was a flourishing town when the Conqueror acquired it. Richard I. granted it to Hamelin, Earl Warenne, and when his heirs failed, it merged in the duchy of Lancaster and so in the crown. About 1290 its principal officers were a mayor and coroner, afterwards assisted by eight burgesses, whom Henry VIII. increased to ten. The town, never very prosperous since the Conquest, had then fallen into great decay, but the petitions of the burgesses for a charter were not heeded till 1573 when Elizabeth incorporated it under a mayor and common council. This charter, restored in 1692 after its surrender to Charles II., remained in force till 1835 when the borough was re-constituted. Thetford returned two members to parliament from 1529 till its disfranchisement in 1868. Its Saturday market, which certainly existed in the 13th century, was granted by the charter of 1573 and also a Magdalen fair (the 22d of July). Fisheries were important in the 13th century.

See A. L. Hunt, Capital of East Anglia (1879); T. Martini, History of Thetford (1779).

THETIS, in Greek mythology, daughter of Nereus, wife of Peleus and mother of Achilles. The chief of the fifty Nereids, she dwelt in the depths of the sea with her father and sisters. When Dionysus leaped into the sea to escape from the pursuit of Lycurgus, king of the Thracian Edones, and Hephæstus was flung out of heaven by Zeus, both were kindly received by Thetis. Again, when Hera, Athena and Poseidon threatened to bind Zeus in chains, she sent the giant Anguron, who delivered him out of their hands. She was married against his will to Peleus (q.v.; see also Achilles). Thetis is used by Latin poets simply for the sea.

THEURIET, CLAUDE ADHÉMAR ANDRÉ (1833-1907), French poet and novelist, was born at Marly-le-Roi (Seine et Oise) on the 8th of October 1833, and was educated at Bar-le-Duc in his mother’s province of Lorraine. He studied law in Paris and entered the public service, attaining the rank of chef de bureau before his retirement in 1886. He published in 1867 the Chemin des bois, a volume of poems, many of which had already appeared in the Revue des Deux Mondes; Le bleu et le noir, bolsmes de la vie réele (1874), Nos isaux (1886), and other volumes followed. M. Theuriet gives nature, simple pictures of rustic and especially of woodland life, and Théophile Gautier compared him to Jaques in the forest of Arden. The best of his novels are those that deal with provincial and country life. Among them are: Le mariage de Gérard (1875); Raymonde (1877); Le fils Mawars (1879); La maison des deux Barbeaux (1879); Sauvagone (1880); Reine des bois (1880); Villa tranquille (1891); Le manuscrit du chanoine (1902). Theuriet received the 3rd prize of the Academy of France, of which he became a member in 1896. He died on the 23rd of April 1907, and was succeeded at the Academy by M. Jean Richepin.

See Emm. Besson, André Théuriet (1890).

THÉVENOT, JEAN DE (1633-1667), French traveller in the East, was born in Paris on the 16th of June 1633, and received his education in the college of Navarre. The perusal of works of travel moved him to go abroad, and his circumstances permitted him to please himself. Leaving France in 1652, he first visited England, Holland, Germany and Italy, and at Rome he fell in with D’Herbelot, who invited him to be his companion in a projected voyage to the Levant. D’Herbelot was detained by private affairs, but Thévenot sailed from Rome in May 1655, and, after vainly waiting five months at Malta, took passage for Constantinople alone. He remained in Constantinople till the end of the following August, and then proceeded by Smyrna and the Greek islands to Egypt, landing at Alexandria on New Year’s Day, 1657. He was a year in Egypt, then visited Sinai, and, returning to Cairo, joined the Lent pilgrim caravan to Jerusalem. He visited the chief places of pilgrimage in Palestine, and, after being twice taken by corsairs, got back to Damietta by sea, and was again in Cairo in time to view the opening of the cataract on the rise of the Nile (on the 14th of August, 1657). In January 1659 he sailed from Alexandria in an English ship, taking Goleta and Tunis on the way, and, after a sharp engagement with Spanish corsairs, one of which fell a prize to the English merchantman, reached Leghorn on the 12th of April. He now spent four years at home in studies useful to a traveller, and in November 1663 again sailed for the East, calling at Alexandria and landing at Sidon, whence he proceeded by land to Damascus, Aleppo, and then through Mesopotamia to Mosul, Bagdad and Mendeli. Here he entered Persia (the 27th of August, 1664), proceeding by Kermanah and Hind to Isfahan, where he spent five months (October 1664-February 1665), and then joined his party with that of the merchant Tavernier, proceeded by Shiraz and Lar to Bander-Abbas, in the hope of finding a passage to India. This was difficult, because of the opposition of the Dutch, and though Tavernier was able to proceed, Thévenot found it prudent to return to Shiraz, and, having visited the ruins of Persepolis, made his way to Basra and sailed for India on the 6th of November 1665, in the ship "Hopewell," arriving at the port of Surat on the 10th of January 1666. He was in India for thirteen months, and crossed the country by Goconda to Masulipatnam, returning open to the sea, from where he sailed to Bander-Abbas and went up to Shiraz. He passed the summer of 1667 at Isfahan, disabled by an accidental pistol-shot, and in October started for Tabriz, but died on the way at Miyana on the 28th of November 1667.

Thévenot was an accomplished linguist, skilled in Turkish, Arabic and Persian, and a curious and diligent observer. He was also well skilled in the natural sciences, especially in botany, for which he made large collections in India. His personal character was admirable, and his writings are still esteemed, though it has been justly observed that, unlike Chardin, he saw only the first picture of the East, and did not find the second. He was posthumously published from his journals in 1674 and 1684 (all 4to). A collected edition appeared at Paris in 1689, and a second in 12mo at Amsterdam in 1727 (5 vols.). There is an indifferent English translation by A. Lovell (London, 1689).

THIAZINES, in organic chemistry, a series of cyclic compounds containing a ring system of four carbon atoms, one nitrogen and one sulphur atom. These may be grouped in three ways, giving the following skeletal structures:

\[ \begin{align*}
(1) & \quad C - C - N \\
(2) & \quad C - C - S \\
(3) & \quad C - N - C \\
(4) & \quad C - S - C 
\end{align*} \]

Members of the first series have not as yet been isolated. Derivatives of the second type have been obtained by A. Luchmann (Ber. 1896, 29, p. 1429) by condensing γ-chlorobutylamine with carbon bisulphide or with mustard oils in the presence of caustic alkali; by M. Kahn (ibid., 1897, 30, p. 1321) on condensing bromhexylamine hydrobromide with thieno-azimide:

\[ \text{CH}_2\text{CH}(_2)\text{CH}(_2)\text{Br} + \text{HS} \rightarrow \text{CH}_2\text{CH}(_2)\text{CH}(_2)\text{S} \]

Benzothiazines are obtained from ortho-aminobenzyl halides and thio-amides:

\[ \text{CH}_2\text{N} + \text{H}_2\text{N} + \text{CS} \rightarrow \text{CH}_2\text{N} \]

The most important thiazines are those derived from class III., thiodiphenylamine, CsHs, being the parent substance of the methylene blue series of dyestuffs. Thiodiphenylamine
is obtained synthetically by heating sulphur with diphenylamine or by the condensation of ortho-aminophenol with pyrocatechin. It is a compound of neutral reaction. The first known dyestuff of this series was Lauth's violet, which was prepared by oxidizing paraphenylene diamine in acid solution in the presence of sulphur. By using dimethyl paraphenylene diamine in place of the simple diamine, methylene blue is obtained. The relationship of these substances to thiophenyldiamine was shown by A. Bernthsen, who, by nitrination of thiophenylamine, obtained a dinitro-compound which on reduction was converted into the corresponding di-aminodervative and this on oxidation yielded Lauth's violet.

Methylene blue is the most important of all blue basic dyes and is put on the market frequently in the form of its zinc chloride double salt, which is soluble in water. Acid oxidents in dilute aqueous solution convert it into methylene azure.

See further A. Bernthsen, Ann., 230, p. 731; 251, p. 1; German Patents 45839 (1887); 47374 (1888). For a discussion as to the constitution of these dyestuffs, whether they are quaternary amomnium salts or a-haloid amides, see A. Ber., 1906, 39, pp. 153, 1365; F. Kehrmann, ibid., 1906, 39, p. 914.

THIAZOLES, in organic chemistry, a series of heterocyclic compounds containing the grouping shown below; the replaceable hydrogen atoms in which are designated a, b and μ. They are prepared by condensing thio-amides with a-haloid ketones or aldehydes, the thio-amide reacting as the tautomeric thio-imino acid. Amino derivatives similarly result from thio-ureas and a-haloid ketones; the o xo derivatives from a-sulphocyanoketones by the action of caustic alkali; and the carboxylic acids from chloro-aceto-acetic ester, &c. and thio-amides. The thiazoles are somewhat basic in character, and combine with the alkyl iodides to form thiazolium iodides.

Dihydrothiazoles, or thiazoline, are obtained by condensing ethylene dibromides with thio-amides; by the action of β-haloid alkylamines on thio-amides (S. Gabriel, Ber., 1881, 24, p. 755; 1896, 29, p. 2610); and by the action of phosphorus pentasulphide on acetyl-β-bromalkylamides (A. Salomon, Ber., 1893, 26, p. 1328). They are much less stable than the thiazoles. The benzothiazoles are a series of weak bases formed by condensing carboxylic acids with ortho-aminophenolhs (A. W. Hofmann, Ber., 1880, 13, p. 1224), by heating the acid anilides with sulphur or by the oxidation of thiazoles. On fusion with caustic alkalis they decompose into their constituent aminothionaphenol and acid. Derivatives of this group are important as substantive cotton dye-stuffs.

THIBAudeau, CLAIR ANTOINE, COMTE (1765-1834), French politician, was born on the 23rd of March 1765, the son of Antoine de Thibaudeau (1739-1813), a lawyer of Poitiers and a deputy to the States-General of 1789. He was admitted to the bar in 1787, and in 1789 accompanied his father to the States-General at Versailles. When he returned to Poitiers in October he immediately set up a local revolutionary club, and in 1792 was returned as a deputy to the Convention.

Thibaudeau joined the party of the Mountain and voted for the death of Louis XVI. unconditionally. Nevertheless he incurred a certain amount of suspicion because he declined to join the Jacobin Club. In May 1793 he was on a special mission in the west and prevented his department from joining the Federalist movement. Thibaudeau occupied himself more particularly with educational business, notably in the organization of the museum of the Louvre. It was he who secured the inclusion of Tom Paine's name in the amnesty of Girondist deputies. Secretary and then president of the Convention for a short period, he served on the Committee of Public Safety and of Generality Security. After the insurrection of 13 Vendémiaire (5th October 1793) he opposed those Thermidorians who wished to postpone the dissolution of the Convention. At the elections for the Corps Législatif he was elected by no less than thirty-two departments. It was only by the intervention of Boulay de la Meurthe that he escaped transportation after the coup d'état of 18 Fructidor (4th September 1797), and he then returned to the practice of his profession. The establishment of the consulate brought him back to public life. He was made prefect of the Gironde, and then member of the council of state, in which capacity he worked on the civil code. He at this time had Napoleon's confidence, and gave him whole-hearted support. He did not entirely conceal his disapproval of the foundation of the Legion of Honour, of the Concordat, and of the Consulate for life, and his appointment as prefect of the Bouches du Rhône, with consequent banishment from Paris, was a semi-dissuage.

A peer of the Hundred Days, he fled at the second Restoration to Lausanne. During his exile he lived in Vienna, Prague, Augsburg and Brussels, occupying himself with his Mémoires sur la Convention et le Directoire (Paris, 2 vols., 1824); Mémoires sur le Consulat: par un ancien conseiller d'état (Paris, 1827); Histoire générale du Napoleon Bonaparte (6 vols., Paris and Stuttgart, 1827-28, vol. iii: not printed); Le Consulat et l'Empire, vol. i, of which is identical with vol. vi. of the Histoire de Napoleon (10 vols., 1834). The revolution of 1830 permitted his return to France, and he lived to become a member of the Imperial Senate under the third empire. He died in Paris on the 8th of March 1854 in his eighty-ninth year.

The special value of Thibaudeau's works arises from the fact that he wrote only of those events of which he had personal knowledge, and that he quotes with great accuracy Napoleon's actual words. His Mémoires sur le Consulat has been translated into English, with introduction and necessary notes, by G. K. Fortescue with the title of Bonaparte and the Consulate (1808). Among the papers left by Thibaudeau were documents of the Moniteur Universel and Mémoires avant ma nomination à la Convention. These were published in a small volume (Paris and Niort, 1875) which includes a list of his works and of the narrative of his life.

THIBAUT (or TRIBAUD) IV. (1201-1253), count of Champagne and Brie, and king of Navarre, French poet, was born at Troyes in 1201. His father, Thibaut III of Champagne, died before his son's birth, and his mother, Blanche of Navarre, was committed to regency. The documents of the period are addressed to Philipp Augustus, king of France, but there is little doubt that the child was acquainted with Chrétien de Troyes and the other trouvères who found patronage at the court of Champagne. Thibaut's verses belong to what is called "courtly" poetry, but they have a personal note that distinguishes them from mere exercises. They are addressed to Blanche of Castille, the wife of Louis VIII., and Thibaut's relations with her have been the subject of much controversy. The count took part with Louis in the crusade against the Albigenenses, but in 1226, with no apparent reason, left the king and returned to Champagne. Three months later Louis died under doubtful circumstances, and Thibaut was accused by his enemies of poisoning him to facilitate his own intrigue with Blanche. The real reason for Thibaut's desertion appears to have been a desire to consolidate his position as heir-apparent of Navarre by an alliance with the disaffected nobility of the south of France, but from this confederation Blanche was skilful enough to detach him. The resentment of the league involved him in a war in which Champagne was laid waste, and his capital saved only by the royal intervention. In 1231 he succeeded his uncle, Sancho VII., as king of Navarre, and from this period date his most fervent songs in praise of his lady. The crusade turned Thibaut's thoughts to religion, and he announced his intention of singing henceforth only in honour of the Virgin. Unfortunately his devotion took darker forms, for before sailing for the Holy Land he ordered and witnessed the burning of a hundred and eighty-three unfortunate men and women convicted of Manichaism. The years 1239 and 1240 were spent in Palestine, and from the time of his return Thibaut devoted
himself to efforts for the improvement of his dominions which he won for him the title of le Bon. He died at Pampeluna on the 14th of July 1253.

Thibaut was the most popular of all the 13th century song-writers, and his work is marked by a grace and sweetness which he alone was able to maintain with the troubadours of the south. He is said to have set his songs to German melodies, and it seems doubtful whether the notes that have come down to us can with justice be attributed to him, but there is no contesting the musical quality of his verse. He was a master beyond the Pyrenees, and Dante admired his poetry. He was one of the most celebrated authors of *jeux-paris*, elaborate discussions between two interlocutors, usually on the subject of love.

Thibaut wrote, was edited in 1851 by T. Tarbé in his Chansonniers de Champagne.

THIBAUT, ANTON FRIEDRICH JUSTUS (1774-1840), German jurist, was born at Hameln, in Hanover, on the 4th of January 1774, the son of an officer in the Hanoverian army, of French Huguenot descent. After passing his school-days in Hameln and Hanover, young Thibaut entered the university of Göttingen as a student of jurisprudence, went thence to Kiel, where he studied under Kant, and afterwards to Kiel, where he worked for a faher-in-law with Niebuhr. Here, after taking his degree of doctor juris, he became a Privatdozent. In 1798 he was appointed extraordinary professor of civil law, and in the same year appeared his *Versuche über einzelne Theile der Theorie der Rechts* (1798), a collection of essays on the theory of law, of which by far the most important was entitled *Über den Einfluss der Philosophie auf die Auslegung der positiven Gesetze*, wherein he sought to show that philosophy without philosophy could not interpret and explain law. In 1799 was published his *Theorie der logischen Auslegung des römischen Rechts*, one of his most remarkable works. In 1802 he published a short criticism of Feuerbach's theory of criminal law, which recalls in many ways the speculations of Bentham. The same year appeared *Über Besitz und Verjährung*, a treatise on the law of possession and the limitation of actions. In 1802 Thibaut was called to Jena, where he spent three years and wrote, in Schiller's summer-house, his chief work, *System des Pandektenrechts* (1803), which ran into many editions. The fame of this book depends before all else upon the fact that it was the first modern complete compendium of the subject, distinguished alike by the accuracy of its sources and the freedom with which subject is handled. It is, in effect, a codification of the Roman law as it was practiced in Germany, modified by Canon law and the practice of the courts into a comprehensive system of Pandect law. At the invitation of the grand-duke of Baden he went to Heidelberg to fill the chair of civil law and to assist in organizing the university; and he never quitted that town, though he received in after years, as his fame grew, invitations to Göttingen, Munich and Leipzig. His class was large, his influence great; and, except Gustav Hugo and Savigny, no civilian of his time was so well known. In 1814 appeared his *Civilistische Abhandlungen*, of which the principal was *Hessbach's* *Thesis*, an essay of so much literature, on the necessity of a national code for Germany (*vide infra*). In 1819 he was appointed to the upper house of the newly constituted Baden parliament. He was also made member of the Scheidungsgericht (divorce court).

In 1836 Thibaut published his *Erörterungen des römischen Rechts*. One of his last works was a contribution in 1838 to the *Archiv für die civilistische Praxis*, of which he was one of the editors (see below). Thibaut married, in 1800, a daughter of Professor Ahlers of Kiel. He died after a short illness, at Kielberg, on the 29th of March 1840.

Thibaut was a man of many matters, and many consistent nature, was much more than a jurist; he deserves to be remembered in the history of music. Palerestia and the early composers of church music were his delight; and in 1824 appeared anony- mously a work in eight vols. entitled *New Finds of the Rhenish Treasure*, in which he eulogized the old music, and especially that of Palerestia. He was an ardent collector of old compositions, and often sent young men to Italy, at his own expense, to discover interesting musical manuscripts or other masterpieces, which holds no mean place. His style is simple and manly, but rich in the happy accidents of expression which come only to true artists.

Most of Thibaut's works have already been mentioned, but his essay on the necessity of a code for Germany (*Über die Notwendigkeit eines allgemeinen bürgerlichen Rechts für Deutschland*), which was inspired by the war of Liberation and written in fourteen days, deserves further notice. Thibaut has explained in the *Archiv für die civilistische Praxis*, in 1838, the origin of this memorable essay. He had realized the change demanded by the war, and had proposed to the Kriegshaupt in the happy future opened up for Germany. The system of small states might be hoped and believed would continue; for the big state he considered crushing to the life of the individual and harmful as concentrating influence on the personal life of a people. This argument the only unity practicable and needful for Germany was that of law; and for this he urged all the German governments to labour.

The framers of the new German civil code (*bürgerliches Gesetzbuch*) in 1879 were indebted for the arrangement of their matter to this work, as it was done beyond the Pyrenees, and beyond this, the code, based on the common law of the several German states, which was adroitly blended by the *ius pandectarium* into an harmonious whole, *vide infra*, reflect his influence. He was one of the earliest to criticize the divorce laws of the time, and, and he carried on with Gustav Hugo a controversy as to these points.

In modern German legal literature Thibaut's influence is not very perceptible. Even at Heidelberg it was quickly superseded by that of his successor, Karl Adolph von Vangerow (1805-1870), and in Germany his works are now little used as text-books. But Thibaut was able to influence his pupil, Savigny, who, who of much to him, describes him as one "who for penetrating acuteness, rectitude of judgment and depth of learning and eloquence of exposition and forcible place...". In short, the controversy belonged to Savigny; the real victory rested with Thibaut.

For further information as to Thibaut's life and work, see Baumbak, Thibaut, Blätter der Erinnerung (1841); Karl Hagemann, *Über den Leben H. Th. und Thibaut, mit Correspondenz*, in die Preuss. Jahrbiicher (1880); Teichmann, in Holtsendorff's *Rechtssikonietz*; and E. Landsberg, in *Allgemeine Deutsche Biographie*, vol. 37.

THIBAW, or HSIPAW, one of the Northern Shan States of Burma. It is called by the Shans, and officially, Hsipaw, and also frequently Üng Pawng (the name of an old capital). It includes four states—Thibaw, the main state, and the sub-states of Möngh Long, Möngh Tung and Thonzh (or Hsimagal). The whole state has an area of 5086 sq. m., and the population in 1910 was 104,700.

The main state lies on the geological fault which runs east and west across the Shan States, from the Salween to Kunlån and beyond to nearly the rim of the Shan tableland at Göktek. It is therefore broken up into a mass of not very well-defined ridges and spurs, crossing and re-entering. The chief plain land is in the valley of the Nam Tu (Myit-nge), near Thibaw town, and the valley or strath of the Pyawng Kawng, Nawng Ping neighbourhood. Elsewhere the valleys are insignificant. The hills on the Möngh Tung border reach their highest elevations in the peaks Loi Pan (6848 ft.) and Loy Htan (6270 ft.); to the north-west of Thibaw town, on the Tawng Peng border, Loy Lam rises to 6386 ft. The valley of the Nam Tu marks the lowest point in the state at Thibaw town, about 1400 ft., and rises on the east in Möngh Tung to a plain level of about 2500 ft., and on the west in Möngh Long to a confused mass of hills with an average height of 4500 ft.; broken up by the Nam Yawn and Nam Kaw valleys, which are about 3000 ft. above mean sea-level.

The chief river is the Nam Tu or Myit-nge, also frequently called by its classical name the Dōktawadi. The main stream rises in the most easterly part of the Shan range, and is divided in two forks; the western fork, the Long Tu, is navigable for 120 ft. above from the falls of Tawnkaw on the Nam Tu to the town of Nam Tu. The eastern branch, the Long Htan, rises on the Nam Tu, and is navigable for 760 ft. above from the falls of Tawnkaw on the Nam Tu to the town of Nam Tu. The valley of the Nam Tu is about 1500 ft. below the general level of the country. Coal is found at various places in the state, but is not of very high quality. There is also a considerable granite quarry near the town, and a large stone quarry at Thibaw (Bawgyo) about 7 m. from Thibaw town. The average maximum temperature at the beginning of April is about 96°, and the minimum
THIELMANN-THIERRY

about the same period 65°. The rainfall averages about 70 in.

for the year. The chief crops are rice, cotton, sesame, tea in the

hills, and thanat, leaf of a tree used for the wrapper of the

Burma, or "green" Cherokee. Cotton cloth was formerly much

made in this country, and a cotton mill is still in operation.

and a cotton mill is also made. Other industries are merely of articles

for local use. The government road to Lashio passes through the

centre of the state, and from this various unmetalled roads

radiate into the different parts of the neighboring states.

The Mandalay-Kunlong railway, now open as far as Lashio, also

passes through the capital. Teak forests exist along the banks of the

River Irrawaddy, and both the Taungthaman and the Bago rivers

are in charge of circles and townships. Each naba-boaing has an

assay, or clerk, and each village has a headman, or kin-man. The

ministers supervise the administration of a certain number of districts.

The system is now being assimilated to that followed in Burma.

The chief Sao Hke was for a time in England. (J. G. Sc.)

THIELMANN, JOHANN ADOLF, FREIHERR VON (1765-

1834), Prussian cavalry soldier, was born at Dresden. Entering

the Saxony cavalry in 1782, he served against the French in the

Revolutionary Wars and in the Jena campaign. When,

after the disaster of Jena, Saxony allied herself with her con-
querror, Thielmann accompanied the Saxony contingent which

fought at the siege of Danzig and at Friedland. In 1809, as

colonel of a Free-Corps, he opposed the advance of the

Austrians into Saxony, and was rewarded for his services with the grade

of major-general, further promotion to lieutenant-general fol-

lowing in 1810. As commander of the Saxon Heavy Cavalry

Brigade he took part in the advance in Moscow two years later.

When his regiment was destroyed, Thielmann was appointed

commander-in-chief of the Saxon army, in which Napoleon,

who took Thielmann into his own suite. His own

sovereign at the same time made him Freiherr. In the war of

Liberation Thielmann took a prominent part; as governor of

Torgau, by his king's orders he at first observed the strictest

neutrality, but on receipt of an order of hand to over the fortress

to the French he resigned his command and, accompanied by

his staff officer Aster, joined the allies. As a Russian general

he was employed in reorganizing the Saxon army after Leipzig,

and in 1814 he commanded the Saxon corps operating in the

Low Countries. Early in the following year he became a

lieutenant-general, and in command of the 3rd army corps he took part in the Waterloo

campaign. From the field of Ligny he retired with the rest of Blücher's

army on Wavre, and when the other corps marched towards

Waterloo, Thielmann covered this movement against Grouchy,

fighting the spirited action of Wavre (June 18-19). He was

later a corps commander at Münster and at Coblenz, and at

the latter place he died in 1834.

See von Hütte, Biographische Skizze des Generals von Thielmann

(Berlin, 1828); von Holzendorff, Beiträge zur Biographie des

Generals Freiherrn von Thielmann (Dresden, 1830); von Peters-
dorf, General Johann Adolf Freiherr von Thielmann (Leipzig, 1894).

THIERRY, the name of two French historians, the brothers

Augustin and Amédée, both of whom, though their literary

and historical powers were far from being equal, displayed the

same devotion to historical study.

1. JACQUES NICOLAS AUGUSTIN THIERRY (1755-1836),

the elder and more gifted, was born at Blois on the 10th of May

1755. He had no advantages of birth or fortune, but was

greatly distinguished at the Blois Grammar School, and entered

the École normale supérieure (1811). In 1813 he left H, and was

sent as a professor to Compiègne, but stayed there a very short

time. His ardent and generous nature led him to embrace the

ideas of the French Revolution with enthusiasm, and in 1789 he

resigned his post at Compiègne, and devoted himself to

the service of Saint Simon's ideal society of the future. He became

the secretary, and, as he would say himself, the "adopted son"

of the famous visionary (1814-17); but, while most of Saint

Simon's followers turned their attention to the affairs of life,

devoting themselves to the problems, both theoretical and

practical, of political economy, Thierry turned his to history.

His imagination had been powerfully impressed by reading

Les Martyrs, in which Châteaubriand had contrasted the two
civilizations and the two races from which the modern world

was formed. His romantic theories were further nourished by the

works of Sir Walter Scott, and though he did not himself actually write romances, his conception of history

fully recognized the dramatic element. His main ideas on

the Germanic invasions, the Norman Conquest, the formation of

the Communes, the gradual ascent of the nations towards free

government and parliamentary institutions are already

observed in the articles contributed by him to the Censeur

européen (1817-20), and later in his Lettres sur l'histoire de

France (1820). From Fauriel he learnt to use the original

texts, and from Mme. de Beaumont he learned the

collection, as yet very ill understood, of the Anglo-Saxon laws,

he composed his Histoire de la Conquête de l'Angleterre par les

Normands, the appearance of which was greeted with great

enthusiasm (1825). It was written in a style at once precise

and picturesque, and was dominated by an idea, at once
generous and false, that of Anglo-Saxon liberty resisting the

invasions of northern barbarians, and reviving, in spite of

defeat, in the parliamentary monarchy. His artistic talent as

a writer makes the weaknesses and deficiencies of his scholar-

ship and the obvious passion of his ideas of no great

importance. He required several years of hard work, cost Thierry his eye-

sight; in 1826 he was obliged to engage secretaries and in 1830

came quite blind. Notwithstanding, he continued to pro-

duce works. In 1827 he republished his Lettres sur l'histoire de

France, with the addition of fifteen new ones, in which he

described some of the more striking episodes in the history

of the rise of the medieval communes. The chronicles of the

11th and 12th centuries and a few communal charters provided

him, without requiring a great amount of erudition, with

materials for a solid work. For this reason his work on the

communes has not become so out of date as his Norman Con-

quest; but he was too apt to generalize from the facts furnished

by a few striking cases which occurred in a small portion of

France, and helped to spread among the public, and even

among professional historians, mistaken ideas concerning one of

the most complex problems relating to the social origins of

France.

Thierry was ardent in his applause of the July Revolution and

the triumph of liberal ideas; at this time, too, his brother

Amédée was appointed prefect, and he went to live with him

for a few years. He retired, however, from politics, and

devoted himself to an examination of euvres historiques, his first essays in the Censeur

européen and the Courrier français (1834), and composed his Recits des temps mérovingiens,

in which he reproduced a vivid and dramatic form some of the most characteristic stories of Gregory of

Tours. These Recits appeared first in the Revue des deux

mondes; when collected in volume form, they were preceded

by long and interesting Considerations sur l'histoire de France.

From the 7th of May 1830, Thierry had already been a member of the

Académie des Inscriptions et Belles Lettres; in 1841, on

the motion of Villemain, the French Academy accorded to

him the first Prix Gobert, which became a kind of literary

inheritance for him, being renewed in his favour fifteen years in

succession. Moreover, he had been allotted the task of publish-

ing in the series of the Documents inédits a selection of acts

bearing on the history of the Third Estate. By the aid of

zealous collaborators (including Bourquelot and Louandre) he

compiled, in four volumes, a valuable Recueil des monuments

inédits de l'histoire du Tiers État (1850-70), which, however,

bear only on the northern part of France. The preface

appeared afterwards in a separate volume under the title of

Histoire du Tiers État. To Thierry belongs the credit for

inaugurating in France the really critical study of the communal

institutions, and we cannot make him responsible for the

neglect into which it relapsed after his death. The last

years of his life were clouded by domestic griefs and by illness.

In 1844 he lost his wife, Julie de Querengal, an intelligent

woman, who had been to him a collaborator as capable as she

was devoted. The revolution of 1848 inflated on him a final blow.
by overturning that régime of the Liberal bourgeoisie the triumph of which he had hailed and justified as the necessary outcome of the whole course of French history. He began to distrust the rationalistic opinions which had hitherto estranged him from the Church. When Catholic writers animadverted on the "historical errors" in his writings he promised to correct them, and accordingly we find that in the final edition of his Histoire de la Conquête his severe judgments on the policy of the court of Rome, together with some faults of detail, are eliminated. Though he did not renounce his Liberal friends, he sought the conversation of enlightened priests, and just before his death it is said that he had proposed to enter the pale of the Church. He died in Paris on the 22nd of May 1856, after several years of suffering endured by heroism.

II. ANÉDOTE SIMON DOMINIQUE THIERRY (1797—1873) was the younger brother of Augustin, and was born on the 2nd August 1797. He began life as a journalist (after an essay, like his brother, at schoolmastering), was connected with the famous romantic harbingers the Globe, and obtained a small government clerkship. His first book was a brief history of Guizoune in 1825, and three years later appeared the first volume of the Histoire des deux mondes, articles which received was so well-liked from a man, from the royalist premier Martinage, a history professorship at Besançon. He was, however, thought too liberal for the government of Charles X., and his lectures were stopped, with the result of securing him, after the revolution, the important post of prefect of the Haute-Saône, which he held eight years. During this time he published nothing. In 1838 he was transferred to the council of state as master of requests, which post he held through the revolution of 1848 and the coup d'état till 1860, when he was made senator—a paid official, it must be remembered, and, in effect, a lucrative sinecure. He also passed throughout all the ranks of the Legion of Honour, became a member of the Académie des Inscriptions in 1841, and in 1862 received the honorary degree of D.C.L. at Oxford. He had, except during the time of his prefecture, never intermitted his literary work, being a constant contributor to the Revue des deux mondes, his articles (usually worked up afterwards into books) almost all dealing with Roman Gaul and its period. The chief were the Histoire des Gaulois, 3 vols. (1828, 1834, 1845; the 8th vol. I. appeared in 1870); Histoire de la Gaule sous l'administration romaine (3 vols., 1840-47; and ed. 1853), which gave of Aillaud a sousseupier of the establishment of the Hengrosi in Europe (1856; 5th ed. in 1874); Tableau de l'Empire romain (1862; 5th ed. in 1871; now quite out of date); Récits de l'histoire romaine au V e siècle: la lutte contre les Barbares, and les luttes religieuses (1860; 2nd ed. in 6 vols. 1860). He died in Paris on the 27th of March 1873. His son, Gilbert Augustin Thierry (born 1843), who began a literary career by articles on Les Révolutions d'Angleterre (1864) and some Essais d'histoire religieuse (1867), afterwards confined himself to the writing of novels.

THIERS, LOUIS ADOLPHE (1797—1877), French statesman and historian, was born at Marseilles on the 16th of April 1797. His family are somewhat grandiloquently spoken of as "cloth merchants ruined by the Revolution," but it seems that at the actual time of his birth his father was a locksmith. His mother belonged to the family of the Chéniers, and he was well educated, first at the lycée of Marseilles, and then in the faculty of law at Aix. Here he began his lifelong friendship with Mignet, and was called to the bar at the age of twenty-three. He had, however, little taste for law and much for literature; and he obtained an academic prize at Aix for a discourse on Vauvenargues. In the early autumn of 1821 Thiers went to Paris, and was quickly introduced as a contributor to the Constitutionnel. In each of the years immediately following his arrival in Paris he collected and published a volume of his articles, the first on the salon of 1822, the second on a tour in the Pyrenees. He was put out of all need of money by the singular benefaction of Cotta, the well-known Stuttgart publisher, who was part-proprietor of the Constitutionnel, and made over to Thiers his dividends, or part of them. Meanwhile he became very well known in Liberal society, and he had begun the celebrated Histoire de la révolution française, which founded his literary and helped his political fame. The first two volumes appeared in 1823, the last two (of ten) in 1827. The book brought him little profit at first, but became immensely popular. The well-known sentence of Carlyle, that it is "as far as possible from meritng its high reputation," is in strictness justified, for all Thiers's historical work is marked by extreme inaccuracy, by prejudice which passes the limits of accidental unfairness, and by an almost complete indifference to the merits as compared with the antecedents of the facts. Thiers himself did not hesitate to declare that Thiers is "a brisk man in his way, and will tell you much if you know nothing." Coming as the book did just when the reaction against the revolution was about to turn into another reaction in its favour, it was assured of success.

For a moment it seemed as if the author had definitely chosen the lot of a literary man, not to say of a literary hack. He even planned an Histoire générale. But the accession to power of the Polignac ministry in August 1829 changed his projects, and at the beginning of the next year Thiers, with the help of the friends of the previous government, founded and became the editor of a new opposition newspaper. Thiers himself was one of the souls of the actual revolution, being credited with "overcoming the scruples of Louis Philippe," perhaps no Herculean task. At any rate he had his reward. He ranked as one of the Radical supporters of the new dynasty, in opposition to the party of which his rival Guizot was the chief literary man, and Guizot's patron, the duc de Broglio, the main pillar. At first Thiers, though elected deputy for Aix, obtained only subordinate places in the ministry of finance. After the overthrow of his patron Laffitte, he became much less radical, and, after some troubles of June 1832, was appointed to the ministry of the interior. He repeatedly changed his portfolio, but remained in office for four years, became president of the council and in effect prime minister, and began his series of quarrels and jealousies with Guizot. At the time of his resignation in 1836 he was foreign minister, and, as usual, wished for a spirited policy in Spain, which he could not carry out. He travelled in Italy for some time, and it was not till 1838 that he began a regular campaign of parliamentary opposition, which in March 1840 made him president of the council and foreign minister for the second time. But he held the post only six months, and, being unable to force on the king an anti-English and anti-Turkish policy, resigned on the 20th of October. He now had little to do with politics for some years, and spent his time on his Histoire du Consulat et de l'Empire, the first volume of which appeared in 1845. Though he was still a member of the chamber he spoke rarely, till after the beginning of 1846, when he was evidently bidding once more for power. Immediately before the revolution of February he went to all but the greatest lengths, and when it broke out he and Odillon Barrot were summoned by the king; but it was too late. Thiers was unable to govern the forces the king had to call to his aid, and was sent to Aix.

Under the republic he took up the position of conservative republican, which he ever afterwards maintained, and he never took office. But the consistency of his conduct, especially in voting for Prince Louis Napoleon as president, was often and sharply criticized, one of the criticisms leading to a duel with a fellow-deputy, Bixio. He was arrested at the coup d'état, was sent to Mazas, and then escorted out of France. But in the following summer he was allowed to return. For the next decade his history was almost a blank, his time being occupied for the most part on The Consulate and the Empire. It was not till 1863 that he re-entered political life, being elected by a Parisian constituency. For the seven years following he was the chief speaker among the small band of anti-Imperialists in the French chamber, and was regarded generally as the most formidable enemy of the empire. While nominally protesting against its foreign enterprises, he perpetually harped on French loss of prestige, and so contributed more than any one else to stir up the fatal spirit which brought
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on the war of 1870. Even when the Liberal-Imperialist Ollivier ministry was formed, he maintained at first anything but benevolent neutrality, and then an open opposition, and it is impossible to say whether mere "canniness," or something better, kept him from joining the government of the National Defence, of which he was in a manner the author.

Nevertheless the collapse of the empire was a great opportunity for Thiers, and it was worthily accepted. He undertook in the latter part of September and the first three weeks of October a circular tour to the different courts of Europe in the hope of obtaining some intervention, or at least some good offices. The mission was unsuccessful; but the negotiator was on its conclusion immediately charged with another—that of composing an agreement with Bismarck. Thiers had long predeceased him. He had been a member of the Academy since 1834. His personal appearance was remarkable, and not imposing, for he was very short, with plain features, ungainly gestures and manners, very near-sighted, and of disagreeable voice; yet he became (after wisely giving an attempt at the ornate style of oratory) a very effective speaker in a kind of conversational manner, and in the epigram of debate he had no superior among the statesmen of his time except Lord Beaconsfield.

Thiers was by far the most gifted and interesting of the group of literary statesmen which formed a unique feature in the French public history of the 19th century. There are only two who at all comparable to him—Guizot and Lamartine; and as a statesman he stands far above both. Nor is this eminence merely due to his great opportunity in 1870; for Guizot might under Louis Philippe have almost made himself a French Walpole, at least a French Palmerston, and Lamartine's opportunities after 1848 were, for a man of political genius, illimitable. But both failed—Lamartine by reason of his market or mind, and Guizot by reason of his temper at once imperious and intriguing, his invertebrate inclination towards brigue, that is to say, underhand rivalry and Caballing for power and place, showed themselves unfavourably; and his constant tendency to inflame the aggressive and chauvinist part of his country neglected fact, was not based on any just estimate of the relative power and interests of France, and led his country more than once to the verge of a great calamity. In opposition, both under Louis Philippe and under the empire, and even to some extent in the last four years of his life, his worst qualities were always manifested. But with all these drawbacks he conquered England, won a place for France among the smallest, class of statesmen—the class of those to whom their country has had recourse in a great disaster, who have shown in bringing her through that disaster the utmost constancy, courage, devotion and skill, and who have been rewarded by as much success as the occasion permitted.

As a man of letters Thiers is very much smaller. He has not only the fault of diffuseness, which is common to so many of the best-known historians of his century, but others as serious or more so. The charge of dishonesty is one never to be lightly made against men of such distinction as his, especially when their evident solicitude for panegyric, casuistry, and the strength of will which makes them (unconsciously, no doubt) close and keep closed the eyes of their mind to all inconvenient facts and inferences, supply a more charitable explanation. Their vanity retains the claim on the reader from Thiers' dealings with the first revolution to his dealings with the battle of Waterloo, constant, angry and well-supported protests against his unfaithfulness were not made through any lapse of thought. This, in another work in which documents were undoubtedly wide, its results are by no means always accurate, and his admirers themselves admit great inequalities of style in him. These characteristics reappear (accompanied, however, by frequent touches of the epigrammatic power above mentioned, which seems to have come to Thiers more readily as an orator than as a historian) in his speeches, which after his death were collected in many volumes by his widow, Sainte-Beuve, whose notices of Thiers are generally kind, says of him, "M. Thiers sais tout, tranche tout, parle de tout, et cette omniscience et "cocksureness" (to use the word of a prime minister of England contemporary with Thiers), and these monstrosities, are the chief pervading features both of the statesman and the man of letters.

His histories, in many different editions, and his speeches, as above, are easily accessible; his minor works and newspaper articles are not, we believe. Very few, not even Souvenirs, were published years after his death appeared Deux opuscules (1891) and Mélanges littéraire (1892), while Notes et souvenirs, 1870-73, were published in a distinct volume. Among his best works are the "Souvenirs de M. Félicien Donsan. Works of him, by M. Laya, M. de Mazeade, his colleague and friend M. Jules Simon, and others, are numerous.

(G. SA.)

THIERS, a town of central France, capital of an arrondissement in the department of Puy-de-Dôme, 24 m. E.N.E. of Clermont-Ferrand, on the railway between that town and St Étienne. Pop. (1906) town, 12,601; commune, 17,418. Thiers is most picturesque situated on the side of a hill at the foot of
which the Durolle rapidly descends through a narrow valley into the Dore, a tributary of the Allier. The streets rising in steep rows contain a large number of stone and wooden houses, some of which date to the 13th century. A fine view of the peak of Limagne and the Dôme mountain is obtainable from the terraces. The church of St. Genis was built in 575 by Avitus, bishop of Clermont, and rebuilt in the 12th century. It has some curious mosaic work of the Merovingian period and a fine tomb of the 13th century. The church of Le Moutier, which formerly formed part of a Benedictine monastery, dates chiefly from the 11th century. Thiery is the seat of a sub-prefecture and has tribunals of first instance and of commerce, a chamber of commerce, a board of trade arbitration, a commercial college, a commercial and industrial school, and a branch of the Bank of France. Its special industry is the manufacture of cutlery, which employs some 13,000 hands in the town and its vicinity. The manufacture of handles and buttons of bone, pasteboard, stamping, hand-made and other papers and machinery are also carried on.

Thiers was sacked about 531 by the soldiers of Thierry, son of Clovis. About the same period Gregory of Tours speaks of a wooden chapel which may have occupied the site of the present church of Le Moutier. The commercial importance of the town was much increased in the 16th century when the manufacture of cutlery was introduced from the neighbouring town of Châtillon (1833).

THIERSCH, FRIEDRICH WILHELM (1784–1866), German classical scholar and educationist, was born at Kirchseiden- dungen near Freiburg on the Unstrut, on the 17th of June 1784. In 1809 he became professor at the gymnasium at Munich, and in 1826 professor of ancient literature in the university of Landshut, transferred in that year to Munich. He died at Munich on the 25th of February 1860. Thielsch, the "tutor of Bavaria" (praeceptor Bavariae), found an extremely unsatisfactory system of education in existence. The principal violent feud between the Protestants' "north" and the Catholic "south" Germany still continued, and the chiefly old monks, offered violent opposition to his reforms, and an attempt was made upon his life. His schemes, however, were carried out, and have remained the governing principle of the educational institutions of Bavaria. Thielsch was an ardent supporter of Greek independence. In 1832 he visited Greece, and it is said that his influence had much to do with securing the throne of the newly created kingdom for Otto of Bavaria. He wrote a Greek grammar, a metrical translation of Pindar, and an account of Greece (L'Etat actuel de la Grèce, 1846).

Biography by his son, H. W. J. Thielsch. (1866); see also G. M. Thomas, Gedächtnissrede auf Friedrich von Thielsch (1866); articles by A. Baumeister in Allgemeine Deutsche Biographie and O. Zöckler in Herzog-Hauck's Realencyclopädie für protestantische Theologie, u. a. J. E. Sandys, History of Classical Scholarship, iii. (1906).

THIETMAR (DIETMAR OF DITTMAR) OF MERSEBURG (975–1018), German chronicler, was a son of Siegfried, count of Walbeck, and was related to the family of the emperor Otto the Great. Born on the 25th of July 975 he was educated at Quedlinburg and at Magdeburg and became provost of Walbeck in 1002 and bishop of Merseburg seven years later. He took some part in the political events of the time; in 994 he was a hostage in the hands of the Northmen, and he was not unfamilier with the actualities of war. He died on the 1st of December 1018.

Thietmar wrote a Chronicon in eight books, which deals with the period between 906 and 1018. For the earlier part he used Widukind's Res gestae Saxonicæ, the Annales Quedlinburgenses and other sources; the latter part is the result of personal knowledge. It is rough in form and the author shows no power of discriminating between important and unimportant events; yet the chronicle is an excellent authority for the history of Saxony during the reigns of the emperors Otto III. and Henry II. No kind of book could be more useful for tracing the details relating to the bishopric of Merseburg and to the wars against the Wends and the Poles. The original manuscript of the work is preserved at Dresden and has been published in facsimile by L. Schmidt (Dresden, 1906). It has been edited by J. M. Lappenberg in Band III. of the Monumenta Germaniae historica, Scriptores; and by F. Kurze (Hanover, 1899); and has been translated into German by J. Laurent (new ed., revised by W. Wattenbach, Leipzig, 1892). See Kurze, Bischof Thietmar von Merseburg und seine Chronik (Halle, 1890); and W. Wattenbach, Deutschlands Geschichtsquellen, Band 11. (Berlin, 1904).

THIMBLE, an implement for use in sewing, serving as a protective covering for the finger in pushing the needle through the material worked upon. For ordinary purposes the thimble is a bell-shaped cap reaching to the first joint and is usually worn on the middle finger. It is made of silver or other metal, sometimes of horn, ivory or bone. The sail-maker's thimble or "thumrel" is a heavy ring, worn on the thumb, with a disc attached which is the part used to press against the needle. The O.E. thymel, from which the word descends, is formed, with the suffix suffix thums, the thumb, the protective covering having been formerly worn in that dat. The thumb, by etymology means the "thumb" finger, and is to be referred to the root tim, to swell, up, become thick, seen in Lat. tumere, "thumrel," &c. The term "thimble" is used by many mechanical appliances, especially of various forms of sleeve, bushing or joining for the ends of pipes, or shaftings, or as covering for an axile, &c. In nautical usage the "thimble" is a metal ring concave on the outside in which a rope runs; it is a protection against chafing.

THIOPHEN, C₄H₄S, a compound occurring in small quantities in crude coal-tar benzene, from which it was first isolated in 1883 by V. Meyer (Ber., 1883, 16, p. 1465). The method adopted by Meyer to recover the thiophen was as follows: Ten volumes of the purest coal-tar benzene were shaken for four hours with one volume of sulphuric acid, the acid layer was removed and neutralized with lead carbonate, and the lead thiophenolate obtained was distilled with an equivalent quantity of ammonium chloride. The distillate obtained was diluted with one hundred volumes of lignoain (previously purified by shaking with fuming sulphuric acid) and then shaken for one or two more times with the same solvents (using ten volumes of acid to one volume of the distillate). The acid layer so obtained was neutralized with lead carbonate and the lead salt again distilled with an equivalent quantity of ammonium chloride. The distillate is finally rectified. It may be obtained in small quantity by passing ethylen or acetylene into boiling sulphur; by passing ethyl sulphide through a red-hot tube; by heating crotonic acid, butyric acid or erythritic with phosphorus pentasulphide; by heating succinic anhydride with phosphorus pentasulphide or sodium succinate with phosphorus trisulphide (J. Volhard and H. Ermann, Ber., 1885, 18, p. 1784); or by heating succinidihydride with two parts of phosphorus trisulphide (C. Harries, Ber., 1901, 34, p. 1496).

It is a colourless liquid having a faint smell resembling that of benzene and boiling at 84° C. In its chief properties it very much resembles benzene, being readily brominated, sulphonated, and nitrated; also, the side chains in the alkyl thiophens are readily oxidized to carboxyl groups. On passing its vapour through a red-hot tube it yields di-thiényl, C₄H₄S₂. It is completely decomposed by hydriodic acid at 140° C. It condenses with aldehydes (in chloroform solution) in the presence of phosphorus pentachloride and hydrogen cyanogen (A. Nahe, Ber., 1897, 30, p. 2373). It can be readily recognized by the blue colour produced when a trace of thiophen is added to iasxin dissolved in concentrated sulphuric acid (the indophenin reaction). The thiophen ketones may be prepared by the interaction of thiophen and its homologues with acid chlorides in the presence of anhydrous aluminium chloride. The thiophen ketones are best prepared by heating the 1,4-diketones with phosphorus pentasulphide, the diketones reacting in the enolic form: R-C=C=CH₂ + H₂O = R+P₂S₅ + R-C=CH₂, C=C-R. Thietmarrei, or oxymethyl thiophene, is prepared by heating laevulenic acid with phosphorus pentasulphide (W. Kues and C. Paul, Ber., 1886, 19, p. 553). On this group see also V. Meyer, Die Thiophengruppe.
THIRLY (or THIRLEY), THOMAS (c. 1506–1570), English prelate, was born at Cambridge and was educated at Trinity Hall in the university there, becoming a fellow of his college. Through the good offices of his friend, Thomas Cranmer, he was introduced so as to prevent him from pursuing his heretical work, one of whose chaplains he had become, in several ways. Among his numerous public appointments were those of dean of the chapel royal and member of the council of the north. In 1540 he was made bishop of Westminster, being the first and only occupant of that see; in 1550, three years after Henry VIII’s death, he resigned the bishopric, which was dissolved, and became bishop of Norwich. As a diplomatist Thirlby had a long and varied experience; on several occasions he was sent on embassies to the emperor Charles V, and he helped to arrange the peace between England and France in 1559. He appears to have served Edward VI loyally throughout his short reign, both at home and abroad, although it is certain that he disliked the religious changes and he voted against the act of uniformity in 1540. He was thus more at ease when Mary ascended the throne. Translated in 1554 to the bishopric of Ely, he took part in the trial of Cranmer at Oxford and in the consecration of Reginald Pole as archbishop of Canterbury, but he himself did not take severe measures against heretics. When Elizabeth became queen the bishop refused to take the oath of supremacy; he afterwards went to Rome; he was elected to Trinity College, Cambridge, in October 1584, and gained the Craven university scholarship and the chancellor’s classical medal. In October 1581 he was elected to a fellowship, and went for a year’s travel on the Continent. At Rome he gained the friendship of Baron (Christian C. J.) von Bunsen, which had a most important influence on his life. On his return, “distrust of his own resolutions and convictions” led him to abandon for the time his intention of being a clergyman, and he settled down to the study of the law, “with a firm determination not to suffer it to encroach upon the oath of supremacy; in other ways he showed himself hostile to the proposed religious changes, and in 1559 he was deprived of his bishopric. For preaching against the innovations he was arrested in 1560, and he was in honourable confinement at Lambeth Palace when he died on the 26th of August 1570.

THIRLWALL, CONNOP (1797–1875), English bishop and historian, was born at Stepney, London, on the 11th of January 1797. His family was of Northumbrian extraction. He was a precocious boy, learning Latin at three, reading Greek at four, and writing sermons at seven. He went to the Charterhouse school, where George Grubb and John Hinde were among his schoolmates. He entered Trinity College, Cambridge, in October 1814, and gained the Craven university scholarship and the chancellor’s classical medal. In October 1818 he was elected to a fellowship, and went for a year’s travel on the Continent. At Rome he gained the friendship of Baron (Christian C. J.) von Bunsen, which had a most important influence on his life. On his return, “distrust of his own resolutions and convictions” led him to abandon for the time his intention of being a clergyman, and he settled down to the study of the law, “with a firm determination not to suffer it to encroach upon the oath of supremacy; in other ways he showed himself hostile to the proposed religious changes, and in 1559 he was deprived of his bishopric. For preaching against the innovations he was arrested in 1560, and he was in honourable confinement at Lambeth Palace when he died on the 26th of August 1570. Translated in 1554 to the bishopric of Ely, he took part in the trial of Cranmer at Oxford and in the consecration of Reginald Pole as archbishop of Canterbury, but he himself did not take severe measures against heretics. When Elizabeth became queen he resigned the bishopric, which was dissolved, and became bishop of Norwich. As a diplomatist Thirlby had a long and varied experience; on several occasions he was sent on embassies to the emperor Charles V, and he helped to arrange the peace between England and France in 1559. He appears to have served Edward VI loyally throughout his short reign, both at home and abroad, although it is certain that he disliked the religious changes and he voted against the act of uniformity in 1540. He was thus more at ease when Mary ascended the throne. Translated in 1554 to the bishopric of Ely, he took part in the trial of Cranmer at Oxford and in the consecration of Reginald Pole as archbishop of Canterbury, but he himself did not take severe measures against heretics. When Elizabeth became queen the bishop refused to take the oath of supremacy; he afterwards went to Rome; he was elected to Trinity College, Cambridge, in October 1584, and gained the Craven university scholarship and the chancellor’s classical medal. In October 1581 he was elected to a fellowship, and went for a year’s travel on the Continent. At Rome he gained the friendship of Baron (Christian C. J.) von Bunsen, which had a most important influence on his life. On his return, “distrust of his own resolutions and convictions” led him to abandon for the time his intention of being a clergyman, and he settled down to the study of the law, “with a firm determination not to suffer it to encroach upon the oath of supremacy; in other ways he showed himself hostile to the proposed religious changes, and in 1559 he was deprived of his bishopric. For preaching against the innovations he was arrested in 1560, and he was in honourable confinement at Lambeth Palace when he died on the 26th of August 1570.

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THIRSK—THIRTY YEARS' WAR

in three volumes (1877–78), two of which are occupied by his charges. His *Letters, Literary and Theological*, with a connecting memoir, were edited by J. J. S. Perowne and L. Stokes (1881). His *Letters to a Friend* (Miss Johnes of Dolaucrothy) are a splendid monument to his memory. Thirsk's work is a revised and corrected edition. For a general view of Thirsk's life and character, see the *Edinburgh Review*, vol. cxliii.; for a picture of him in his diocese, *Temple Bar*, vol. lxxvi.

**THIRSK**, a market-town in the Thirsk and Malton parliamentary division of the North Riding of Yorkshire, England, 22 m. N.W. by N. from York by the N.Y.

*The* Union and the *League* formed.

It lies in a fertile plain W. of the Hambleton Hills, on the Codbeck, a small tributary of the Swale. The church of St Mary, entirely Perpendicular, with parvis, chancel, nave, aisles, porch, and tower 80 ft. in height, is one of the most beautiful churches in the Riding. The original work of oak is especially noteworthy. The moat of the ancient castle built by the Mowbrays about 980 remains. The principal modern buildings are the assembly rooms, mechanics' institute, and court-house. Standing in the fertile district of the Vale of Mowbray, the town has an extensive agricultural trade. Agricultural implements are manufactured. In addition to the manorial engineering, tanning and brick-making are carried on, and there are large flour-mills.

At the time of the Domesday Survey, Thirsk (Treske) was a manor of little importance belonging partly to the king and partly to Hugh, son of Baldric. Soon afterwards it was granted to Robert de Mowbray, who often resided there, and is said to have raised the castle round which the borough grew up. His estates, being forfeited for treason against William Rufus, were restored by Henry I. to Nigel de Albin, Robert's cousin, who took the name of Mowbray. Roger, son of Nigel, took part in the rebellion against Henry II. In 1174, and although he was allowed to retain his estates, his castle at Thirsk was destroyed. The manor remained in his family until the death of John de Mowbray, duke of Norfolk, without issue male in 1475, and after passing through several families was finally sold in 1723 to Ralph Bell, whose descendants thereafter held the manor. Thirsk is first mentioned as a borough in a charter granted by Roger de Mowbray to Newburgh Priory in the reign of Henry II.

*Defeat of the Bohemians.*

It was governed by a bailiff elected by the burgesses at the court leet of the lord of the manor, and never received a charter of Incorporation. The burgesses were represented in parliament by two members in 1295 and again from 1532–53 to 1832, when by the Municipal Reform Act the number was reduced to one. In 1885 the town was disfranchised. Roger de Mowbray held a market by prescription in Thirsk in the 13th century, and by Camden's time (c. 1586) it had become one of the best markets in the North Riding. It is still held by the lord of the manor.

See *Victoria County History: Yorkshire; William Grainge, The Vale of Mowbray: a historical and topographical account of Thirsk and its neighbourhood* (1893).

**THIRTY YEARS' WAR** (1618–1648), the general name of a series of wars in Germany which began formally with the claim of Frederick, archduke of Austria, prince-elector of Bohemia, to the crown of Bohemia, under the treaty of Westphalia. It was primarily a religious war and was waged with the bitterness characteristic of such wars, but at the same time political and feudal quarrels were interwoven with the religious question, with the consequence that the armies, considering themselves as their masters' retainers rather than champions of a cause, plundered and burned everywhere, military violence being in no way restrained by expediency. In a war based on the principle *ejus regio ejus religio* it was vain to expect either the professional or the national type of army to display its virtues.

Fifty years before the outbreak of the war the Convention of Passau had compromised the burning questions of the Reformation, but had left other equally important points as to the secularization of church lands and the consecration of Protestant bishops to the future. Each such case, then, came before the normal government machinery. A Diet was constituted that even though at least half of the secular princes and nine-tenths of their subjects were Protestants, the voting majority was Catholic in beliefs and in vested interests. Moreover, the Jesuits had rallied and disciplined the forces of Catholicism, while Protestantism, however firm its hold on the peoples, had at the courts of princes dissipated itself in doctrinal wrangles. Thus, as it was the princes and the free cities, and by no means the mass of the people, that settled religious questions, the strongest side was that which represented conservatism, peace and Catholicism. Realizing this from the preliminary murrinings of the storm, the Thirties' prince that was called upon promptly answered by the Catholic League. This group was headed by the wise and able Maximilian of Bavaria and supported by his army, which he placed under a soldier of long experience and conspicuously ability, Count Tilly.

The war arose in Bohemia, where the magistrates, roused by the systematic evasion of the guarantees to Protestants, refused to elect the archduke Ferdinand to the vacant throne. Bohemian Protestants, offered it instead to Frederick, the elector palatine. But the aggrandizement of this elector's power was entirely unacceptable to the manufacture of iron and manufactures—forces of Saxony above all. They declared themselves neutral, and Frederick found himself an isolated rebel against the emperor Ferdinand, and little more than the nominal head of an incoherent nobly in his new kingdom.

Even thus early the struggle showed itself in the double aspect of a religious and a political war. Just as the Protestants and their nominee found themselves looked upon askance by the other Protestants, so the emperor himself was unable to call upon Maximilian's Army of the League without promising to aggrandize Bavaria. Indeed the emperor was at first—before Frederick intervened—almost a mere archduke of Austria, waging a private war against his neighbours. Only the incoherence of his enemies saved him. They ordered taxes and levies of soldiers, but the taxes were not collected, and the soldiers, unpaid and unfed, either dispersed to their homes or plundered the country-side. The only coherent force was the mercenary corps of Ernst von Mansfeld, which, thrown out of employment by the termination of a war in Italy, had entered the service of the Union. Nevertheless, the Bohemians were conspicuously successful at the outset. Under Count Thurn they won several engagements, and Ferdinand's army under Longueville, in Bohemia under Prince Eugene of Savoy (1623–1625), was driven back. Thurn appeared before Vienna itself. Moravia and Silesia supported the Bohemians, and the Austrian nobles attempted, in a stormy conference, to wrest from Ferdinand not only religious liberty but also political rights that would have made Austria and Bohemia a loose confederation of powerful nations. Ferdinand firmly refused, though the deputation threatened him to his face, and the tide ebbed as rapidly as it had flowed. One or two small military failures, and the enormous political blunder of bringing in the elector palatine, sealed the fate of the Bohemian movement, for no sooner had Frederick accepted the crown than Maximilian let loose the Army of the League. Spanish aid arrived. Spinola with 20,000 men from the Low Countries and Franche Comté invaded the Palatinate, and Tilly, with no fears for the safety of Bavaria, was able to combine with Buquoy against *Defeat of the Bohemians.*

*Battle of the Wisselberg.*

The resistance was crushed at the battle of the Wissel Berg near Prague (8/18 November 1620). With this the Bohemian war ended. Some of the nobles were executed, and Frederick, the "Winter King," was put to the ban of the Empire.

The menace of Spinola's invasion broke up the feeble Protestant Union. But the emperor's revenge alarmed the Union princes. They too had, more or less latent, the tendency to separatism and they were Protestants, and neither in religion nor in politics could they suffer an all-powerful Catholic emperor. Moreover, the alternative to a powerful emperor was a powerful Bavaria, and this they liked almost as little.
There still remained for the armies of Tilly and Buquet the reduction of the smaller garrisons in Bohemia, and finally expelled railed under Mansfeld, who was joined by the disbanded soldiery of the Protestant Union's short-lived army. Their new strategy was that which was the distinguishing mark of the Thirty Years' War. The control of ramified states had to be, as it were, a law of their own, quite independent of the wishes or needs of the sovereign whose interests they were supposed to serve.  

The conquest of territory upon hostile territory and Mansfeld was so far successful in these for the position of Tilly. 1621 became distinctly unfavourable to the emperor. He had to recall Buquet's army to Hungary to fight against Gabriel Bethlen, the prince of Transylvania, and in an unsuccessful battle at Neunhäuser (July 10) Buquet was killed. Tilly and the League Army fought warmly and did not risk a decision. Thus even the proffered Fresh combat- mediation in the German war might have been accepted but for the fact that in the Lower Palatinate a corps of English volunteers, raised by Sir Horace Vere for the service of the English princess Elizabeth, the fair queen of Bohemia, found itself compelled to accompany the troops under Mansfeld to the country of the nearest probable enemy—in their case the bishop of Spire. This brought about a fresh intervention of Spinola's army, which had begun to return to the Low Countries to prosecute the war. The Emperor, however, had thoroughly eaten up the Palatinate that the magnates of Frederick's own towns begged Tilly to expel his general, decamp into Alsace, where the Palatinate, with the Dutch, was in a state of extreme hunger and in winter safety.  

The winter of 1621–22 proved to be one of the most dangerous negotiations which ever degenerated into an article of war.  

Gottes Freund, der Pfaffen Feind, a plunderer of peasants or priests. Whatever he was the margrave George Frederick of Baden-Durlach, regarded to be of the princes the most skilful sequestor of ecclesiastical lands.  

In April 1622, while Vere garrisoned the central fortresses of the Palatinate, Mansfeld, Christian and George Frederick took the field against Tilly, who at once demanded assistance from Spinola. The latter, though engaged with the Dutch, sent a corps under his subordinate Cordova. Before this arrived Mansfeld and the margrave of Baden-Durlach entered Heidelberg (17/18 April 1622). Nevertheless Tilly's army was not as easily dissolved as one of theirs, and soon the allies had to surrender. And when Cordova came up, and Tilly and the Spaniards combined defeated George Frederick at Wimpfen and Neckar (26 April/6 May). Following up this success, Cordova chased Mansfeld back into Alsace, while Tilly went north to oppose Christian. The 10,500 men of the Majesty of the Holy Roman Empire was almost destroyed by the League Army at Höchst. Mansfeld, and with him Frederick, had already set out from Alsace to join Christian, but when that leader arrived with only a handful of beaten men, the war was practically at an end. Frederick took Mansfeld and Christian back to Alsace, and after dismissing their troops from his employment, retired to Sedan. Henceforth he was a prisoner by powerless exile, and his lands and his electoral dignity, forfeited by the last, went to the prudent Maximilian, who thus became elector of Bavaria. Finally Tilly conquered the Palatinate fortresses, now guarded only by the English volunteers.  

The next act in the drama, however, had already begun with the adventures of the outlaw army of Mansfeld and Christian.  

After Höchst, had it not been for them, the war might have ended in compromise. James I. of England was busy as always with mediation schemes. Spain, being then in close connexion with him, was working to prevent the transfer of the electorate to Maximilian, and the Protestant princes of North Germany being neutral, a diplomatic struggle over the fate of the Palatinate, where the capture of the army supported the arms supported a prisoner in equilibrium, might have ended in a new convention of Passau the same year, which might have regulated the present troubles and left the future to settle its own problems. The struggle would only have been deferred, it is true, but meanwhile the North German Pro- testants, now helpless in an unarmed neutrality, would have taken the hint from Maximilian and organized themselves and their army. As it was, they remained powerless and inactive, while Tilly's army, instead of being disbanded, was kept in hand to deal with the adventurers.  

These, after eating up Alsace, moved on to Lorraine, whereupon the French government "warned them off." But ere long they found the Electorate of Palatinate, who had been reduced, together with Spinola, who was besieging Bergem-op-Zoom, and the States-General invited Mansfeld to relieve it. Time was short and no sooner had the Lower Rhine possible, and the adventurers therefore moved straight across Luxemburg and the Spanish Netherlands to the rescue. Cordova barred the route at Fleurus near the Sambre, but the desperate invaders, held together by the sheer Christian character of their leaders, thrust them out of their way (19/29 August 1622) and relieved Bergem-op- Zoom. But ere long, finding Dutch discipline intolerable, they marched to the rich county of East Friesland.  

Their presence raised a panic in the heads of the Protestant princes of North Germany. In 1623 Mansfeld issued from his Frisian stronghold, and the threat of a visitation from his army induced the princes of the Lower Saxon Circle to join him. Christian was himself a member of the Circle, and although he resigned his bishopric, he was taken, with many of his men, into the service of his brother, the duke of Brunswick-Wolfenbüttel; around the mercenary nucleus gathered many thousands of volunteers, and the towns and the nobles' castles alike were alarmed at the progress of the Catholics, who were reigning Protestant bishops. But this circle was not all that had been by the misadventure of the mercenaries. The authorities of the circle ordered Christian to depart. He returned to Holland, therefore, but Tilly started in pursuit and caught him at Stadthoorn, where on 28 July/6 August 1623 his army was all cut to pieces.  

Tilly's army marched to Friesland, which, like the Bohemians, had ordered collectively to evacuate the country and levies of troops that the members individually furnished either not at all or unwillingly, disbanded their army to prevent originating. So Mansfeld, too, having eaten up East Friesland, returned to Holland in 1624.  

The only material factor was now Tilly's ever-victorious Army of the League, but for the present it was suspended inactive in the midst of a spider's web of European Foreign Inter- vention. Spain and England had quarrelled. The latter became the ally of France, over whose policy Richelieu now ruled, and the United Provinces and (later) Denmark joined them. Thus the war was extended beyond the borders of the Empire, and the way opened for ceaseless foreign interventions. From the battle of Stadthoorn to the pitiful end twenty years later, the decision of German quarrels lay in the hands of foreign powers, and for two centuries after the treaty of Westphalia the evil tradition was faithfully followed.  

France was concerned chiefly with Spain, whose military possessions all along her frontier suggested that a new Austria, more powerful than Charles the Bold's, might arise. To Ger- many, only subsidies were sent, but in Italy the Valtelline, as the connecting link with France, was still in French hands, and Germany, was mastered by a French expedition. James, in conjunction with France, re-equipped Mansfeld and allowed him to raise an army in England, but Richelieu was unwilling to allow Mansfeld's men to traverse France, and they ultimately went to the Low Countries, where, being raw pressed-men for the most part, and having neither pay (James having been afraid to summon parliament) nor experience in plundering, they perished in the winter of 1625. At the same time a Hugenot rising paralysed Richelieu's foreign policy. Holland after the collapse of the French expedition was anxious for her own safety owing to the steady advance of Spinola. The only member of the alliance who intervened in Germany itself was Christian IV. of Denmark, who as duke of Holstein was a member of the Lower Saxon Circle, as king of Denmark was anxious to extend his influence over the North Sea ports, and as Protestant dreaded the rising power of the Catholics. Gustavus Adolphus of Sweden, judging better than any of the difficulties of avaricing the Empire and Spain, contented himself for the present with carrying on a war with Poland.  

Christian IV. raised an army in his own lands and in the Lower Saxon Circle in the spring of 1625. Tilly at once advanced to meet him. But he had only the Army of the League, Ferdinand's
troops being occupied with repelling a new入侵 of Gabriel Bethlen. Then, like a *danes ex machina*, Wallenstein, duke of Friedland, came forward and offered to raise and maintain an army in the emperor’s service. It was an army like Mansfeld’s in that it lived on the country, but its operations were systematic and its products economically used, so that it was possible to feed 50,000 men where Mansfeld and his like had barely subsisted 20,000. This method, the high wages which he paid his own men, his own uniforms and his own discipline, his personality gave it a cohesion that neither a free company nor an army of mere Lower Saxon contingents could ever hope to possess.

In 1625, in spite of Tilly’s appeals, Wallenstein did nothing but levy contributions about Magdeburg and Halberstadt, keeping his new army well away from the risks of battle until he could trust it. It was for this reason that he refused to take part in the siege of Frankfurt, and that he not only disregarded Christian IV, who had been joined by Mansfeld and Christian of Brunswick, had in 1626, 60,000 men. Wallenstein and Tilly together had only a very slight numerical superiority, and behind them was nothing. Even the hereditary provinces of Austria were threatening revolt owing to their having to maintain Maximilian’s troops (the new elector thus recouping his expenses in the Palatinate war) and Gabriel Bethlen was again in the field. But on the other side the English subsidies failed, and the Protestant armies soon began to suffer in consequence. Tilly opposed Christian IV., Wallenstein Mansfeld. The latter, having stood still about Lübeck out of fear that it was fortunate for Brandenburg that the food was exhausted, advanced upon Wallenstein, attacked him in an entrenched position at the Bridge of Dessau and was thoroughly defeated (15/25 April 1626). He then wandered across Germany into Silesia and joined Wallenstein. His resistance was broken up by Mansfeld’s strong positions, compelled Mansfeld and Bethlen to choose between attacking him and starving. So, without the latter, he was unable to live. Wallenstein, according to a later, was disarmed and Mansfeld was required to leave Hungary.

Mansfeld and Christian of Brunswick died soon afterwards, the one in Hungary, the other in Westphalia. King Christian, left alone and unable, without English subsidies, to carry on the war methodically, but took the offensive, as Mansfeld had done, in order to live on the Thuringian countryside. But Tilly, with whom Wallenstein had left part of his army, moved as quickly as the king, brought him to action at Lutter-am-Bärenberge in Brunswick and totally defeated him (17/27 August).

With this, armed opposition to Tilly and Wallenstein in the field practically ceased until 1636. But there was enough danger to prevent the disbandment of their armies, which continued to live on the country. In the intervening years the balance of forces, political and military, was materially altered. France opposed Spain and the emperor in Italy with such vigour as Huguenot outbreaks permitted, England quarrelled with France, but yet like France sent subsidies to the North German Protestants. Gustavus held his hand, while Christian slowly gave up fortress after fortress to the South. Protestant princes in the West and against Gabriel Bethlen, subdued Silesia, where a small part of Mansfeld’s army had been left in 1626, and afterwards drove Christian’s army through Jutland (1627). But Wallenstein, with his dreams of a united Germany free in conscience and absolutely obedient to the emperor, drifted further and further away from the League. Ferdinand thought that he could fulfill the secular portion of Wallenstein’s policy while giving satisfaction to the bishops. The princes and bishops of the League continued to oppose any aggrandizement of the emperor’s power at the expense of the latter. But in the assumption of the character of a last of the embattled, the two Western Protestant cities were strong enough to refuse to admit Wallenstein’s garrisons. In 1628 Wallenstein, who had received the duchy of Mecklenburg on its rightful lord being put to the ban for his share in the Danish war, began to occupy his new towns, and also to spread along the coasts, for his united Germany could never be more than a dream until the possibility of Danish and Swedish invasions was removed. But the Hanse towns rejected his overtures, and Stralsund, second-rate seaport though it was, absolutely refused to admit a garrison of his wild soldiers. The result was the famous siege of Stralsund (February to August 1628), in which, with some slight help from overseas, the citizens compelled the hitherto unconquered Wallenstein army to retire. The siege was, as the result proved, a turning-point in German history. The emperor’s policy of restoring order had practically universal support. But the instrument of the restoration was a plundering army. Even this might have been borne had Wallenstein been able to give them, as he wished, not only peace but religious freedom. But when Christian signed the peace of Lübeck, and the Edict of Restitution (1629) gave back one hundred and fifty northern ecclesiastical foundations to the Catholics, men were convinced that one ruler meant one religion. Rather than endure this the North Germans had called in Gustavus Adolphus, and, just as Gustavus landed, the resentment of the princes of the League against Wallenstein’s policy and Wallenstein’s soldiers came to a head, and the emperor was forced to dismiss him. His soldiers were taken over by Tilly, and for the surprise he disappeared from the scene.

A thoroughly trained and recently recruited army from good yeomen and good soldiers of fortune, paid good wages, and led by a great captain, was a novelty in war that more than compensated for Tilly’s numerical superiority. Gustavus, however, after landing at Peenemünde in June, spent the rest of the year in establishing himself firmly in Mecklenburg and Pomerania, partly for military reasons, partly in view of a future Swedish hegemony of the Baltic, and most of all in order to secure the active support of the more important Protestant princes, so as to appear as an auxiliary rather than a principal in the German conflict. Though Gustavus, and of course his brother, the elector William of Brandenburg joined him, very unwillingly. He was soon afterwards allied with France, by the treaty of Bärwalde (January 1631). John George of Saxony, still attempting to stifle the war by his policy of neutrality, sent a last appeal to Vienna, praying for the revocation of the Edict of Restitution. Meanwhile Tilly had marched into north-eastern Germany. On the 19/20 March 1631, the old general of the League destroyed a Swedish garrison at New Brandenburg, and although Gustavus concentrated upon him with a swiftness that surprised the old-fashioned soldiers, Tilly wasted no time in manoeuvres but turned back to the Elbe, where his lieutenant Pappenheim was besieging Magdeburg. This city had twice defied Wallenstein’s attempts to introduce a garrison, and it was now in arms against the League. But John George, their prince, had not yet decided to join Gustavus. The latter, as yet without active allies, thought it impossible to go forward alone, and could only hope that his sudden and brilliant storm (5/13 April) of Frankfurt-on-Oder would bring back Tilly from the Elbe. But the hope was vain. Tilly and Pappenheim pressed the siege of Magdeburg, and the citizens, directed by Swedish policy, thought desperately that the place was surrounded, sacked and burnt on the night of the 10th of May 1631, amidst horrors that neither of the imperialist generals was able to check, or even to mitigate. The Catholics rejoiced as though for another St Bartholomew’s day, the Protestants were paralysed, and even Gustavus, accused on all hands of having allowed the Magdeburgers to perish without giving them a helping hand, sorrowfully withdrew into Pomerania. But Tilly, in spite of Pappenheim’s remonstrances, turned westward against Hesse-Cassel and other minor principalities whose rulers had declared for Gustavus. The old duke of Brunswick, the elector of Saxony, and the elector of Brandenburg, then George William of Brandenburg joined him, very unwillingly. Pappenheim began the siege of Magdeburg (February 1632), where the army entrenched itself, and, in spite of sickness and famine, stoically awaited the attack. The desired result was achieved. At the end of July Tilly, returning from the west before he had accomplished his reduction, made his appearance and was twice repulsed (13/23 and 18/28 July), losing 6,000 men out of 22,000. Moreover, Ferdinand having in his moment of triumph flatly rejected John George’s appeal against the Edict, Saxony took up arms. Thereupon Tilly, turning away from Gustavus’s entrenchments, invaded Saxony, being reinforced en route by 20,000 men from Italy (the war there being left to the Spaniards). The elector at once made an alliance with the Swedes.

1 In which he exacted life for plunder and plunders for plunder in return for the slaughter at New Brandenburg.
Then Gustavus advanced in earnest. Tilly had taken no measures to hold him off while the invasion of Saxony was in progress, and he crossed the Elbe at Wittenberg. 16,000 Saxons joined the 26,000 Swedes at Dülben, and some of the western Germans had already come in. Tilly had just captured Leipzig, and outside his place was carried away by Pappenheim's enthusiasm, he gave battle on the 7/17 September to the now superior allies. The first battle of Breitenfeld (q.v.) was a triumphant success for Gustavus and for the new Swedish system of war, such a battle as no living soldier had seen. The raw Saxons, who were commanded by Armim, once Wallenstein's lieutenant, were routed by Tilly's men without the least difficulty, and the balance of numbers returned again to the imperialist side. But the veterans of the Leib-Mall were nevertheless driven off the field in disorder, leaving 6000 dead. Tilly himself was thrice wounded, and only the remnant of his own faithful Wallon regiments remained with him and bore him from the field.

All Protestant Germany hailed Gustavus as the liberator. Wallenstein, glad of the defeat of the Catholic army, proposed to co-operate with the Swedes. John George, the Swedish general Horn and the Swedish chancellor Oxenstierna united in advising Gustavus to march straight upon Vienna. Richelieu, who desired to humble Ferdinand rather than to disestablish the power of the Catholic princes, wisely left the matter at large. Gustavus deliberately chose to move into South Germany, there to relieve the Protestants oppressed by Maximilian, to organize the cities and the princes in a new and stronger Protestant Union, the Corpus Evangelicorum, and to place himself in a country full of resources whence he could strike out against the emperor, Tilly, and the Rhine Spaniards in turn. To the Saxons he left the task of rousing the Bohemian Protestants, perhaps with the idea of thoroughly committing them to the war upon Ferdinand. The Swedish army pushed on through Halle, Erfurt, Arnim, Altenburg, and Lübben to the "Pfaffengasse," the long lane of bishops and abbeys along the Main and the Rhine, it wintered in luxury. The Palatinate was reorganized under Swedish officials and the reformed religion established again. In March 1632 the campaign was resumed. Nuremberg and Donauwörth welcomed Gustavus. Tilly's army, rallied and re-organized for the defence of Bavaria, awaited him on the Lech, but after a fierce battle the passage was forced by the Swedes (4/11 April) and Tilly himself was mortally wounded. Augsburg, Munich and all the towns and open country south of the Danube were occupied without resistance. At the same time the John George's army entered Prague without firing a shot.

The emperor had now either to submit or to re-establish Wallenstein. Wallenstein demanded as the price of his services the reversal of the Edict, and power to dethrone every prince who adhered to the Swedes. His terms were accepted, and in April 1632 he took the field as the emperor's alter ego with a new army that his recruiters had gathered in a few weeks. He soon expelled the Saxons from Bohemia and offered John George amnesty. The latter declared the basis of the League of Heilbronn returned to the Palatinate, and while Horn and Banér operated against an imperial army under Aldringen in the Neckar country, Bernhard took Regensburg from Maximilian's army. But it was now late in the year and Wallenstein was intent upon peace. With this object he endeavoured to secure the higher officers of the army, but these were gradually won over by Spanish emissaries; the emperor, having decided to continue the war in alliance with Spain, dismissed his general for the second time. Wallenstein then openly attempted to unite the Swedish, Saxony and other Protestant armies with his own, so as to compel all parties to make peace. But his army would not follow, the coup d'état failed, and Wallenstein was murdered at Eger (15/25 February 1634). All unity, Catholic or Protestant, died with him, and for the
next fourteen years Germany was simply the battle-ground of French, Spanish, Austrian and Swedish armies, which, having learned the complicity and advantages of plunder in the school of Mansfeld and Wallenstal, reduced the country to a state of misery that no historian has been able to describe, save by detailing the horrors of one or other village among the thousands that were ruined, and by establishing the net result that Germany in 1645 was worse off than England in 1485, so much worse that while England was the healthier for having passed through the fever of the Wars of the Roses, Germany remained for 150 years more in the stillness of exhaustion.

Success was for the present with the emperor and Spain. Gallas, now without contesting for the imperial crown, and with his companion from boyhood, whereas Bernhard, the Rupert of the German war, disagreed with Horn. Under the leadership nominally of the king of Spain, the imperialists now overthrew the Spaniards in Catalonia, captured Regensburg and Donauwörth, and when the Spanish Cardinal Infante joined them with 15,000 men on his way from Italy to the Netherlands, they were invincible. Bernhard attacked them in an entrenched position at Nördlingen (27 August, 6 September 1634) and was beaten with a loss of 17,000 men to 2000 of the defenders. Nördlingen was to	

**Battle of Nördlingen**

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**Aggressive policy of France**

The French army numbered 130,000 men in 1635, and 200,000 in the year after. One army assembled in Upper Alsace and another occupied Lorraine, which had been conquered in 1633; a corps under Henri de Rohan was despatched from the south. The most complete and dazzling achievement of fortune met with en route, to expel the enemy from the Valtelline, and so to cut the route to the Netherlands. Another force, co-operating with the duke of Savoy, was to attack the Milanes. Bernhard's army was prepared to defend the Neuf in the last days of October, when the French garrisons holding the places of Alsace. Having thus arranged to isolate the Spanish Netherlands, Richelieu sent his main army, about 30,000 strong, thither to join Frederick Henry of Orange and so to crush the Cardinal Infante. This was strategy on a scale hitherto unknown in the war. Tilly, Wallenstein and Gustavus had made war in the midst of political and religious troubles that hung over centrifugal tendencies. They had made war as they could, not as they wished. Richelieu had unified France under the absolute authority of the king, and his strategy, like his policy, was masterful and clear. But the event proved that his confederates were unable to hold with an unshakable grip the neck of the Spanish power when Gallas and the imperialists were at hand. As a great undertaker in the State and absorbed large forces. But not content with this Richelieu cultivated a climate of pious sentiments and a feeling of sympathy at the same time as he separated them. His forces were not sufficient for these tasks and he was therefore compelled to give battle, both in the Netherlands and in Germany, working with allies whose interests were not his. The army on the Meuse won a victory at Avins, south of Huy, and afterwards joined Frederick Henry in the siege of Nancy. The capture of Nancy and Montmédy in sixties of warfare parted so far from their former associates over the Waal that the inroad of Frederick Henry's army proceeded. Gallas was one of those rare outbursts of a momentary "people's war," which occur from time to time in the world of 18th centuries. The effect of it was that Frederick Henry withdrew to his own country, and in 1636 the French northern army had to face the whole of the Cardinal Infante's forces. In Italy the Franco-Piedmontese army achieved practically nothing, the gathering of the French contingent and its passage of the Alps consumed so much time. But the French took a successful mountain campaign, which even to-day is quoted as a model of its kind.

The Spanish and Lorraine, besides the Spaniards, the dispossessed duke of Lorraine was in the field against the French. Neither side was strong enough to prevail completely. Bernhard waged a desultory campaign in Germany, and then, when supplies gave out, he took refuge with his advancing army on the frontier of Austria, and the year's army was taken into the French service, he himself remaining in command and receiving vague promises of a future duchy of Alsace. Gallas's army from Frankfurt-on-Main pushed far into the Rhine basin, but his strength was not sufficient to compel it to retreat. In eastern Germany the consequences of the peace of Prague were that Saxony, Brandenburg and other states, signing the peace in the spring of 1635, were the first to continue the war. Thus John George turned his arms against the Swedes in his neighbourhood. But their commander Banér was as superior in generalship as he was inferior in numbers, and held the field until the renewal of Gustavus's peace with Poland, which expired in this year, set free a fresh and uncorrupted Swedish corps that had been held ready for eventualities in that country. This corps, under Torstensson, joined him in October, and on the 1st December the Swedes were invested by the imperialists.

Thus Richelieu's great scheme was only very partially executed. The battle of Avins and Rohan's Valletine campaign, the only attempt to re-established the line of battle against the southern French, was one of those accidents within Germany in which within German men were chiefly occupied in considering whether to accept the terms of the peace of Prague. But the land had no rest, for the armies were not disbanded.

In the Netherlands the campaign in 1635 were carried out with energy. John George, aided by an imperialist army, captured Magdeburg, drove back Baner to Lüneburg, and extended his right wing (imperialists) through Mecklenburg into Pomerania, where, however, a Swedish force under the elder Wrangel checked its progress. The Saxons then passed over the Elbe at Tangermünde and joined the imperialists, threatening to interpose between Baner and the Baltic. But Baner was too quick for them. He destroyed an isolated brigade of imperialists at Perleberg, and before the Brandenburg contingent could join John George, brought on a general action at Wittstock (29 September 4 October 1636). The battle was decided in three hours, 27 August, and Baner was able to attack both in front and rear. But while his first entrenchments defied the frontal attack Baner threw the most of his army upon the enveloping force and crushed it. The Wittstock, the king of Denmark, 11,000 killed and wounded, the combined army 11,000 killed and 8000 prisoners. The prestige of so brilliant a victory repaired even Nördlingen, and many North German princes who were about to make peace took fresh heart.

In the west, though there were no such battles as Wittstock, the campaign of 1636 was one of the most remarkable of the whole war. The Cardinal Infante was not only relieved by the retreat of the Dutch, but also reinforced by a fresh army under a famous cavalry officer, Johann von Weert. He prepared, therefore, to invade France from the north-west. Even though the army that advanced at the end of October from the Franche Comté, was delivered to the French, the French were too much scattered to offer an effective resistance, and Prince Thomas of Savoy-Carignan and Johann von Weert, the Cardinal Infante's generals, took Corbie, La Capelle, and some other places, passed the Somme and advanced on Compiègne. For a moment Paris was in danger, but the Cardinal Infante, by ordering Prince Thomas not to go too far in case he was needed to repel a Dutch inroad into Belgium, missed his opportunity. Louis XIII and Richelieu turned the Parisians from panic to enthusiasm. The burghers turned and won a battle at the dilapidated walls, and the old Huguenot marshal, Jacques Nompert, duc de La Force (d. 1642), standing on the steps of the Hôtel de Ville, raised men for the regular army by the hundred. Money, too, was willingly given, and some 12,000 volunteers went to Compiègne, whither Gaston from Orleans, Longueville from Normandy, and Condé, from Franche Comté, brought levies and reinforcements. Thus the army at Compiègne was soon


2 Composed partly of Bavarians who had fought their way from the battle of the Leuth to the Wesser, partly of Cologne troops who had joined the Bavarians against the Protestants of north-west Germany.
In the north-east, the effect of Wittstock proved but transient. Though the Swedes had driven the Hesse-Cassel, after an attempt at resistance, agreed to the treaty of Frankfurt. But the Swedes, taking Erfurt and Torgau found himself the target of several opponents—the Bavarians under Götz, who had remained on the Western Rhine, but had met the Swedes with skill, but had passed into Belgium in 1635, the beaten army of Wittstock, and a potential Brandenburg contingent. The Swedes did no more than defend their own country, but the imperialists and the inhabitants of Belgium, whose defeat he had envisaged, but who had been compelled by the surcease of the Swedes, were left the job of clearing the way for the Swedes, and the conquest of Coburg, which Monsieur’s army recaptured in November.

The gallantry of the defenders, which bore heavily on the townpeople, was rewarded by a singular trait of professionalism. The Swedes had attacked the entrenchments of Maubeuge, in winter quarters, and the garrison of Coburg, it is said, surrendered in good time in order not to be omitted in the allotment of comfortable billets in Belgium.

During the episode of Coburg another storm burst on the eastern frontier of France. The prince of Condé, governor of Burgundy, had in the spring entered Franche-Comté and besieged Dôle, but the inhabitants as well as the Spanish troops vigorously opposed him, and his army ultimately went south to that of Gaston. But, although Duke Charles IV, was active in the north-east, the armistice of the end of the French war with the Low Countries Prince Thomas and Piccolomini repulsed in turn the Dutch and the French. In the south Condé led from Bayonne an army that crossed the Pyrenees and joined the army in the Low Countries. Gaston, however, continued his small war in Lorraine with some success.

The name of Savoy with his own army and a French corps under Créqui advanced to the Ticino, and an action in which both sides lost several thousand men was fought at Tornavento a few miles from the future battlefield of Mantua, for which in its details this affair bears a singular resemblance (June 22, 1636). But the victory of the French was nullified by the refusal of Victor Amadeus, for political reasons, to advance on Milan, and Rohan, who had come down from the Valtelline to co-operate, hastily drew back into his stronghold. On the edges of the western Pyrenees a few towns were taken and retaken.

The campaign of 1637, on the French and Spanish side, was not particularly favorably disposed to either party. From Catalonia a Spanish army invaded Languedoc that was brought to a standstill in front of the rocky fortress of Leucate and defeated with heavy losses by the French relieving army under Schomberg, duke of Schauenburg (July 9th). But in August the Valtelline the Valtelline the lord regiments by Rohan mutinied for want of pay and Rohan had to retire to France. On the Low Countries frontier the cardinal de La Valette captured Câble Cambrai, Landrecies and Maubeuge, and, in the Low Countries, the landgrave of Hesse-Cassel, the duke of Savoy and the duke of Mantua, which occurred almost simultaneously, affected the political foundations of the war but little. The balance, such as it was, however, was unfavourable to France, for the duchess of Mantua went over to the imperialists and the duchess of Savoy was opposed by the princes of her house. On the other hand, Ferdinand III., in spite of Spain, had to concede more power to the electors as the price of the imperial dignity.

On the Rhine and in the adjacent countries Johann von Weert, returning from Belgium with his Bavarians, captured Ehrenbreitstein and marauded the French and expanded small French detachments from the elector of Trier, whose ruler, the archbishop, had been put to the ban by the emperor. Then, passing into the Main valley, he took Hanau. The main imperial army was deployed from Alsenz to the east in order to repair the disaster of Wittstock, and Charles of Lorraine, with his own small force and a detachment of French cavalry, beat them off at the Saône in June, after which Bernhard advanced vigorously against Piccolomini, the imperial commander in Alsenz, and crossed the Rhine at Rheinau. But soon Piccolomini was joined by Johann von Weert, and Bernhard retired again.

1 For the first time in the history of western Europe Cossacks appeared on French territory, and they were marked by extraordinary atrocities. They did not remain long at the front, for their insubordination and misconduct were so flagrant that even Gallas found them intolerable and dismissed them.

In 1638 the French operations in Italy, Belgium and Spain were in the main unsuccessful. In Italy Créqui was killed in an action on the 17th of March, and the Spanish commander in the mouth of the Po, the future duke of Savoy, also princely in the Low Countries Prince Thomas and Piccolomini repulsed in turn the Dutch and the French. In the south Condé led from Bayonne an army that crossed the Pyrenees and joined the army in the Low Countries. Gaston, however, continued his small war in Lorraine with some success.

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In 1639, as before, Richelieu’s attacks on Spain, other than those directed upon Alsace and Baden, were unsuccessful. In the north the French devoted this year, as they had devoted 1637 to the siege of Innsbruck, for the purpose of maintaining the view of a future frontière de fer. The two objectives selected, Besin and Thionville, were far apart, and the imperial army to which Piccolomini was posted midway between them. Piccolomini, by a forced march from Liége and Huy through the Ardennes, flung himself upon the besiegers of Thionville before their "circumvallation" became complete, and after a short but hard siege annihilated them (June 7, 1639) before the covering or rescuing army had even passed the Argonne. Then, however, Piccolomini, whose troops had bought the victory dearly, stood still for a time,
Thirty Years' War

and Hesdin, besieged with much pomp by Richelieu's nephew, La Meilleraie, surrendered on the 29th of June. On the side of the Pyrenean Condé as usual showed himself both unlucky and incapable. In Italy Cardinal de La Valette died, after allowing Prince Nino Savelli to take the city of Leggiuno, the most important French post except Casale, Chiavasso and the citadel of Turin taken by Thomas and Legrez.

The return of Harcourt, called by his men "Cadet-la-Perle" on account of his earrings, but a bold and exceedingly competent soldier. Under him served Turenne, hitherto known only as a younger brother of the duke of Bouillon. Harcourt reviewed them for the first time, and asked for the opinion of the review he advanced from Carignano to revisit Casale, detaching Turenne as flank-guard to hold off Prince Thomas on the side of Turin. The enterprise was entirely successful, but Thomas and Legrez was at one moment cut off as Harcourt, in the meantime, out-manoeuvred Legrez bested a defile on the Chiari-Carignano road (whence the action is called the Route de Quiers) while Thomas lay in wait to the north of Turin and the flank-guard sharply repulsed the prince, and by hard fighting the French returned safe and victorious (November 29th).

In Alsace Bernhard was carried off by a fever just as he was prepared to fight his way in a junction with him. He was fortunate in the opportunity of his death, for his dream of a duchy of Alsace had already brought him into conflict with Richelieu, and their conflict could hardly have ended more happily than in the death of the latter. Once took steps to secure his army 1 for the service of France, and Richelieu's officers were placed in charge of the country. But Bernhard had already decided that the long negotiations between the landgrave of Hesse-Cassel and the various powers ended in her allying herself with France and raising an army in return for a subsidy. Another event of importance in this year was the death of the last of the Palatinate princes, Palatine Charles.

Fate of the Spanish fleet.

In 1640 the French still kept up their four wars in Belgium, Germany, Italy and Spain. But the Belgian and Spanish frontiers were no longer directly attacked. On the side of Languedoc there was no further danger from the foolish imposition of strict defensive forms, and equally foolish threats to punish those who did not appear at the rendezvous, caused the Catalans, who were already defending themselves against the French both efficiently and vigorously, to turn their arms against the old enemy Castle. In December 1640 Portugal declared herself independent under a new king of the house of Braganza. In the Low Countries Louis XIII, hitherto unable to give his usual important forces of Arras, which surrendered on the 8th of August.

In Italy, however, Cadet-la-Perle kept the moral ascendancy he had won in the previous year. On the 16th of December 60,000 men he advanced from Carignano against the 20,000 Spaniards who were besieging Casale and attacked their line of circumvallation boldly and openly on the 29th of April. He himself led horseback led his stormers over the parapet.

In Germany Baner's course was temporarily checked. The archduke dialogued from him his few remaining posts in Bohemia, and when at last Bernhard's old army, under the duke de Longueville, crossed the Rhine at Bacharach and joined Baner in Thuringia, the latter, with his small army of 30,000 men, the broken country about Saalfeld until the country would no longer support the combined army. The Weimar and Hesse-Cassel armies retired to the Rhine at Welden, and, in the hope of detaching both German armies, the landgrave of Hesse-Cassel from the Swedish alliance, the imperial general wasted their territories, ignoring Baner. After the departure of the Swedes the imperial army,疗法 aghast to find the French army on their flank, the Swedish general could only watch for his opportunity.

This came in the winter months of 1640-1. Negotiations for peace were constantly in progress, but no result seemed to come out of them. The Swedes were assembled at Reenshausen, and the French army scattered over north-western Germany. Baner suddenly moved south heading for Ratisbon, for the defence of which the Swedes called the young Piccolomini's from the upper Rhine— were hurried up by the emperor. The Weimar Army under Guébriant joined the Swedes on en route, and the combined army reached the objective. But a thorn hindered them and gave them the time to concentrate his forces, and after a series of minor operations Baner's army found itself again in possession of Hesse, Lüneburg, Brunswick, etc. Guébriant's army, however, had again separated from him in order to live, and in May was at Berlin, and the remainder of the army was assembled at Karlsburg, 16 miles south of Schaumburg, to the north of the Rhine. The battle took place on the 20th of May Baner, worn out by fatigue, died, and after some intrigues and consultations the army elected the Count of Turenne to command. The last fortified place held by the Austrians in Lower Saxony, Wolfenbüttel, was now besieged by Torstensson's Swedes and Germans and Guébriant's French and Walenriachers, and the archduke, on the 20th of May, advanced with the army of the United Provinces, and outside the walls on the 29th of June. The war had now receded far from Alsace, which was firmly held by France, and no longer threatened even by Charles of Lorraine, who had made his peace with Louis XIII in the spring, and whose army had followed Guébriant into Germany. The losses of the Germans at Wolfenbüttel caused some of their princes to accept the peace of Prague, but the Holy Roman Emperor, Charles Leopold (Frederick William, the Great Elector) gave up the Austrian alliance and neutralized his dominions.

In 1641 Harcourt thoroughly established his position, without much help from Hungary. The Spanish insurrections continued and the French occupied Barcelona, but underwent a serious reverse at Tarragona. In the north La Meilleraie captured and held some of the Artois towns, but was driven out of the open country by the superior army of the Cardinal Infante. A formidable conspiracy against Richelieu brought about a civil war in which the king's troops were defeated at Marfaie, near Sedan (the fortress of Turenne's discontented brother, the semi-independent duke of Bouillon), by a mixed army of rebels, Spaniards, and Imperialists (July 6th). This, however, led to nothing further and the cardinal further his conquests. But his thanks for having joined the rebels, his newly regained fortresses were reoccupied by the French.

In December 1641 there began at Münster and Osnabrück in Westphalia the peace negotiations which, after eight more years of spasmodic fighting, were to close this ruinous war.

In 1642 Torstensson, having cleared up the war for a moment in the north-west, turned upon Silesia, defeated an imperialist corps at Schweidnitz and took some fortresses, but drove back when the archduke and Piccolomini came up with the main Austrian army. In October, however, he was joined by fresh troops from the north-east, crossed the Elbe and besieged Leipzig. The imperialist army, which was joined by the Saxons when their country was again the theatre of war, marched to the assistance of Torstensson. The battle of Leipzig was of enormous loss in the second battle of Breitenfeld 2 (November 1642).

But, although the Austrians feared an advance on Vienna itself, the victors waited for the fall of Leipzig and then took up winter quarters. Guébriant had throughout the year operated independently of the Swedes. The Bavarians had advanced into the lower Rhine region in order to support, in concert with the Belgian army of Spain, a fresh outbreak in France (Cinq-Mars, 1642). The emperor, with the field army, had driven the French from the Rhine, and before the new offensive Torstensson's army, strengthened and reinforced from the Netherlands, was made not simultaneously but successively, and Harcourt moreover was able to reinforce his army with herds of cattle. The French received fresh troops and a large convoy. The citadel was relieved and the town surrendered soon afterwards. Legrez retired to Milan, Prince Thomas was allowed to take his few remaining troops to Lyons, and recognized the duchess's regency.

"Forstalling others who desired its services, notably the Winter King, who intended to allay his quarrel with Spain and to force the retrocession of the Palatinate"! 3

The emperor executed all the officers and every tenth man of the regiment in which the panic began.

3 The emperor executed all the officers and every tenth man of the regiment in which the panic began.
Melo, the Cardinal Infante's successor, did not profit by his victory, turning back instead to oppose the Dutch and Guébriant. In Italy, Thomas of Savoy and his brother, submitting to the regency of the duchess, led her troops in concert with the French against the Spaniards of the Milanese, and took Tortona. Louis himself conquered the main part of the Casale Marittima and the Mars by executing its leaders, and Marshal de la Motte-Houdencourt held Catalonia and defeated Leganés at Lerida (October 7th).

Before the next campaign opened Louis and Richelieu were dead. One of the last acts of the king was to designate the young duc d'Enghien, son of the incapable Condé, as general of his northern army. Harcourt had strangely failed, Guébriant was far away, and the rest of the French must again experience but incapable of commanding an army.

Yet it was no small matter to put in their place a youth of twenty-one, who might prove not merely inexperienced but also incompetent. But Enghien's victory was destined to be the beginning of the Spanish army of a long hegemony of military Europe.

Melo had selected the Meuse route for his advance on Paris. On it he would meet only the places of Rocroi and Rethel; these mastered, he would descend upon Paris by the open lands between the Marne and the Oise. He hoped by a feint against Landrecies, and under cover of this secretly massed his Sambre and Ardennes corps on the Meuse, while Enghien, having the safety of Landrecies in mind, moved to St Quentin. There, however, the young general learned at the same moment that Louis XIII was dead and that the Spaniards had invested Rocroi. With the resolution and swiftness which was his whole career, he marched at once to offer them battle. Enghien's more experienced counsellors, the generals of the old school, were for delay. To risk the only French army at such a moment, they said, was madness, and even the fiery Gassion asked, "What will become of us if we are beaten?" But Enghien replied, "That will not concern me, for I shall be dead," and his personality overcame the fears of the doubters.

The battle took place on the 10th of May 1643, in a plain before Rocroi, without any marked tactical advantage of position on either side. Melo's cavalry was routed, and nearly all the infantry, 18,000 men of the best regiments in the Spanish army, the old Low Countries tercios, with their general the Conde de Fuentes, a veteran of fifty years' service, in their midst, stood their ground and were assailed on every side. Two hundred and sixty colours and standards went to grace Nâtre Dame.

But even Rocroi, under the existing conditions of warfare, was decisive only in so far as, by the destruction of Spain's superiority in Belgium, it saved France from further inroads from the north. Enghien indeed followed up the débris of Melo's army beyond the Sambre, but on the Rhine Guébriant, who had marched away from the region of Cologne into Württemberg, and there was nothing to prevent the imperialists in the northwest from joining Melo. The thorough establishment of the French on the Rhine and the need of co-operating with the Swedes was considered by the young general to be more important than fighting Melo in front of Brussels, and in spite of the protests of the Regent and Mazarin, he decided to attack Thionville. Taking a leaf out of Melo's book, he threatened Brussels in order to draw all the defenders thither, and then suddenly turned eastward. Enghien arrived on June 18th, a corps from Champagne had already reached the place on the 16th, and on the 8th of August Thionville surrendered. The small fortress of Sierck followed suit (September 8th).

Guébriant meanwhile had attempted without success to cover the French and Protestant posts in Württemberg against the united forces of his old opponents from the lower Rhine (Hatzfeldt's Bavarians) and a fresh Bavarian army under Mercy, and had retired into Alsace. Reaching Enghien he discovered his army was decimated into three-quarters in October, sent him a corps under Josias Ranzau to enable him to recross the Rhine and seize winter-quarters in Germany so as to spare Alase. Guébriant did so, but he was mortally wounded in the siege of Rottweil, a town at the source of the Neckar, and Ranzau, taking over the command, allowed himself to be surprised. This disaster was explained away by Charles of Lorraine (who had again changed sides and now commanded his own, Hatzfeldt's and Mercy's armies). At Tuttlingen on the headwaters of the Danube, Ranzau was taken prisoner, with the loss of 12,000 men, which under Piccolomini manoeuvred for a while to the west of Dresden. But Piccolomini was replaced by Gallas, who, though cherish ing visionary schemes of uniting Hatzfeldt's troops and Lestocq's Cologne-Bavarian-North German army with his own for a decisive blow, had in fact to fall back through Bohemia. The Swedes followed. Taking the small towns and avoiding the large places, Torstensson swept through Bohemia and Moravia in his steps dogged through the devastated country by Gallas, until he reached Brünich. Thence, however, he suddenly retreated to the shores of the Baltic. Christian of Denmark had declared war on Sweden, and threatened to isolate the Swedish forces in Germany. Torstensson, therefore, wintered in Holstein, Gallas, unable to follow him through districts already eaten up, in Saxony. In Italy and Switzerland he carried on the same operations without any result.

In 1644 Gascogne of Orleans, with La Meilleraye and Gassion under him, began the conquest of the Dunkirk region, capturing Gravelines in July. Melo, having no army to oppose them, and having invaded land and water, was forced to retreat. Marshal Plessis-Praslin undertook nothing serious, while Turenne's march in Spain La Motte-Houdencourt lost Lerida, and was ineffective in Italy, also.
cousin the landgrave of Hesse-Cassel. But at this point the army, headed by Bernhard's old colonels, demanded to be put into rest-quarters, and Turenne allowing them to disperse as they wished, was surprised by Mercy and Weert—who brought his courage of nothing else. The battle of Jarnac placed two-thirds of his forces. But Turenne instead of retreating to the Rhine installed himself in the landgrave's country, which was defended by a few Hessians and Swedes, while Engihr hurled up from the Moselle, in pursuit of the Rhine, the disaster. The "Army of Weimar" and the "Army of France" joined forces, as in 1643, almost under the eyes of the enemy. Engihr, pushing the French from Ladenburg, by Heilidelberg, Wimpfen, Rotterburg and Dinkelsbühl. But from day to day the balance leaned more and more on the French and Turenne, after Hadamar, threatening Vienna (April), had drawn off into Moravia, where he was thrown into a desperate struggle. The emperor was able to give Maxilian an Austrian corps to be added to Mercy's army. Mercy therefore, after manoeuvring for some time, Engihr, who was a strong position atAllerhein near Nördlingen, directly barred the way to the Danube. The second battle of Nördlingen (August 3, 1645) was as desperately fought as the first, and had not Mercy been killed at the crisis of the day, Engihr would probably have been disastrously defeated. As it was, the young duke was victorious, but he had only 1500 infantry left in rank and file out of 7000 at the end. Soon afterwards Engihr fell ill, and his army returned to France. Turenne, left with a few thousand men only, attempted in vain to hold his ground in Germany and had to make a hasty retreat before the archduke Leopold William, who had made peace with Rakóczy, and, leaving Torsentsson's successor Wrangel in Bohemia, was driven by the imperialists under their new general, Melander-Holzapfel. As the few obtainable supply of men was not enough to hold the line, the Siemens crossed the Rhine to give the enemy and his army to the enemy's rear-guard, and Melander-Holzapfel was forced to retire before him. Turenne entered Wedberg, and took up the pursuit of the defeated army. But before he settled down into winter quarters he sent a corps to the Moselle, which dislodged the Imperialists from the river and regained the position of his predecessor in the Danube. In Flanders, Gascort of Orleans conquered a number of their strongholds. In Saxony, the Low Countries, and the Danube, the archduke Leopold William and the Bavarians followed suit.

The campaign of 1646 in Hesse up to August was as usual uneventful, each army being chiefly concerned with its food. But at last the archduke retired a little, leaving Turenne and Wrangel free to join their forces. Turenne had no intention of repeating the experiences of Freiburg and Nördlingen. War had by now settled down into the groove whence it did not issue till 1703. It was more profitable to attack the small objects that were sought by manoeuvre than by battle. The archduke Leopold William decided to lay between the Rhine and the enemy's army in their district, and breaking it up by starvation, and pushing one's own army into rich districts regardless of the enemy's army. The usual practice was the first method. Turenne chose the second. Delayed at the opening of the year by orders from Mazarin to stand still—the elector of Bavaria had opened negotiations in order to gain time for the archduke Leopold William to march into the west—Turenne found it impossible to reach Hesse by the short and direct route, and he therefore made a rapid and successful march through the Rhine as far as Wesel, whence, crossing unopposed, he joined Wrangel on the upper Lahn (August 10th). The united armies were only 19,000 strong. Then the Imperialists, fearing to be hemmed in and starved between Turenne and the Rhine, fell back to Fulda, leaving the Munich road clear. The interior of Bavaria had not been fought over for eleven years, and was thus almost the only prosperous land in desolated Germany. Turenne and Wrangel marched straight forward on a broad front. On the 22d of September, far ahead of the pursuers, for whom they left nothing to eat, they reached Augsburg, and for the rest of the year they devastated the country about Munich in order to force Maximilian to make terms. An armistice was concluded in the winter, Maximilian having been finally brought to consent by an ill-judged attempt of the emperor (who desired that Bavaria would go the way of Brandenburg and Saxony) to secure it for his army. The French and Swedes wintered in southern Württemberg.

In Flanders, Gaston of Orleans and Engihr took Dunkirk and other fortresses. In Italy, where the Tuscan fortresses were attacked, the French and Prince Thomas their ally were completely checked at first, until Mazarin sent a fresh army under his son, the Prince of Condé, to replace them. The campaign of 1647 was a battle of the Low Countries Spaniards, concluding with a truce with the Dutch, threw their whole force upon France, but this attack dissipated itself in sieges. In Italy Plessis-Praslin won an unprofitable victory over the viceroy of the Milaneses on the Oglio (July 4th). In Spain Condé, resuming the siege of Lerida, was repulsed with even more loss than Harcourt had been the year before, and had to retire upon the mere appearance of a relieving army. In Germany Turenne and Wrangel parted company. The latter returned to Hesse and Bohemia, but was driven back by the imperialists under their new general, Melander-Holzapfel. As the few obtainable supply of men was not enough to hold the line, the Siemens crossed the Rhine to give the enemy and his army to the enemy's rear-guard, and Melander-Holzapfel was forced to retire before him. Turenne entered Weiden, and took up the pursuit of the defeated army. But before he settled down into winter quarters he sent a corps to the Moselle, which dislodged the Imperialists from the river and regained the position of his predecessor in the Danube. The Weimar Army had refused to follow him to the Meuse, and mutinied for their arrears of pay. Turenne, the campaign of 1648 brought the decision at last. Turenne and Wrangel, having refitted their forces and united in Hesse as in 1646, steadily drove back the imperialists and Bavarians, whose 30,000 combatants were accompanied by a horde of nearly 130,000 hangers-on—men, women and children—to the Danube. For a moment, at Nördlingen, in the French and the Swedes separated, but they soon reunited, moved on to and beyond the Danube, and at Zusmarshausen (May 17th) catching the enemy in the act of manoeuvring, they destroyed his rear-guard, Melander being amongst the dead. The battle of Zusmarshausen was a drama; the Inn, but Piccolomin, was crossed; the Turenne and Wrangel advanced, and the Tabulae Frisonis, iii. and iv.; lives of Turenne, Condé, Wallenstein, Gustavus, &c.; vols. ix. and x. of Clausewitz's works; Lorenzzen, Schwedten Armee im 30jähr. Kriege; Loewe, Organisation der Wallenstein'sehen Heere; Prés de Compagnes de Gustave Adolphe (Brussels, 1887).

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THISTLE—THÖKÖLY

THISTLE, a name, as generally employed, of vague application, being given to almost any herbaceous plant that is of a spiny character. More strictly, it is applied to the species of Cardius. These are Composite herbaceous, which was to be followed by the bracts surrounding a head of purplish-white, tubular, five-parted flowers seated on a pitted and hairy receptacle. The anthers have appendages both at the apex and at the base, and the style has a ring of hairs at the point of bifurcation of the two stigmas. The fruit is surrounded by a tuft of silky-white hairs. The species, chiefly natives of Europe and Western Asia, are numerous, and some are of great beauty, though, not unnaturally, looked on with disfavour by the farmer. The blot and numerous allied species have medicinal properties.

THISTLEWOOD, ARTHUR (1770-1820), an officer; also a political instigator of the Cato Street conspiracy, a plot formed to murder many British ministers in 1820. A son of William Thistlewood, and born at Topham Place in Lincolnshire, young Thistlewood passed his early years in a desultory fashion; he became a soldier and visited France and America, imbuing republican opinions abroad and running into debt at home. Then taking up his residence in London he joined the Spencean Society, a revolutionary body; associated himself with James Watson (d. 1838) and other agitators; and in December 1816 helped to arrange a meeting at Westminster Hall, by which the machine of the Tower of London and the Bank of England, and by a general revolution. The proposed rising was a dismal failure, but the Hebeans Corpus Act was suspended and Thistlewood and Watson were seized, although upon being tried they were acquitted.

Becoming more violent Thistlewood formed other plots, talked of murdering the prince of Wales, and was sentenced to a year's imprisonment for challenging the home secretary, Lord Sidmouth, to a duel. After his release in May 1819, having broken away from Henry Hunt and the more moderate reformers, he prepared a new and comprehensive plot. On the 23rd of February 1820, at a time of great distress and during the unrest caused by the death of George III, the cabinet ministers had arranged to dine at the earl of Harrowby's house in Grosvenor Square. Thistlewood knew of the dinner. With some associates he hired a room in the neighbouring Cato Street, collected arms and made ready to fall upon Harrowby's guests. However, the authorities had been informed of the plot, probably by one of the conspirators named George Edwards; officers appeared upon the scene and arrested some of the conspirators; and although Thistlewood escaped in the confusion he was seized on the following day. Tried for high treason, Thistlewood and four others were sentenced to death, and were hanged on the 1st of May 1820.

See Sir S. Walpole, History of England (1890), vol. i.

THÖKÖLY, IMRE (EMERICH), PRINCE (1657-1705), Hungarian statesman, was born at Késmark on the 20th of September 1657. He lost both parents while still a child. In 1670, fleeing from the dangers of Upper Hungary, where the Protestants and Imperialists were constantly in arms against each other, he took refuge with his kinsman Michael Teleki, the chief supporter of Michael Apafi, prince of Transylvania. Here he came into contact with the Turks, possibly because of his previous hopes of the high-born, highgifted youth who was also a fellow sufferer, a large portion of his immense estates having been confiscated by the emperor. The discontent reached its height when Leopold (Feb. 27, 1673) suspended the Hungarian constitution, appointed Johan Gaspar Ampringen dictator, deprived 450 Protestant clergy of their livings and condemned 67 more to the galleys. Encouraged by promises of help from Louis XIV, the Magyars now rose pro libertate et libellis, and chose the youthful Thököly as their leader. The war began in 1679. Upper Hungary and the Transylvania were soon in Thököly's possession.

In 1681, reinforced by 10,000 Transylvanians and a Turkish army under the pasha of Nagyvârd, he compelled the emperor to grant an armistice. On the 15th of June 1682 he married Helen Zrínyi, the widow of Prince Francis Rákóczi I. Thököly's distrust of the emperor now induced him to turn for help to the sultan, who recognized him as prince of Upper Hungary on condition that he paid an annual tribute of 40,000 florins. In the course of the same year Thököly captured fortress after fortress from the emperor and his allies, but in the end the emperor won. The arrangement by which his son was to receive the title of king offered to him by the Turks. At the two diets held by him, at Kassa and Tálya, in 1683, the estates, though not uninfluenced by his personal charm, showed some want of confidence in him, fearing lest he might sacrifice the national independence to the Turkish alliance. They refused therefore to grant him either subsidies or a levée en masse, and he had to take what he wanted by force. Thököly materially assisted the Turks in the Vienna campaign of 1683, and shared the fate of the gigantic Turkish army. The grand vizier nevertheless exchanged the title of the Hungarian prince for one of the new titles that were made from Adrianople. Thököly was again invited to Adrianople to defend himself before the Diet, but, declining to go, he placed himself in the care of the sultan, who promised to receive him at his next visit to Adrianople.

In 1686 Thököly was released from his dungeon and sent with a small army into Transylvania, but both this expedition and a similar one in 1688 ended in failure. The Turks then again grew suspicious of him and imprisoned him a second time. In 1690, however, the Turks despatched him into Transylvania a third time with 16,000 men and, in September, he routed the united forces of General Heister and Michael Teleki at Zernest. After this great victory Thököly was elected prince of Transylvania by the Kereszténymező Diet, but could only maintain his position against the imperial armies with the utmost difficulty. In 1691 he quitted Transylvania altogether. He led the Turkish cavalry at the battle of Slankamen, and in fact served valiantly but vainly against Austria during the remainder of the war, especially distinguishing himself at Zenta. He was excluded by name from the amnesty promised to the Hungarian rebels by the peace of Karlowitz (Jan. 26, 1699).

After one more unsuccessful attempt, in 1700, to recover his principality, he retired to Galata with his wife. From the sultan he received large estates and the title of count of Wladin. He died in 1705. He was buried in the great Armenian cemetery at Nicosia, but in the course of 1906 his relics were transferred to Hungary.

See Correspondence of Thököly (Hung.), ed. by Kálmán Thaly (Budapest, 1896); V. Frnak, Papii Innocens XI. und Ungarn's Befreiung von der Türkenscherehtschaft (Freiburg, 1902); Memoirs of
THOLOBATE—THOMAR


THOLOBATE (Gr. βλόθος, a circular structure, dome, and βάςison, a base), the architectural term given to the cylindrical drum on which a dome is raised. In the earlier Byzantine churches, the dome rested directly on the pendentives and the windows were pierced in the dome itself; in later examples, between the pendentive and the dome an intervening circular wall was built, in which the windows were pierced, and this is the type which was universally employed by the architects of the Renaissance, of whose works the best-known examples are those of St Peter at Rome, St Paul's in London, and the churches of the Invalides, the Val de Grace and the Sorbonne in Paris.

Another number of German Universities, (1833), come to a university, and, in the 17th century, he was visiting in the 17th century, he was paying some of the earliest examples of those of the beech tombs at Mycenae and in other parts of Greece, which were covered by domes built in horizontal courses of masonry. The Tholos at Epidaurus, built by Polykleitus (c. 400 B.C.), and the Tholos at Olympia, known as the Philippeon, are the most remarkable examples, and in both cases were covered with a sloping roof and not with a dome.

THOLUCK, FRIEDRICH AUGUST GOTTORE (1799-1877), German Protestant divine, was born at Breslau, on the 30th of March 1799. He received his education at the gymnasium and university of his native town, and early distinguished himself by great versatility of mind and power of acquiring languages. A love of Oriental languages and literature led him to exchange the university of Breslau for that of Berlin, that he might study to greater advantage, and there he was received into the house of the Orientalist Heinrich Friedrich von Diez (1750-1817). He was introduced to pietistic circles in Berlin, and came specially under the influence of Baron Hans Ernst von Kottwitz (1757-1843), who became his "spiritual father," and of the historian Neander. Before deciding on the career of theological professor, he went to the East. Meanwhile he was feeling the influence to a certain degree of the romantic school, and of Schleiermacher and Hegel too, though he never sounded the depths of their systems. At length, in his twenty-first year, he finally decided to adopt the academical calling. In 1821 he was Privatdozent and in 1823 became professor extraordinary of theology in Berlin, though he was at the same time active in the work of home and foreign missions. He lectured on the Old and New Testaments, theology, apologetics and the history of the church in the 18th century. In 1821 appeared his first work, Sturms, seine theosophische Persönlichkeit; and following the same line of study he published Blütensammlung aus der morgenländischen Mystik (1825) and Speculative Trinitätstheologie des späteren Orients (1826). His well-known essay on the nature and moral influence of heathenism (1822) was published by Neander, with high commendation, in his Denkwürdigkeiten; and his Commentary on the Epistle to the Romans (1824) secured for him a foremost place amongst the most suggestive, if not the most accurate, Biblical interpreters of that time. Another work, which was soon translated into all the principal European languages, Die wahre Wehe des Zweiflers (1825-1826 ed.), with the title of Das Lied der Lüste (1870), the outcome of his own religious history, procured for him the position which he ever after held of the modern Pietistic apologist of Evangelical Christianity. In 1825, with the aid of the Prussian government, he visited the libraries of England and Holland, and on his return was appointed (in 1826) professor ordinarius of theology at Halle, the centre of German rationalism, where he afterwards became preacher and member of the supreme consistorial council. Here he made it his aim to combine in a higher unity the learning and to some extent the rationalism of J. S. Semler with the devout and active Pietism of A. H. Francke; and, in spite of the opposition of the theological faculty of the university, he succeeded in changing the character of its theology. This he effected partly by his lectures, particularly his exegetical courses, but, above all, by his personal influence upon the students, and, after 1833, his theological position was that of a mild and large-hearted orthodoxy, which laid more stress upon Christian experience than upon rigid dogmatic belief. On the two great questions of miracles and inspiration, he made contributions to modern criticism and philosophy. The battle of his life was on behalf of the mystical and religious experience, in opposition to the externality of rationalism, orthodoxy or sacramentarianism. Karl Schwarz happily remarks that, as the English apologists of the 18th century were themselves infected with the poison of the deists whom they endeavoured to refute, so Tholuck absorbed some of the heresies of the rationalists whom he tried to overthrow. He was also one of the prominent members of the Evangelical Alliance, and few men were more widely known or more beloved throughout the Protestant churches of Europe and America than he. He died in the First in June 1877. As a preacher, Tholuck ranked among the foremost of his time. As a teacher, in the field of theology, he entertained remarkable sympathy and won great success. As a thinker he can hardly be said to have been endowed with great creative power.

After his commentaries (on Romans, the Gospel of John, the Sermon on the Mount and the Epistle to the Hebrews) and several volumes of sermons, his best-known books are Stunden christlicher Andacht (1839-1840; 2nd ed., 1870), intended to take the place of J. H. D. Chazkoff's standard ratiocinative work, Die Frage nach dem unmittelbaren Glauben. In reply to David Strauss's Life of Jesus (Glaubwürdigkeit der evangelischen Geschichte, 1847). He published at various times valuable contributions towards a history of rationalism and of Rationalismus (1853-1866), Geschichte des Rationalismus (1863); and a number of essays connected with the history of theology and especially of apologetics. His views on inspiration were indicated in his work Die Propheten und ihre Weissagungen (1860), in his essay on the "Alte Inspirationslehre," in Deutsche Zeitschrift für christliche Wissenschaft (1850), and in his Gespräche über die vornehmsten Glaubensfragen der Zeit (1846; new ed., 1850).

He also contributed many articles to Herzog's Realencylopädie, and for several years edited a journal (1830-1849), Literarischer Anzeiger.

Tholuck, L. Wittie, by L. Witte (2 vols., 1884-1886); A. Tholuck, ein Lebensbürs, by M. Kähler (1877), and the same author's art. "Tholuck," in Herzog's Realencylopädie; Zur Erinnerung an Tholuck, by C. Siegfried, Protestantische Kirchenzeitung (1885), No. 45, and 1886, No. 47; Karl Schwarz, Zur Geschichte der neuesten Theologie (4th ed., 1869); F. W. F. Nippold's Handbuch der neuesten Kirchengeschichte; cf. Philip Schaff, Germany, its Universities, Theology and Religion (1857), and the article in the Allgemeine deutsche Biographie.

THOMA, HANS (1839- ), German painter, was born at Bernau in the Black Forest. Having started life as a painter of clock-faces, he entered in 1859 the Carlsruhe academy, where he first studied the preparation of colour, and afterwards went to Munich to study and worked, with but indifferent success, in Düsseldorf, Paris, Italy, Munich and Frankfort, until his reputation became firmly established as the result of an exhibition of some thirty of his paintings in Munich. In spite of his studies under various masters, his art has little in common with modern ideas, and is formed partly by his early impressions of the simple idyllic life of his native district, partly by his sympathy with the early German masters, particularly with Altdorfer and Cranach. In his love of the details of nature, in his precise (though by no means faultless) drawing of outline, and in his predilection for local colouring, he has distinct and admirable qualities. Many of his pictures have found their way into two private collections in Liverpool. A portrait of the artist, and two subject pictures, "The Guardian of the Valley" and "Spring Idyll," are at the Dresden Gallery; "Eve in Paradise" and "The Open Valley" at the Frankfurt Museum. Other important pictures of his are "Paradise," "Christ and Nicodemos," "The Flight into Egypt," "Charon," "Pietà," "Adam and Eve," "Solitude," "Tritons," besides many landscapes and portraits. He has also produced numerous lithographs and pen drawings, and some decorative mural paintings, notably in a café at Frankfort, and in the music room of Mr Fringsheim's house in Munich.

THOMAR, a town of central Portugal, in the district of Santarem; on the river Nabão, a tributary of the Zezere, 4 m. from Paialvo railway station, which is 89 m. N.E. of Lisbon.
by the main line to Oporto. Pop. (1900), 6888. Thomar contains examples of the best Portuguese architecture from the 12th century to the 17th. The ruined castle of the Knights Templar, given to that order in 1159, is said to occupy the site of the ancient Nabantia. On the suppression of the Templars, who had done good service against the Moors, King Diniz of Portugal founded the Order of Christ in 1314. The convent palace of the Knights of Christ includes a church and cloister dating from the 12th century. Two cloisters and a chapter-house, added in the 16th century by Prince Henry the Navigator, a very fine 16th-century church built in the Manoelian or Manueline style by João de Castilho, to which the older church served as a chancel, and other buildings erected later. The convent contains Flemish and Portuguese paintings of the 16th century, of the so-called "Grão Vasco" school. Its aqueduct, 3 m. long, was built 1595-1615. Other interesting buildings are the churches of Santa Maria do Ólival, rebuilt in the Gothic style in 1490 on the site of an older Templar foundation; São João Baptista, also Gothic, built in 1490, but with Manoelian additions; Nossa Senhora do Concelho, Renaissance of 1579; and the palace of Prince Henry the most ancient tradition makes the palace of 13th century by Queen Catherine, widow of John III.

THOMAS, ST., one of the twelve apostles. The synoptical Gospels give only his name, associating him in their lists with Matthew (Matt. x. 3; Mark iii. 18; Luke vi. 15); in Acts i. 13 he is coupled with Philip. In the Gospel of John (xi. 16; xiv. 5; xx. 24 seq.; xxii. 2) he appears in a characteristic light, full of personal devotion and ready to die with his Master, but slow to grasp the true significance of the personality of Jesus, and incredulous of the resurrection till direct evidence convinces him of it. In the time of the chancel of its risen Lord John translates the Aramaic name or surname Thomas by the Greek equivalent Didymus (twin). Tradition has it that he was the twin brother of a sister Lyssias (his parents being Diophanes and Rhoa, and his birthplace Antioch; "XII. Apost. Patriae," in Chron. Pasch. ii. 142), or of a brother Eliezer (Hom. Clem. ii. 1), or, according to the Syriac Acta Thomasae (ed. Wright, Eng. trans. pp. 155, 180), of Jesus Himself. The last form of the tradition seems to be derived from the name Judas Thomas, which he bears in Edessene legend (cf. Eusebius, H. E. i. 15, 10), and through the identification of Thomas with Judas, the brother of the Lord. The most ancient tradition makes Thomas the evangelist of Parthia (Eus. H.E. iii. 1, 1); and at Edessa, which claimed to possess his bones, it was related that their missionary Addai (Doctrine of Addai, ed. Phillips, 1876, p. 5), whom Eusebius calls Thaddaeus (H.E. i. 13), was sent to them by him. Later tradition, originating with the Acta Thomasae, and accepted by catholic teachers from the middle of the 4th century, makes him proceed to India and there suffer martyrdom. The Indian king Gundaphor of the Acta is, however, certainly identical with the historical Gundophares, whose dynasty was Parthian, though his realm included regions of loosely reckoned to India. The Parthian and Indian missions of Thomas may perhaps therefore be regarded as derived from a single tradition, but it is very doubtful whether it is based on any historical facts. The oldest extant tradition is that St. Thomas did not suffer martyrdom at all (Heracleon ap. Clem. Alex. Strom. iv. 9). The best investigation of the traditions connecting St Thomas with India is that by W. R. Phillips (Indian Antiquity, 1903, xxxii. 1-15, 145-160). The ingenious conjectures of von Gutschmid (N. Rhein. Mus. xix. 161 seq.) and Sylvain Lévi (Journ. asiatique, 1897, p. 27 seq.) are greatly weakened by the fact that they do not derive the consideration of the names in their original Syriac form. Bishop Medlycott's India and the Apostle Thomas (1903) is wholly untrustworthy.

The Acta Thomasae, very imperfectly published by Thilo (1832) and Tischendorf (1851), have been edited in Greek by Bonnett (Leipzig, 1883, 2nd ed., with new matter, 1903), and in the original Syriac, with an English translation, by W. Wright (Apoecryphal Acts, 1879, 2nd ed.); also by H. K. Schmidt, Die Acta Apostolica, ii. (2nd ed.), 423-425 (Brunswick); F. C. Burkitt in Journ. Theol. St. i. 280 seq., ii. 94. The Acta are said by Photius to be a part of the Henodómos or Apostólos of the Gnostic Leucius Charinus, but this unknown personage is to be thought of as a collector of Gnostic "Acts of Apostles," rather than as the first author. In spite of extensive Catholic revision, the "Acts of Thomas" form one of the most interesting monuments of Syriac Gnosticism. Internal evidence shows them to be of the 2nd century, and the very ancient allegorical hymn about the soul which is preserved in the Syriac text (p. 274 seq., Eng. trans., p. 238 seq.) is perhaps the latest of the Gnostic ones. This hymn was translated into the Greek Acts, along with the rest of the work (Bonnet, pp. 219-224, Anaîl, holländ. xx. 158-164). It is one of the most remarkable pieces in Syriac literature, and has been edited separately by Burkitt (Studi et Fonti, ii. 3 (Cambridge, 1897). A metrical English version is given in F. G. Burkitt's Early Eastern Christianity, p. 218 seq. (London, 1904).

("Clement of St Thomas") is a name often applied to the members of the ancient Christian churches of southern India, which claim him as their first founder, and honour as their second founder a certain bishop named Thomas, who is said to have received the presbyters from Jerusalem to Malabar in A.D. 345.1 According to their tradition, St. Thomas went from Malabar to Mylapur, now a suburb of Madras, where the shrine of his martyrdom, rebuilt by the Portuguese in 1547, still stands on Mt St Thomas, and where a miraculous cross is shown with a Pahlavi inscription which may be as old as the end of the 7th century. We know from Cosmas Indicopleustes that there were Christian churches of Persian (East-Syrian) origin, and doubtless of Nestorian creed, in Ceylon, in Malabar, and at Calliana (north of Bombay) before the middle of the 6th century, when St Thomas, the reputed apostle of Persia, may have been their special advocate. Since the southern India never died out or wholly lost their sense of connexion with their mother church, for we find them sending deputies in 1490 to the Nestorian patriarch Simeon, who furnished them with bishops (Assemani, Bib. or. iii. 1, 590 seq.). Hard pressed by the Moslems, they welcomed the approach of the Portuguese, but proved by no means tractable to efforts to bring them within the Roman obedience. At length a formal union with Rome was carried through in the synod of Diamper (1599). Syriac was to remain the ecclesiastical language, but the service books were corrected and purified from error. A century and a half of foreign Jesuit rule followed, but the loss of independence was not lost. A great schism took place in 1653, and of 200,000 Christians of St Thomas only 400 remained loyal to Rome, though many of their churches were soon won back by the Carmelites. Those who remained independent fell under the influence of the Jacobite Mar Gregorius, styled patriarch of Jerusalem, who reached Malabar in 1665 as an emissary from Ignatius, patriarch of Antioch. From his time the independent Christians have been Jacobites, the counter-efforts of the Nestorians under Mar Gapar have been feeble and unfruitful, and the Jesuits have often come to nothing after his death in 1750. Since the time of Claudius Buchanan, whose Christian Researches in Asia (1811) excited great interest, much has been done for the Christians of India by English missionary effort, and Anglicans have cultivated friendly relations with the clergy of the independent native church, while discouraging dependence on the Jacobite patriarch of Antioch.

A valuable though tedious and ill-arranged history of the Christians of St Thomas is that by W. Germann, Die Kirche der Thomaschristen (Hamburg, 1877). Cross, Histoire du christianisme des Indes (The Hague, 1724); Alexius de Mazaris, Christianismus malabaricae (Latin by F. Raulin, Rome, 1745) (especially for the synod of Diamper); Paulinus a. Bartholomaeo, India orientalis christiana (4to, Rome, 1794); George Milne Rae, The Syrian Church in India (Edinburgh and London, 1892).

THOMAS À KEMPIS (c. 1380-1471), the name by which the Augustinian canon and writer Thomas a Kempis (Hainichen, Malloleus) is commonly known. He was born in 1379 or 1380 in the town of Kempen, lying about 15 miles north-west of Düsseldorf, in one of the many patches of territory between

1 See the sketch in Syriac of the history of the church of Malabar printed and translated by Land, Anec. Syr. i. 24 seq. It was sent to Schaff at Leiden in 1720 by Mar Gabriel, the last Nestorian bishop in Malabar (see Germann, p. 542).
THOMAS (ARCHBISHOP)

the Meuse and the Rhine belonging to the archiepiscopal principal
ipality of Cologne. “Ego Thomas Kempsi,” he says in his chro
icle of the monastery of Mount St Agnes, “scolarisch Daventriensis, ex diocese Colonienisi natus.” His father was a poor hard-worked peasant; his mother “ad custodiam rei domesticae attenta, in opere alaris, in victu sobria, in potu abstemia, in verbo pauca, in factis pudica,” as her son fondly says, kept a dame’s school for the younger children of the town. John and Gertrude Hammerken had two sons, John and Thomas, both of whom found their way to Deventer, and thence to Zwolle and to the convent of Mount St Agnes. Thomas reached Deventer when he was barely twelve years old, and for some
me by a dame the beginnings of his learning, and in a few months
great joy entered the classes of Florentius Radewyn. After the fashion of the time he was called Thomas from Kempen, and the school title, as was often the case then, pushed aside the family name. Thomas Hammerken was forgotten; Thomas à Kempsi has become known to the whole Christian world.

This school at Deventer had become famous long before Thomas à Kempsi was admitted to its classes. It had been founded by Gerhard Groot (q.e.), a wealthy burgher who had been widowed, left a large fortune with which he inhabited his knight’s
broek, the Flemish mystic. It was at Deventer, in the midst of this mystical theology and hearty practical benevolence, that Thomas à Kempsi was trained. Gerhard Groot was his saintly ideal. Florentius Radewyn and Gerhard’s other early disciples were his heroes; their presence was his atmosphere, the measure of their lives his horizon. But he was not like them; he was not an educational reformer like Radewyn, nor a man of affairs like Gerhard. He liked books and quiet corners all his days, he says; and so, when conviction of sin and visions of God’s grace came to him in the medieval fashion of a dream of the anger and forgiveness of the Virgin, Florentius told him that a monk’s life would suit him best, advised him to join the Augustinian order, and sent him to Zwolle to the new convent of Mount St Agnes, where his brother John was prior. Thomas was received there in 1390, he professed the vows in 1407, received priest’s orders in 1413, became sub-prior in 1425 and died on the 8th of August 1471, being ninety-one years old.

The convent of Mount St Agnes was poor, and most of the monks had to earn money to support their household by copying MSS. Thomas was a most laborious copyist: missals, books of hours, illuminated MSS. In addition to these, he wrote or edited a large number of original writings, most of them relating to the convent life, which was the only life he knew. He wrote a chronicle of the monastery and several biographies— the life of Gerhard Groot, of Florentius Radewyn, of a Flemish lady St Louise, of Groot’s original disciples; a number of tracts on the monastic life—The Monk’s Alphabet, The Discipline of Cloisters, A Dialogue of Novices, The Life of the Good Monk, The Monk’s Epitaph, Sermons to Novices, Sermons to Monks, The Solitary Life, On Silence, On Poverty, Humility and Patience; two tracts for young people—A Manual of Doctrine for an Young, and A Manual for Children; and books for edification— On True Compunction, The Garden of Roses, The Valley of Lilies, The Consolation of the Poor and the Sick, The Faithful Dispenser, The Soul’s Soliloquy, The Hospital of the Poor. He also left behind him three collections of sermons, a number of letters, some hymns and the famous Imitatio Christi (though his authorship of this has been disputed). These writings help us to see the man and his surroundings, and contemporary pious records make him something more than a shadow. We see a real man, but a man helpless anywhere save in the study or in the convent—a little man, with wavy locks of red-brown hair, who had a habit of stealing away to his cubiculum whenever the conversation became too lively; somewhat bent, for it is on record that he stood upright when the psalms were chanted, and even rose on his tiptoes with his face turned upwards; genial, if shy, and occasionally given to punning, as when he said that he preferred Psalms to Salmones; a man who perhaps led the most placid uneventful life of all men who ever wrote a book or scribbled letters. It was not that he lived in uneventful

times: it is impossible to select a stormier period of European history, or a period when the stir of the times made its way so well into the obscurest corners. Bohemia, Huss leading, was ablaze in revolt at one end of Europe; France and England, then France and Burgundy, were at death-grips at the other. Two popes anathematized each other from Avignon and from Rome, and zealous churchmen were at their wit’s end to concoct ways and means, by general councils of Constance and Basel and otherwise, to restore peace to a distracted church, and to discipline the clergy into decent living. But Thomas knew nothing about all this. He was intent on his copying, on his books, and on his quiet conversations. His very biographies are colourless. He had not even the common interest in the little world coming up to the convent gate which most monks may be supposed to have. His brethren made him oeconomiae prefectus, but he was too “simple in worldly affairs” and too absent-minded for the post, and so they deposed him and made him sub-prior once more. And yet it is this placid kindly fresh-coloured old man who has come down to us as the author of that book the Imitation of Christ, which has been translated into more languages than any other book save the Bible, and which has moved the hearts of so many men of all nations, characters and conditions of life.

On the controversy as to the author of the Imitatio, see the article Imitatio of Christ in the New Catholic Dictionary. See also James Williams, Thomas of Kempsi (1910). The classical edition of the works of Thomas à Kempsi by Sommalli—Thomas Mallools à Kempsi opera omnia (3 vols. in 1, 1607)—has been many times reprinted. A critical edition in 8 vols. by J. H. Poth, has also been undertaken. The best collection of
ishes of Thomas à Kempsi are those by S. Kettlewell (1882) and F. R. Cruise (1887), written from the Protestant and the Catholic stand-points respectively. A penny tract by F. R. Cruise, entitled Outline of the Life of Thomas & Kempsi (1904), contains substantially all that is known concerning him.

THOMAS (d. 1100), archbishop of York, is a native of Bayeux, and is usually called Thomas of Bayeux. His father was a priest named Osbert, and Samson, bishop of Worcester from 1086 until his death in May 1112, was his brother. Owning largely to the generosity of Odo, bishop of Bayeux, Thomas studied in France, Germany and Spain and became known as a scholar; then he became one of Bishop Odo’s officials and after 1066 one of William the Conqueror’s chaplains or secretaries. In 1070 he succeeded Aldred as archbishop of York, but declining to pay the church fines exacted by the Conqueror, he was exiled by King William, however, induced him to submit and he was consecrated, but his profession of obedience was to Lanfranc personally and not to the archbishops of Canterbury. In 1071 both archbishops travelled to Rome for their palls and while there Thomas wished Pope Alexander II. to decree the equality of the sees of Canterbury and York. The pope, however, referred the dispute to a council of English prelates, and this met at Windsor at Whitson
tide 1072. It was then decided that the archbishop of Canterbury was the superior of the archbishop of York, who had no rights south of the Humber, but whose province included Scot
land. But this decision did not put a period to the dispute. It broke out again, and in 1092 and again in 1093 Thomas protested against what he regarded as infringements of his archiepiscopal rights. The first of these occasions was over the dedication of the cathedral built by Remigius at Lincoln and the second was over the consecration of St Anselm to the archbishopric of Canterbury. In 1100, during Anselm’s exile, Thomas reached London too late to crown Henry I., the ceremony having been hurriedly performed by Maurice, bishop of London, but his anger was stirred up anew when the new king, after his coronation as York, went to the 18th of November 1100. Thomas rebuilt the minster at York, where he appears to have been an excellent archbishop; he knew something of church music and wrote hymns.

Thomas had a nephew, Thomas, the son of his brother Samson, who was also archbishop of York. The younger Thomas became archbishop in 1108 and like his uncle he refused to promise obedi
ence to the archbishop of Canterbury; his consecration was then
THOMAS MAGISTER—THOMAS, A. G.

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delayed and the dispute was still unsettled when St Anselm died in April 1109. Henry I. and his bishops then decided against Thomas, who was forced to make the necessary promise and was consecrated in London in June 1109. He died at Beverley on the 24th of February 1116.

THOMAS, surnamed Magister (i.e. officium),1 also known as a monk by the name Theodoulos Monachos, a native of Thessalonica, Byzantine scholar and grammarian and confidential adviser of Andronicus II. (1282–1328). His chief work, Έκλογή Ὑφήλιων υἱῶν Αἰτίων, is a selection of collected Attic Attic words and phrases, partly arranged in alphabetical order, compiled as a help to Greek composition from the works of Phrynichus, Anaximenes, Herodias and Moeris. He also wrote scholia on Aeschylus, Sophocles, Euripides (with life), and three of the four plays of Aristophanes; the scholia on Pindar, attributed to him in two MSS, are now assigned to Demetrius Triclinius. His speeches and letters consist partly of declamations on the usual sophistical themes, partly dealt with contemporary historical events: an argument between the fathers of Cynegirus and Callimachus (two Athenians who fell at Marathon) as to which had the better claim to have the funeral oration pronounced over him first; a discussion on the duties of a king and of his subjects; a defence of the Byzantine general Chandrenos addressed to the emperor; a letter on the jurisdiction of the Catalans and Turks in Thessaly and Macedonia; a congratulatory letter to Alexander of Trachonitis, and a version of the Life of Cyril, Bishop of Thessalonica.

Editions of the Έκλογη by F. Ritschl (1832), C. Jacobitz (1833) and C. D. Beck (1836); other works in J. P. Migne, Patrologia graeca, clxv.; see also C. Krumbacher, Geschichte der byzantinischen Literatur (1858)." 

THOMAS OF CELANO, Franciscan friar and disciple and biographer of St Francis of Assisi. Born at Celano in the Abruzzi, he joined St Francis probably about 1214, and he appears to have been one of the first band of friars who went into Germany. He was commissioned by Gregory IX. to write the Life of St Francis, and in 1229 he completed the First Legend; in 1247 at the command of the minister general he composed the Second Legend, and a few years later the Tract on the Miracles of St Francis. He also composed in 1255 the Legend of St Clare; and he is one of those to whom the sequence Dies Irae is attributed.

Thomas of Celano's writings on St Francis have been critically edited by E. d'Alençon in 1906; the value of this work is enhanced by the fact that critical opinion is veering round to the view that Thomas of Celano is not the last authority for the life of St Francis (see Note on the Sources, appended to article FRANCIS OF ASSISI).

An English translation (The Lives of St. Francis of Assisi by Brother Thomas of Celano) by A. G. Ferrers Howell appeared in 1908.

A biography of Thomas of Celano is brought together by Guillaume d'Alençon's Prolegomena; see also Introduction to Ferrers Howell's translation.

(E. C. B.)

THOMAS OF ERCEDOUNE, called also THE RHYMER, and sometimes given the surname of LEARMONT (fl. ? 1220–? 1297), poet and prophet in the legendary literature of Scotland. The historical person of that name figures in two charters of the 13th century, and from this it appears that he owned lands in Ercedoune (now Earlston), in Berwickshire, which were made over by his son and heir on the 2nd of November 1294 to the foundation of the Holy Trinity at Soitra (or Soutra) on the borders of the same county. This would seem to imply that Thomas the Rhymer was already dead, but J. A. H. Murray, who edited The Romance and Prophecies (E.E.T.S., 1875), thinks that he was living three years later in a Cluniac priory in Ayrshire. He figures in the works of Barbour and Harry the Minstrel as the sympathizing contemporary of their heroes, and Walter Bower, who continued the Scolochronicon of Fordun, tells how he prophesied the death of Alexander III. in 1285. Barbour makes the bishop of St Andrews in 1306 express a hope that a prophecy of Thomas referring to Bruce will come true; and Neyman says that he foretold the battle of Kiblance. In the folk-lore of Scotland his name is associated with numerous fragments of verse of a gnomic and prophetic character. The

1For the duties of this important office, see J. B. Bury, Later Roman Empire (1889), i. 45.

romance of Thomas and the elf-queen was attributed to Ercedoune by Robert Mannyng de Brunne, but the earliest text, in the Auchinleck MS. in the Advocates' library, Edinburgh, is in a dialect showing southern forms, and dates from the beginning of the 14th century. It may be based on a genuine work of Thomas, a version by him of the widely diffused Tristan Saga. This text was published in 1804 by Sir Walter Scott, and was by him assigned to the Rhymer. The most widely accepted opinion is that it is a translation of a French original. The Rhymer's lands at Earlston are still identified. In 1840 died the last of a family named Learmont, which claimed descent from the poet. It may be noted that the Russian poet Michael Lermontov claimed Thomas of Ercedoune as his ancestor.

See A. H. Murray's edition of The Romance and Prophecies (E.E.T.S., 1875); Brandis's Thomas of Ercedoune (Berlin, 1829); and Köbling's Die nordische und die englische Version der Tristransage (Heilbronn, 1882); also McNell's Sir Tristan (S.T.S., 1886); Lumby's Early Scottish Prophecies (E.E.T.S., 1870), and the reprint of the Whole Prophecy of Scotland (1603) by the Bannatyne Club (1833).

THOMAS OF MARGA, a Nestorian bishop and author of an important monastic history in Syria, who flourished in the 9th century A.D. He was born early in the century, probably of Persian parents, in the region of Salakh to the north-east of Mosul. As a young man he became in 832 a monk of the famous Nestorian monastery of Beth 'Abbê, which was situated at the confluence of the Great Zab with one of its tributaries, about 25 m. due east of Mosul. A few years later he was acting as secretary to Abraham, who had been abbot of Beth 'Abbê. He then went to Edessa, but was brought back to Beth 'Abbê from 837 to 850. At some date during these 13 years Thomas was promoted by Abraham to be bishop of Marga, a diocese in the same district as Beth 'Abbê, and afterwards he was further advanced to be a metropolitan of Beth Garmâi, a district farther to the south-east in the mountains which border the Tigris basin. It was during the period of his life at Beth 'Abbê and his bishopric that he composed The Book of Governors, which is in the main a history of his own monastery, but includes lives of holy men in other parts of Mesopotamia and the regions east of the Tigris. The work was probably planned in imitation of the famous Paradise of Paradisi, the history of Egyptian monasticism which had become well known to Syria-speaking Christians in the version of 'Anān-Ishā (6th century).

The Book of Governors has been edited with a English translation and a copious introduction by E. W. Budge (2 vols., London, 1893), who claims that "it occupies a unique position in Syrian literature, and is the only work that has come down to us of which it has been already said that it is still regarded by all classes of Nestorians to whom it is known." It gives a detailed history of the great monastery of Beth 'Abbê down to the time of the author, and is at the same time of the highest interest to Nestorian in its few unpretentious but very naive and candid spirit, and it throws much light on the history of Christianity in the Persian dominions. There is a later edition by P. Bedjan (Paris, 1901) (N. M.)

THOMAS, ARTHUR GORING (1850–1892), English musical composer, was the youngest son of Freeman Thomas and Amella, daughter of Colonel Thomas Frederick. He was born at Ratton Park, Sussex, on the 20th of November 1850, and educated at Haileybury College. He was intended for the Civil Service, but delicate health interfered with his studies, and in 1873 he went to Paris to cultivate the musical talent he had displayed from an early age. Here he studied for two years with Émile Durand. In 1875 he returned to England, and in 1877 entered the Royal Academy of Music, where for three years he studied under Ebenzer Prout and Arthur Sullivan, winning twice the Lucas medal for composition. At a later period he received some instruction in orchestration from Max Bruch. His first published composition was a song, "Le Roy Henri," which appeared in 1871. An early comic opera, Don Braggadocio (libretto by his brother, C. I. Thomas), was apparently unfinished; some of the music in it was afterwards used for The Golden Web. A selection from his second opera, The Light of the Harem (libretto by Clifford Harrison), was performed at the Royal Academy of Music on the 7th of November 1879, with such success that Carl Rosa commissioned him to write
THOMAS, C. L. A.—THOMAS, G. H.

Esméralda (libretto by T. Marxials and A. Rendegger), which was produced at Drury Lane on the 5th of March 1834. Two years later it was given (in German) at Cologne and Hamburgh, and in 1790 (in French) at Covent Garden. On the 16th of April 1885 Rosa produced at Drury Lane Thomas's fourth and best opera, Naïscha (libretto by Julian Sturgis), a German version of which was given at Breslau in 1890. A fifth opera, The Golden Web (libretto by F. Corder and B. C. Stephenson), slighter than its predecessors, was produced (after the composer's death) at Liverpool, Feb. 15, and at the Lyric Theatre, London, Mar. 11, 1893. Besides these dramatic works Thomas's chief compositions were a psalm, "Out of the Deep," for soprano solo and chorus, London, 1838; a choral suite, The SeventhCOMMANDER (W. B. S.)

THOMAS, CHARLES LOUIS AMBROISE (1811–1889), French musical composer, was born at Metz on the 9th of August 1811. He studied at the Paris Conservatoire, and won the Grand Prix de Rome in 1832. Five years later (in 1837) his first opera, La Double òchelle, was produced at the Opéra Comique. For the next two or thirty years Thomas's productions were incessant, and most of his operatic works belonging to this period enjoyed an ephemeral popularity. A few of these are still occasionally heard on the continent, such as Le Calè (1849), Le Serçe d'une nuit d'été (1850), Psyché (1857). The overture to Raymond (1851) has remained popular. So far the composer's operatic career had not been marked by any overwhelming success. He occupied a place among the recognized purveyors of operas in the French capital, but could scarcely claim to having achieved European renown. The production of Mignon at the Opéra in 1866, however, marked a turning point. Thomas's elevation to the position of one of the foremost French composers.

Goethe's touching tale had very happily inspired the musician; Mme Galli Mérié, the original interpreter of the title rôle, had modelled her conception of the part upon the well-known picture by Ary Scheffer, and Mignon at once took the fancy of the public, its success being repeated all over the continent. It has since remained one of the most popular operas belonging to the second half of the 19th century. Thomas now attempted to turn Shakespeare's Hamlet to operatic account. His opera of that name was produced with success at the Paris Opéra in 1866, where it enjoyed a long vogue. If the music is scarcely adequate to the subject, it nevertheless contains some of the composer's best work. The scene of the esplanade is genuinely dramatic, the part of Ophelia is poetically conceived, and the ballet music is very brilliant. Ambrose Thomas's last opera, Françoise de Rémimini, was given at the Opéra in 1882, but has not maintained itself in the répertoire. Seven years later La Tempête, a ballet founded on Shakespeare's play, was produced at the same theatre. Ambrose Thomas succeeded Aubier as director of the Paris Conservatoire in 1871. His music is often distinguished by refined touches which reveal a sensitive mind, and there is a distinct element of poetry in his Mignon and Hamlet, two operas that should suffice to keep the composer's memory green for some time to come. He died on the 12th of February 1896.

THOMAS, GEORGE (c. 1756–1802), British military adventurer in India. Thomas was born of poor parentage in Ireland in 1756, deserted from the British Navy in Madras, and made his way north to Delhi, where he took service under the begum Samru of Sardhana. Supplanted in her favour by a Feroe Indian, he transferred his allegiance to Appa Rao, a Mahatra chiefman, and subsequently set up an independent kingdom of his own in Haryana with his capital at Hansi. Thomas was a man of great personal strength and daring, and considerable military genius. In the turmoil of falling kingdoms in the India of that day his sword was always at the service of the highest bidder; but he had the virtues of his profession—he never betrayed an employer, was kind and generous to his soldiers, and was always ready to succour a woman in distress. He cherished dreams of conquering the Punjab and fought one of his best campaigns against the Sikh chiefs; but he was finally defeated and captured by Sindhia's army under General Perron (q.v.). His iron constitution was broken by exposure and excessive drinking, and he died on his way down the Ganges on the 22nd of August 1802.

See Franklin, Military Memoirs of Mr George Thomas (1803); Compton, Military Adventurers of Hindustan (1826).

THOMAS, GEORGE HENRY (1816–1870), American general, was born in Southampton county, Virginia, on the 31st of July 1816. Graduating from West Point in 1840, he served as an artilleryman in the Mexican War. In the battle against the Samuels Indians in Florida (1841), and in the Mexican War at the battles of Fort Brown, Resaca de la Palma, Monterey and Buena Vista, receiving three brevets for distinguished gallantry in action. From 1851 to 1854 he was an instructor at West Point. In 1855 he was appointed by Jefferson Davis, then secretary of war, a major of the 2nd Cavalry. His regimental superiors were A. S. Johnston, R. E. Lee and Hardee. All three resigned at the outbreak of the Civil War and Thomas was long in doubt as to his duty. He finally decided to adhere to the United States. He was promoted in rapid succession to be lieutenant-general on the staff of General Grant, and in the charge of the 9th Army Corps of 50,000 men. He was commander of the division of west Virginia. Under Rosecrans he was engaged at Ring River and was in charge of the most important part of the manoeuvring from Orchard Creek to Fort Donelson. In the rains of the latter part of the year 1862, he was attached to the army of the Cumberland. On the 19th of September 1863 he achieved great distinction, his firmness on that disastrous field, where he gained the name of "The Rock of Chickamauga," being all that saved a terrible defeat from becoming a hopeless rout. He succeeded Rosecrans in command of the Army of the Cumberland shortly before the great victory of Chattanooga (q.v.), in which Thomas and his army played a most conspicuous part, his divisions under Sheridan, Wood and Baird carrying Missionary Ridge in superb style. In Sherman's advance through Georgia in the spring of 1864, the Army of the Cumberland numbered over 65,000 men present for duty. Thomas handled these with great skill in all the engagements and flanking movements from Chattanooga to Atlanta. When J. B. Hood broke away from Atlanta in the autumn of 1864, menaced Sherman's long line of communications and endeavoured to force Sherman to follow him, Sherman determined to abandon his communications and march to the sea, leaving to Thomas the difficult task of dealing with Hood. Thomas hastened back with a comparatively small force, racing with Hood to reach Nashville, where he was to receive reinforcements. At the battle of Franklin on the 30th of November 1864, a large part of Thomas's force, under command of M. Schofield, checked Hood long enough to cover the concentration at Nashville (q.v.). Here Thomas had to organize his force, which was drawn from all parts of the West and included many young troops and even quartermaster's employees. He declined to attack until his army was ready and the ice which covered the ground had melted sufficiently to enable his men
THOMAS, I.—THOMAS, T.

To move. The whole of the North, and even General Grant himself, were impatient of the delay. General Logan was sent with an order to supersede Thomas, and soon afterwards Grant left the Army of the Potomac to take command in person. Before either arrived Thomas made his attack (December 15th-16th, 1864) and inflicted on Hood the most crushing defeat sustained in the open field by any army on either side in the whole war. Hood's army was completely ruined and never again appeared on the field. For this brilliant victory Thomas was made a major-general in the regular army and received the thanks of Congress. After the termination of the Civil War he commanded military departments in Kentucky and Tennessee until 1869, when he was ordered to command the division of the Pacific with headquarters at San Francisco. He died there of apoplexy, while writing an answer to an article criticizing his military career, on the 18th of March, 1869.

Thomas was beloved by his soldiery, for whom he always had a fatherly solicitude. He was a man of solid rather than brilliant attainments; he remained in the army all his life, and never had any ambitions outside of it; the nickname of "Slow Trot Thomas" given him by the cadets at West Point characterized him physically and mentally; his mind acted deliberately, and his temperament was somewhat sluggish; but his judgment was accurate, his knowledge of his profession was complete in every detail, and when he had finally grasped a problem, and the time arrived for action, he struck his blow with extraordinary vigour and rapidity. The only two battles in which he was in chief command—Mill Springs and Nashville, one at the beginning and the other near the end of the war—were signal victories, without defect and above criticism. His service during the intervening three years of almost incessant conflict and manoeuvring was marked by loyal obedience to his superiors, skilful command of his subordinates, and successful accomplishment of every task entrusted to him.

THOMAS, ISAIAH (1749-1831), American printer, was born in Boston, Massachusetts, on the 19th of January 1749. He was apprenticed in 1755 to Zephaniah Fowle, a Boston printer, with whom, after working as a printer in Halifax, Portsmouth, New Hampshire, and Charleston, South Carolina, he formed a partnership in 1770. He issued in Boston the *Massachusetts Spy* three times each week, then (under his sole ownership) as a semi-weekly, and beginning in 1771, as a weekly which soon espoused the Whig cause and which the government tried to suppress. On the 16th of April 1775 (three days before the battle of Concord, in which he took part) he took his presses and types from Boston and set them up at Worcester, where he was postmaster for a time; here he published and sold books, and built a paper-mill and bindery, and he continued the paper until about 1802 except in 1776-1778 and in 1786-1788. The *Spy* supported Washington and the Federalist party. In Boston Thomas published, in 1774, the *Royal American Magazine*, which was continued for a short time by Joseph Greenleaf, and which contained many engravings by Paul Revere; and in 1775-1803 the *New England Almanac*, continued until 1819 by his son. He set up printing houses and book stores in various parts of the country, and in Boston with Ebenezer T. Andrews, published the *Boston Almanac* and *Boston Magazine*, from 1791. At Walpole, New Hampshire, he published the *Farmer's Museum*. About 1802 he gave over to his son, Isaiah Thomas, junr., his business at Worcester including the control of the *Spy*. Thomas founded in 1812 the American Antiquarian Society. He died in Worcester on the 4th of April 1831.

His *History of Printing in America, with a Biography of Printers, and an Account of Newspapers* [2 vols., 1810; 2nd ed., 1874], with a catalogue of American publications previous to 1770 and a catalogue of the works of Isaiah Thomas, by his grandson B. P. Thomas) is important work, accurate and thorough.

THOMAS, PIERRE (1614-1698), sieur du Fossé, French scholar and author, was the son of a master of accounts at Rouen. He was sent as a child to be educated at Port Royal, and there he received his final bent towards the life of a recluse, and even of a hermit, which drew him to establish himself in the neighbourhood of Port Royal des Champs. In 1661 he came to Paris, and in 1666 was arrested along with I. L. Le Maistre (de Sacy), and after a month in the Bastille was exiled to his estate of Fossé. He later made yearly visits to Paris. Apart from his collaboration with de Sacy, Thomas wrote some hagiographic works and left Memorials (1697-1698 and again 1876-1879), which are highly praised by Ste Beuve as being a remarkable mirror of the life at Port Royal.

THOMAS, SIDNEY GILCHRIST (1850-1885), British inventor, was born on the 16th of April 1850 at Canonbury, London. His father, a Welshman, was in the civil service, and his mother was the daughter of the Rev. James Gilchrist. His father's death leaving his family with a considerably reduced income, he gave up his original idea of becoming a doctor and obtained an appointment as a police court clerk, which he held till May 1879. During these twelve years, besides the work of a busy police court, which brought him into intimate contact with social problems, he found time to study chemistry, and attended lectures at the Birkbeck Institute. He set himself to solve the problem of eliminating phosphorus from iron by means of the Bessemer converter, and by the end of 1875 was convinced that he had discovered a method. He communicated his theory to his cousin, F. C. Gilchrist, who was chemist to iron works in Wales, and experiments were made, which proved satisfactory. Edward Martin, manager of the Blaenavon Works, undertook the conducting of the experiments on a larger scale and undertook to help in taking out a patent. In March 1878, the first public announcement of the discovery was made at the meeting of the Iron and Steel Institute, but without attracting much attention; and in September a paper was written by Thomas and Gilchrist on the "Elimination of Phosphorus in the Bessemer Converter" for the autumn meeting of this institute, but was not read till May 1879. Thomas, however, made the acquaintance of E. W. Richards, the manager of Bolckow Vaughan & Co.'s works at Cleveland, Yorkshire, whom he interested in the process, and from this time the success of the invention was assured and domestic and foreign patents were taken out. The "basic process" invented by Thomas was especially valuable on the continent of Europe, where the proportion of phosphoric iron is much larger than in England, and both in Belgium and in Germany the name of the inventor became more widely known than in his own country. In America, although non-phosphoric iron largely predominates, an immense interest was taken in the invention. But Thomas had been overworking for years, and his lungs became affected. A long sojourn and a residence in Egypt proved unavailing for the renewal of his health and he died in Paris on the 1st of February 1883. He had what W. E. Gladstone, in a review of the *Memoirs* published in 1891, described as an "enthusiasm of humanity," and he left his fortune to be used for the promotion of philanthropic work. A police court mission was endowed in his memory.


THOMAS, THEODORE (1835-1905), American musician, was born at Essen, Germany, on the 11th of October 1835. His early musical training was received chiefly from his father. At the age of five he made his first public appearance as a violinist. In 1845 he was taken to America by his parents, and became first violin in the orchestra that accompanied Jenny Lind in 1850, Sonntag in 1852 and Grisi and Mario in 1854. In 1862 he began to organize his own orchestra, and from 1864 to 1878 were performed a series of symphony concerts inaugurated by him in Irving Hall, which were regarded as one of the great musical institutions of New York City. His "summer night" concerts begun in 1866 in Terrace Garden were continued in Central Park. From 1855 to 1868 he took part in a series of chamber music concerts in New York. In the latter year his orchestra made its first tour, and continued to give concerts in various American cities until it was disbanded in 1888. To Theodore Thomas is largely due the popularization of Wagner's
works in America, and it was he who founded the Wagner union in 1872. During most of the seasons from 1877 to 1891 he was conductor of the New York Philharmonic Society, and from 1892 to 1891, of the Brooklyn Philharmonic Society. He was director of the Juilliard College of Music (1878–1879), conductor of the American Opera Company (1887), and for thirty years (1873–1904) the conductor of the biennial May festivals at Cincinnati. In 1891 he removed to Chicago, and became the conductor of the Chicago Orchestra; in 1893 he was musical director of the Columbian Exposition. He died on the 4th of January 1905.

THOMAS, WILLIAM (d. 1554), English soldier and writer, was probably a native of Radnorshire and was educated at Oxford. In 1534 he went to Italy, where he spent the greater part of the next five years, and in April 1550, soon after his return to England, he was made one of the clerks of the privy council; he also taught the science of politics to the young king Edward VI., for whose instruction he wrote some treatises and some "commonplaces of state." Being a strong Protestant he took part in the rising against Queen Mary led by Sir Thomas Wyat in 1554, being captured and thrown into the Tower of London. Having whilst in prison tried to commit suicide and been tortured on the rack in the hope of incriminating the princess Elizabeth, he was found guilty and was hanged at Tyburn on the 19th of May 1554.

THOMASIUS, Christian (1655-1728), German jurist and publicist, was born at Leipzig on the 1st of January 1655, and was educated by his father, Jakob Thomasius (1622-1684), at that time head master of the Thomasschule. Through his father's lectures Christian came under the influence of the political philosophy of Hugo Grotius and Samuel Pufendorf, and continued the study of law at Frankfurt-on-Oder. In 1683 he commenced the career of professor of natural law at Leipzig, and soon attracted attention by his abilities, but particularly by his daring attack upon traditional dogmas in theology and jurisprudence. In 1687 he made the daring innovation of lecturing in German instead of Latin, and in the following year published a monthly periodical (Scherzhaften und ernsthafte, vernünftige und einfältige Gedanken über allerhand lustige und nützliche Bücher und Fragen) in which he ridiculed the pedantic weaknesses of the learned, taking the side of the Pietists in their controversy with the orthodox, and defending mixed marriages of Lutherans and Calvinists. In consequence of these and other views, he was denounced from the pulpit, forbidden to lecture or to write (May 10, 1690), and his arrest was ordered. The latter he escaped, and the elector Frederick III. offered him a refuge in Halle, with a salary of 500 talers and the permission to lecture. He took part in founding the university of Halle (1694), where he became second and then first professor of law and rector of the university. He was one of the most esteemed university teachers and influential writers of his day. He died, after a successful and honourable career, on the 23rd of September 1725.

Though not a profound and systematic philosophical thinker, Thomasius prepared the way above all, in law, literature, social life and theology. It was his mission to introduce a rational, common-sense point of view, and to bring the higher powers of divine and human sciences into close and living contact with the everyday world. He thus created an epoch in German literature, philosophy and law, and Spittler opens with him the modern period of ecclesiastical history. He made it the object of his labours to prepare a modern, comprehensive and lucid system of the control of theology, and fought bravely and consistently for freedom of thought and speech on religious matters. He is often spoken of in German works as the author of the "territorial system," or Ernestian theory of ecclesiastical government. But he taught that the state may interfere with legal or public duties only, and not with moral or private ones. He would not have even atheists punished, though they should be expelled the country, and he came forward as an earnest opponent of the prosecution of witches and of the use of torture. In theology he was not a naturalist or a deist, but a believer in the necessity of revealed religion for salvation. He strongly upholds the theory of the free will of man, a theory dear to Spener, and there was a mystic vein in his thought; but other elements of his nature were too powerful to allow him to attach himself wholly to that party.

Thomasius's most interesting and influential German publications were his periodical already referred to (1688-1689): Erinnerung zur Verurtheilthe (1691, 5th ed., 1710); Vernünftige Gedanken über allerhand auserlesene und juristische Handlungen (1750-1771); Geschichte der Dichter aller Zeiten und aller Länder (1752-1782), and Vorarlbergische Geschichtsquellen und Erinnerungen (1804); H. Dernburg, Thomasius and the Stiftung der Universität Halle (1865); B. A. Wagner, Thomasius, ein Beitrag zur Würdigung seiner Verdienste (1872); Nicoladoni, Christian Thomasius. Ein Beitrag zur Geschichte der Aufklärung (Berlin, 1888); and E. Landsberg, Zur Biographie von Christian Thomasius (1894).

THOMASON, GEORGE (d. 1666), English book and tract collector, was a London bookseller, whose life contains few items of interest save the fact that he was concerned in a royalist plot in 1651. He is famous, however, as the man who brought together the great collection of books and tracts published during the time of the Civil War and the Commonwealth; this was formerly called the "King's Pamphlets," but is now known as the "Thomason Collection." During the years just before the outbreak of war a great number of writings covering every phase of the questions in dispute between king and people were issued, and in 1641 Thomason began to collect these. Working diligently at his task for about twenty years, he possessed nearly 5000 pamphlets. Putting these in order of publication and then arranging them in chronological order he had them bound in 1863 volumes. After many vicissitudes the collection was bought in 1761 from his descendants by George III., who presented it to the British Museum, where it now is (see Newspapers). Thomasian died in London in April (1666).

THOMASVILLE, a city and the county-seat of Thomas county, Georgia, U.S.A., about 200 miles S.W. of Savannah. Pop. (1900), 5322, of whom 3256 were negroes; (1910), 6727. Thomasville is served by the Atlanta, Birmingham & Atlantic, the Atlantic Coast Line and the Florida Central railways. It is attractively situated (about 250 ft. above the sea) on a high plateau, is surrounded by pine forests, and is a well-known winter resort. There are fine drives in the vicinity. Thomasville has a city hospital, a public library (1876) and a good public school system, and is the seat of Young's College (for girls), which was founded by E. Remer Young, a wealthy planter of Thomas county, was incorporated in 1869 and was opened in 1871, and of the Vashon industrial school (1903) for girls, maintained by the Women's Home Mission Society of the Methodist Episcopal Church, South. The city has a large trade in lumber, especially yellow pine; other products are of the citron and of tomatoes, and vegetables. The municipality owns and operates the water-works and electric-lighting plant; the water supply is obtained in part from artesian wells 1900 ft.
THOMOND, EARL AND MARQUESSE—THOMPSON, SIR H. 869

deep. Thomavsville was settled about 1825, was incorporated as a town in 1831, and was chartered as a city in 1880.

THOMOND, EARL AND MARQUESSE OF, Irish titles borne by the great family of O'Brien, the earldom from 1543 to 1741 and the marquessate from 1800 to 1855. Thomond, or Tuaith-Muin, was one of the three principalities of Munster, forming the northern part of the province. Its earls were descended from Turlough O'Brien (c. 1009-1086), king of Munster, and from him through the celebrated king of Ireland, Brian Boruimh. Turlough's descendants, Conchohar O'Brien (d. 1556) and Brian Ruadh O'Brien (d. 1576), kings of Thomond, were both typical Irish chieftains. Conchohar's tomb and effigy with a crown are still to be seen in the ruined abbey of Corcomroe, Co. Clare. His descendant Conor O'Brien (d. 1539), prince of Thomond, took part in the feud between the great families of Fitzgerald and Butler and was the last independent prince of Thomond. It is interesting to learn that in 1534, when he was in some straits, he wrote to the emperor Charles V. offering to submit to his authority. Conor's brother, Murrough O'Brien (d. 1551), prince of Thomond, the succeeding chieftain of the O'Briens, was created a peer of Ireland and granted a pension by Henry VIII. in 1543, when he was created earl of Thomond. By special arrangement the earldom descended, not to his son Dermot, but to his nephew, Donough, who became the 2nd earl. Dermot, however, inherited the barony of Inchiquin, which was conferred upon his father at the same time as the earldom.

Conor O'Brien, the 3rd earl (c. 1534-c. 1582), was for some years at the outset of his career, harassed by the attacks of his discontented kinsmen. Then in his turn he rose against the English, but was defeated and fled to France; in 1571, however, he was pardoned and formally surrendered his lands to Elizabeth. One of his younger sons was Daniel O'Brien (c. 1577-c. 1664) who, after loyally serving Charles I and Charles II., was created Viscount Clare in 1663. His grandson Daniel, the 3rd viscount (d. 1691) served James II. in Ireland, being outlawed and deprived of his estates by the English parliament. The three succeeding viscounts Clare all distinguished themselves in the service of France. Daniel, the 4th viscount, was mortally wounded at the battle of Marsaglia in 1693; his brother Charles, the 5th viscount (1670-1761) after a brilliant military career, was made a marshal of France in 1757. When Charles, the 7th viscount, died in 1774 the title became extinct.

Donough O'Brien, the 4th earl (d. 1624), called the "great earl," was the son and successor of the 3rd earl. He served England well in her warfare with the rebellious Irish during the closing year of Elizabeth's reign and was made president of Munster in 1605. He had two sons, Henry, the 5th earl, (d. 1639) and Barnabas, the 6th earl (d. 1657). During the Irish rebellion of 1641-47 Barnabas showed a prudent neutrality, and then joined Charles I at Oxford, where in 1645 he was created marquess of Billington, but the patent never passed the great seal and the title was never assumed. The succeeding earls were Barnabas's son Henry (c. 1621-1691) and Henry's grandson Henry (1688-1741) who was created an English peer as Viscount Tadcaster. When he died the earldom of Thomond became extinct.

The estates of the earldom descended to the last earl's nephew, Percy Wyndham (c. 1713-1774), a younger son of Sir William Wyndham, Bart. He took the additional name of O'Brien and was created earl in 1756. When he died unmarried the title again became extinct.

In 1880 Murrough O'Brien, 5th earl of Inchiquin (c. 1724-1808), was created marquess of Thomond. He was succeeded by his nephew William (c. 1765-1846) who was created a British peer as Baron Tadcaster in 1826. His brother James, the 3rd marquess (c. 1768-1855), was an officer in the navy and became an admiral in 1833. When he died the marquessate became extinct.

See John O'Donoghue, Historical Memoirs of the O'Briens (Dublin, 1860).

THOMPSON, FRANCIS (1860-1907), English poet, was born at Ashton, Lancashire, in 1860. His father, a doctor, became a convert to Roman Catholicism, following his brother Edward Healy Thompson, a friend of Manning. The boy was accordingly educated at Ushaw College, near Durham, and subsequently studied medicine at Owens College, Manchester; but he took no real interest in the profession of a doctor and was bent on literary production. A period of friendlessness and failure (from the point of view of "practical life") followed, in which he became a solitary creature who yet turned his visions of "the world" into unrecognized verse. It was not till 1893 that, after some five obscure years, in which he was living at the lowest depths of destitution and ill health, his poetic genius became known to the public. Through his sending a poem to the magazine Merrie England, he was sought out by Mr and Mrs Wilfrid Meynell and rescued from the verge of starvation and self-destruction, and these friends of his own communion, recognizing the value of his work, gave him a home and procured the publication of his first volume of Poems (1893). His debt to Mrs Meynell was repaid by a most moving and devoted friendship. It was the attention of sympathetic critics, in the St James's Gazette and other quarters, and Coventry Patmore wrote a eulogistic notice in the Fortnightly Review (Jan. 1894). An ardent Roman Catholic, much of Francis Thompson's verse reminded the critics of Crashaw, but the beauty and splendour though often strange inventiveness of his diction were immediately recognized as giving him a place by himself among contemporary poets, recalling Keats and Shelley rather than any of his own day. Persistent ill health limited his literary output, but State Songs (1899) and New Poems (1897) confirmed the opinion formed of his remarkable gifts. But his health was hopelessly broken down by tuberculosis. Cared for by the friends already mentioned, he lived a frail existence, chiefly at the Capuchin monastery at Tanlarsap, and later at Storrington; and on the 13th of November 1907 he died in London. He had done a little prose journalism, and in 1905 published a treatise on Health and Holiness, dealing with the ascetic life; but it is with his three volumes of poems that his name will be connected. Among his work there is a certain amount which can justly be called eccentric or unusual, especially in his usage of poetically compound terms in his work; but nothing he said or wrote is simply beautiful than "The Daisy," nothing more intimate and reverent than his poems about children, or more magnificent than "The Hound of Heaven." For glory of inspiration and natural magnificence of utterance he is unique among the poets of his time. (H. Cn.)

THOMPSON, SIR HENRY, Bart. (1820-1904), English surgeon, was born at Framingham, Suffolk, on the 6th of August 1820. His father wished him to enter business, but circumstances ultimately enabled him to follow his own desire of becoming a physician, and in 1848 he entered the medical school of University College, London. There he had a brilliant career, and obtained his degree at London University in 1851 with the highest honours in anatomy and surgery. In 1851 he married Miss Kate Loder, a talented pianist, who, though stricken with paralysis soon afterwards, was always a devoted helpmate to him. In 1853 he was appointed assistant surgeon at University College Hospital, becoming full surgeon in 1863, professor of clinical surgery in 1866, and consulting surgeon in 1874. In 1884 he became professor of surgery and pathology in the Royal College of Surgeons, which in 1852 had awarded him the Jacksonian prize for an essay on the Pathology and Treatment of Stricture of the Urethra, and again in 1860 for another on the Health and Morbid Anatomy of the Prostate Gland. These two memoirs indicate the department of medical practice to which he devoted his main attention. Specializing in the surgery of the genito-urinary tract, and in particular in that of the bladder, he went to Paris to study under Civiale, who in the first quarter of the 19th century proved that it is possible to crush a stone within the human bladder, and after his return he soon acquired a high reputation as a skilful operator in that
class of disease. In 1863, when the king of the Belgians was suffering from stone, he was called to Brussels to consult in the case, and after some difficulties was allowed to perform the operation of lithotomy; this was quite successful, and in recognition of his skill Thompson was appointed surgeon-extraordinary to the king, an appointment which was continued by Leopold II. Nearly ten years later he carried out a similar operation on the emperor Napoleon, who, however, died four days after the second crushing, not from the surgical interference, as was proved by the post-mortem examination, but from uraemic poisoning. Besides devising various operative improvements in the treatment of the disease which he was the foremost to study, Sir Henry Thompson wrote various books and papers dealing with them, including *Clinical Lectures on Diseases of the Urinary Organs, Practical Lithotomy and Lithotomy, Tumours of the Bladder, Suprapubic Lothotomy, and Preventive Treatment of Calculous Disease*. Among other books of a medical character that came from his pen were *Food and Feeding, and Diet in Relation to Age and Activity*, both of which passed through a number of editions. In 1874 he took a foremost part in founding the Cremation Society of England, of which he was the first president; and he was active in promoting legislation in connection with the preservation of cemeteries. He also recommended and maintained as a means of disposing of the body after death, but also did much towards the removal of the legal restrictions by which it was at first sought to prevent its practice in England. On various occasions he denounced the slackness and inefficiency of the methods of death-certification prevalent in Great Britain, and in 1892 his agitation was instrumental in procuring the appointment of a select committee to inquire into the matter; its report, published in the following year, in great measure confirmed his criticisms and approved the remedies he suggested. But medicine and hygiene by no means exhaust the list of Sir Henry Thompson's activities. In art he was an accomplished sketcher and, moreover, an amateur of painting whose pictures were hung at the Royal Academy and the Paris Salon. About 1870 he began to get together his famous collection of china, in particular of old blue and white Nanking; this time became so large that he could no longer find room for it, and most of it was sold. A catalogue of it, illustrated by himself and Mr James Whistler, was published in 1878. In his famous "octaves" he may be said to have elevated the giving of dinner parties into a fine art. The number of courses and of guests was almost alike in all, and both were selected with the utmost care and discrimination to promote the "feast of reason and the flow of soul." In literature, in addition to more serious works, he produced two novels—*Charley Kingston's Aunt* (1885) and *All But* (1886)—which met with considerable success. In science he became a devotee of astronomy, and for a time maintained a private observatory in his house at Molesey. He further did much to promote astronomical study in Great Britain by presenting Greenwich Observatory with some of the finest instruments now among its equipment, his gifts including a photoheliograph of 9-in. aperture; a 36-in. reflecting telescope, and a large refracting telescope having an object-glass of 26-in. diameter and a focal length of 23½ ft. The offer of the last instrument was made in 1894. Its manufacture was undertaken by Sir Howard Grubb of Dublin, and its erection was completed in 1897. It added greatly to the instrumental resources of Greenwich, especially for photographic work, and its importance may be gauged from the fact that both in aperture and focal length it is double the size of any instrument possessed by the observatory at the time it was put in place. That Sir Henry Thompson, who was knighted in 1867, received a knighthood in 1894, was probably not unconnected with the presentation of this telescope to the national observatory. Thompson died on the 18th of April 1904. His family consisted of an only son, Herbert, a barrister and well-known Egyptologist, who succeeded to the baronetcy, and two daughters, of whom the elder (author of a valuable *Handbook to the Public Picture Galleries of Europe*, first published in 1877), married Archdeacon Watkins of Durham, and the younger married the Rev. H. de Candole.

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**THOMPSON, SIR JOHN SPARROW** (1844-1894), Canadian jurist and statesman, was born at Halifax, Nova Scotia, on the 10th of November 1844, of Irish descent. At fifteen he entered a lawyer's office, and in 1865 was called to the provincial bar. In 1871 he incurred much odium by leaving the Methodist Church, in which he had been prominent, and becoming a Roman Catholic, a change dictated solely by religious motives. In 1877 he was elected to the local legislature for Antigonish as a Conservative, and in 1878 became attorney-general. In May 1882 he became premier, but in June was defeated at the general election, though retaining his own seat, and in July was made a judge of the provincial Supreme Court. When in September 1885, he was appointed minister of justice in the federal cabinet, and soon after was elected member for Antigonish. In 1886 he successfully defended in the Federal parliament the hanging of Louis Riel (q.v.), which had greatly angered the French Roman Catholics; in 1887-1888, together with Mr Joseph Chamberlain and Sir Charles Tupper, he arranged a Fisheries Treaty with the American commissioners, which was afterwards thrown out by the United States Senate. During the following years he defended the government with great skill in various offices, as minister of fisheries, and in November 1887 succeeded Sir John Abbott as premier of Canada. The length of time during which the Conservatives had held office had gathered around many parasites, and Thompson was compelled to face charges, some of them true, against prominent Conservatives. He promptly announced his intention to "lop the mouldering branches away," and would probably have reorganized his party, but on the 12th of December 1894 he dropped dead at Windsor Castle, a few minutes after having been sworn in by Queen Victoria as a member of the privy council.

Though a quiet man who did not advertise, few Canadian statesmen have done so much honest and solid work. In 1892 he finished the codification of the Canadian criminal code; in 1893 his firmness and knowledge as British arbitrator at Paris on the Bering Sea dispute between Great Britain and the United States were of great service.

His *Life* has been written by J. C. Hopkins (Toronto, 1895).

**THOMPSON, LAUNT** (1833-1894), American sculptor, was born at Abbeyleix, Ireland, on the 8th of February 1833. In 1847 he emigrated to the United States, and settled with his mother at Albany, New York. After studying anatomy in the office of a physician, Dr Tombs, his acquaintance with William Wilmerforce, he was appointed governor of Sierra Leone in 1868, but was recalled on account of his hostility to the slave trade. In 1872 he returned to his military duties, and, after serving in the south of France, was in 1815 attached as Arabic interpreter to an expedition against the Wahabees of the Persian Gulf, with whom he negotiated a treaty (dated Jan. 1820) in which the slave trade was for the first time declared piracy. He was promoted major in 1825, lieutenant-colonel in 1829 and major-general in...
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1854. He entered parliament as member for Hull (1833-1837), and afterwards sat for Bradford (1847-1852, 1857-1870). He took a prominent part in the corn-law agitation, his *Catechism of the Corn Laws* (1837) being by far the most effective pamphlet published on the subject. In 1829 he became the proprietor of the *Westminster Review*, to which he contributed a large number of articles, republished in 1842 in six volumes, under the title *Exercises, Political and Others*. His mathematical publications were of a somewhat eccentric kind. He published a *Theory of Parallels* (1842), and was also the author of *Geometry without Axioms*, in which he endeavoured to "get rid of axioms and postulates*. His *History of Jute Manufacture* (1859) was, however, a contribution of great value to the science of musical acoustics, and went through many editions. It may be said to have formed the basis of the tonic sol-fa system of music. He died at Blackheath, near London, on the 7th of September 1869.


THOMPSON, WILLIAM HEPWORTH (1810-1886), English classical scholar and master of Trinity College, Cambridge, was born at York on the 27th of March 1810. He was privately educated before entering the university. In 1834 he became a fellow of Trinity, in 1833 professor of Greek (to which a canonry in Ely Cathedral was then for the first time attached), and in 1866 master of his college. With the exception of the year 1836, when he acted as headmaster of a newly established school in Leicester, his life was divided between Cambridge and Ely. He died at his master’s lodge on the 1st of October 1866. Thompson proved a worthy successor to Whewell; the twenty years of his mastership were years of progress, and he himself took an active part in the abolition of tests and the reform of university studies and of the college statutes. As a scholar he devoted his attention almost entirely to Plato; and his *Phaedrus* (1868) and *Gorgias* (1871), with especially valuable introductions, still remain the standard English editions of these two dialogues. He also edited (1856) from the author’s MSS. *Lectures on the History of Ancient Philosophy* by William Archer Butler (1814-1848; lecturer on moral philosophy at Trinity College, Dublin), the value of which was greatly enhanced by Thompson’s notes. See article by J. W. Clark in *Dict. Nat. Biog.*; and J. E. Sandys, *History of Classical Scholarship* (1853), vol. iii.

THOMSEN, GRIMUR (1820-1876), Icelandic poet and man of letters, was born in 1820. He came in 1837 to the university of Copenhagen, where he first studied law and philology, but later, philosophy and aesthetics. He became an enthusiastic follower of the Pan-Scandinavian movement, although this was not generally favoured by his countrymen. After some years of foreign travel, in 1848 he entered the Danish diplomatic service, and remained in it till 1851, when he returned to Copenhagen, where he became the chief of one of the departments of the Danish foreign office. He retired in 1866 and then went back to Iceland, where he passed the rest of his life, active in the politics and the literature of his native island. He died in 1896. He is the best ballad poet Iceland has produced. His poems are unaffected and mostly free from rhetoric, the besetting sin of Icelandic poets. His subjects are principally taken from Icelandic or Scandinavian history and mythology. He is very unlike most of his contemporaries, both in style and thought: he is Icelandic to the core, and on that account is perhaps the modern Icelandic poet most appreciated by foreigners besides his poems (two separate collections, Reykjavik, 1880, and Copenhagen, 1880), he is the author of numerous critical and historical essays in Icelandic and Danish, and some larger works in Danish, of which his dissertation on Lord Byron (Copenhagen, 1842) deserves to be mentioned. Grímur Thomsen was a warm admirer of Greek literature, and translated a great number of poems from that language into Icelandic. (S. B.)

THOMSEN, HANS PETER JÖRGEN JULIUS (1826-1900), Danish chemist, was born in Copenhagen on the 16th of February 1826, and spent his life in that city. From 1847 to 1856 he was engaged in teaching chemistry at the Polytechnic, of which from 1883 to 1892 he acted as director, and from 1856 to 1866 he was on the staff of the military high school. In 1866 he was appointed professor of chemistry at the university, and retained that chair until his retirement from active work in 1891. His name is famous for his researches in thermochemistry, and, especially between 1869 and 1882, he carried out a great number of determinations of the heat evolved or absorbed in chemical reactions, such as the formation of salts, oxidation and reduction, and the combustion of organic compounds. His collected results were published in 1865-1886 in four volumes under the title *Thermochemische Untersuchungen*, and also a *Résumé* in English, under the title *Thermal Analysis*. In 1866 he established in Copenhagen a process for manufacturing soda from cryolite, obtained from the west coast of Greenland. He died on the 13th of February 1900. His brother, Carl August Thomsen (1834-1894), was lecturer on technical chemistry at the Copenhagen Polytechnic, and a second brother, Thomas Gottfried Thomsen (1841-1901), was assistant in the chemical laboratory at the university till 1884, when he abandoned science for theology, subsequently becoming minister at Norup and Roskilde.

THOMSON, SIR CHARLES WYVILLE (1830-1882), Scottish naturalist, was born at Bonsyre, Linlithgowshire, on the 5th of March 1830, and was educated at Edinburgh University. In 1850 he was appointed lecturer in, and in 1853 professor of, botany at Aberdeen, and in 1853 he became professor of natural history in Queen’s College, Cork. A year later he was nominated to the chair of mineralogy and geology at Queen’s College, Belfast, and in 1860 was transferred to the chair of natural history in the same institution. In 1868 he assumed the duties of professors of botany at the Royal College of Science, Dublin, and finally in 1870 he received the natural history chair at Edinburgh. He will be specially remembered as a student of the biological conditions of the depths of the sea. Being interested in crinoids, and stimulated by the results of the dredgings of Michael Sars (1805-1869) in the deep sea off the Norwegian coasts, he succeeded, along with Dr W. B. Carpenter, in obtaining the loan of H.M.S. "Lightning" and "Porcupine", for successive deep-sea dredging expeditions in the summers of 1868 and 1869. It was thus shown that animal life exists in abundance down to depths of 650 fathoms, that all invertebrate groups are represented (largely by Tertiary forms previously believed to be extinct), and, moreover, that deep-sea temperatures are by no means so constant as was supposed, but vary considerably, and indicate an oceanic circulation. The results of these expeditions were described in *The Depths of the Sea*, which he published in 1873. The remarkable results gained for hydrography as well as zoology, in association with the practical needs of ocean telegraphy, soon led to the granting of H.M.S. "Challenger" for a circumnavigating expedition, and Thomson sailed at the end of 1871 as director of the scientific staff, the cruise lasting three years and a half (see *Challenger Expedition*). On his return he received many academic honours, and was knighted. In 1873 he published two volumes (The Voyage of the Challenger in the Atlantic), of a preliminary account of the results of the voyage, meanwhile carrying on his administrative labours in connexion with the disposition of the special collections and the publication of the monographs dealing with them. His health never robust, was meanwhile giving way; from 1879 he ceased to perform the duties of his chair, and he died at Bonsyre on the 10th of March 1882. See obituary notice in *Proc. Soc. Edin.* (1883); also Thomson and Murray, Reports of the Voyage of H.M.S. "Challenger" (Edinburgh, 1888).

THOMSON, JAMES (1700-1748), English poet, author of *The Seasons*, was born at Ednam, in Roxburghshire, on the 11th of September 1700—the third son and fourth child of Thomas Thomson, minister of that place. His mother, Beatris, was the daughter of Mr Trotter of Fogo, whose wife, Margaret, was one of the Houses of Bassenden. About 1701 Thomas Thomson removed to Southdean near Jedburgh. Here James was educated at first by Robert Riccalltoun, to whose verses on
Winter he owed the suggestion of his own poem. In 1712 he attended a school at Jedburgh, held in the aisle of the parish church. He learnt there some Latin, but with difficulty, and the earliest recorded utterance of the future poet was "Confound the building of Babel." He began very soon to write verses, and we are told that every January he destroyed almost all the productions of the preceding year. And this was just as well, for the little that has escaped the fire contained no promise of him who was not in favour of his own poem. In 1715 he went to the university of Edinburgh. It is said that as soon as the servant who brought him thither had quitted him, he returned full speed to his father's house, declaring that he could read just as well at home; he went back, however, and had not been long at college before he lost his father, who died, according to one remarkable but highly improbable story, in the attempt to lay a ghost. The incident should have left more impression than we can trace upon the mind of the poet, at this date nervous and afraid of the dark; but In his "Winter" he writes of all which stories with a quiet and "whim of horror." He made friends at the university with David Mallock, who afterwards called himself Mallet, and with Patrick Murdoch, his future biographer. In 1719 he became a divinity student, and one of his exercises so enchanted a certain Auditor Benson, that he urged Thomson to go to London and there make himself a reputation as a preacher. It was partly with this object that Thomson left Edinburgh without a degree in March 1725. His mother saw him embark, and they never met again; she died on the 10th of May of that year. There is sufficient evidence that the subject of Thomson's earliest extant declamation, which Dr Johnson attributes to him; and in July 1725 we find him engaged, as a make-shift, in teaching "Lord Binning's son to read." This son was the grandson of Lady Grizel Baillie, a somewhat distant connexion of Thomson's mother. She was the daughter of Sir Patrick Home, whom, after the defeat of Argyll, she fed in his concealment near his own castle; she was also, like other Scottish ladies, a writer of pretty ballads. This heroical and poetical is supposed to have encouraged Thomson to come to England, and it is certain that she procured him a temporary home. But he had other friends, especially Duncan Forbes of Culfin, by whom he was recommended to the duke of Argyll, the earl of Burlington, Sir Robert Walpole, Arbuthnot, Pope and Gay. Some introductions to the literary world he may have owed to Mallet, then tutor in the family of the duke of Montrose.

Thomson's "Winter" appeared in March 1726. It was warmly praised by Aaron Hill, a man of various interests and projects, and in his day a sort of literary oracle. It was dedicated to Sir Spencer Compton, the Speaker, who rewarded the poet, to his great disgust, with a bare twenty guineas. By the 11th of June 1727 a second edition was called for. Meanwhile Thomson was residing at Mr Watts's academy in Tower Street as tutor to Lord George Graham, second son of the duke of Montrose, and previously a pupil of Mallet. "Summer" appeared in 1727. It was dedicated in prose, a compliment afterwards versified, to Bubb Dodington. In the same year Thomson published his "Poem to the Memory of Sir Isaac Newton," with a fulsome dedication to Sir Robert Walpole, which was afterwards omitted, and the verses themselves remodelled when the poet began to inveigh against the ministry as he did in British, published in 1729. "Spring" appeared in 1726, published by Andrew Millar, a man who, according to Johnson, dealt somewhat handsomely by and "raised the price of literature." It was dedicated to the counts of Hertford, afterwards duchess of Somerset, a lady devoted to letters and the patroness of the unhappy Savage. In 1729 Thomson produced "Sophonisba," a tragedy now only remembered by the line "O Sophonisba, Sophonisba, O," and the parody "O Jimmy Thomson, Jimmy Thomson, O," which caused him to remodel the unhappy verse in the form, "O Sophonisba, I am wholly thine." A poem, anonymous but unquestionably Thomson's, to the memory of Congreve who had died in January 1729, appeared in that year. In 1730 "Autumn" was first published in a collected edition of The Seasons. It was dedicated to the Speaker, Onslow. In this year, at the suggestion of Rundle, bishop of Derry, one of his patrons, he accompanied the son of Sir Charles Talbot, solicitor-general, upon his travels. In the course of these he projected his Liberty as "a poetical landscape of countries, mixed with moral observations on their government and people." In December 1731 he returned with his pupil to London. He probably lived with his patrons the Talbots, leisurely meditating on his new poem, the first part of which did not appear until the close of 1734 or the beginning of 1735. But meanwhile his pupil died, and in the opening lines of Liberty Thomson pays a tribute to his memory. Two months after his son's death Sir Charles Talbot became chancellor and gave Thomson a sinecure in the court of chancery. About this time the poet worked for the relief of Dennis, now old and in extreme poverty, and induced even Pope to give a half-contemptuous support to the bitter critic of the Rape of the Lock. Liberty was completed in five parts in 1736. The poem was a failure; its execution did not correspond with its design; in a sense indeed it is a survey of countries and might have anticipated Goldsmith's Traveller. It was not, however, the poem which readers were expecting from the author of The Seasons, who had taken them from the town to the country, and from social and political satire to the world of nature. It is in the main a set of wearisome declamations put in the mouth of the goddess, and Johnson rightly enough remarks that "an enumeration of examples to prove a position which nobody denied as it was from the beginning superfluous, must quickly grow disgusting." The external appearance of the work was for many years perverted by the zeal of partisanship.

He was established in May 1736 in a small house at Richmond, but his patron died in February 1737 and he lost his sinecure; he then "whips and spurs" to finish his tragedy Agamemnon, which appeared in April 1738, not before he had been arrested for a debt of £70, from which, according to a story which has been discredited on quite insufficient grounds, Quin relieved him in the most generous and tactful manner. Quin, it is said, visited him in the sponging-house and "balanced accounts with him" by insisting on his accepting a hundred pounds as a return for the pleasure which the actor had received from the poet's works. The incident took place probably a little before the production of Agamemnon, in which Quin played the leading part. The play is of course modelled upon Aeschylus and owes whatever of dignity it possesses to that fact; the part of Cassandra, for instance, retains something of its original force, pathos and terror. But most of the other characters exist only for the purpose of political innuendo. Agamemnon is too long absent at Troy, as George is too long absent in Germany; the arts of Aegeus the are the arts of Walpole; the declarations of Tantalus are the declarations of Wyndham or Pulteney; Alexander, consoling himself with the muses on his island in Cyclades, is Bolingbroke in exile. Thomson about this time was introduced to Lyttelton, and by him to the prince of Wales, and to one or the other of these, when he was questioned as to the state of his affairs, he made answer that they were "in a more poetical posture than formerly." Agamemnon was put upon the stage soon after the passing of Walpole's bill for licensing plays, and its obvious bias fixed the attention of the censorship and caused Thomson's next venture, Edward and Eleanor, which has the same covert aim, to be proscribed. This was a play generally accepted notice that, like its predecessor, it follows a Greek original, the Alcestis of Euripides. It has also, what Agamemnon has not, some little place in the history of literature, for it suggested something to Lessing for Nathan der Weise, and to Scott for the Talisman. The rejection of the play was defended by one of the ministry on the ground that Thomson had taken a Liberty which was not agreeable to Britannia in any Season. These circumstances sufficiently account for the poet's next experiment, a preface to Milton's Areopagitica. He joined Mallet in composing the masque of Alfred, represented at Cleeveden on the Thames before the prince of Wales, on the 1st of August 1740. There can be little question that "Rule
Britannia," a song in this drama, was the production of Thomson. The music of the song, as of the whole masque, was composed by Arne. In 1744 Thomson was appointed surveyor-general of the Leeward Islands by Lyttelton with an income of £300 a year; but his patron fell into disfavour with the prince of Wales, and in 1747, when Thomson lost, at the close of 1747, the pension he received from that quarter. For a while, however, he was in flourishing circumstances, and whilst completing at his leisure The Castle of Indolence produced Tancred and Sigis- munda at Drury Lane in 1745. The story is found in Gil Bias, and is ultimately to be traced to The Decameron. It owes much to Le Sage in language, plot and sentiment, and the conflict of emotion, in depicting which Thomson had some little skill, is here effectively exhibited. He was assisted herein by his own experience. The "Amanda of The Seasons is a Miss Elizabeth Young, a lady of Scottish birth, whose mother was ambitious for her and forbade her to marry the poet, anticipating that she would be reduced to singing his ballads in the streets. The last years of his life were saddened by this disappointment.

The Castle of Indolence, after a gestation of fifteen years, appeared in May 1748. It is in the Spenserian stanza with the Spenserian archaisms, and is the first and last long effort of Thomson in rhyme. It is not impossible that his general choice of blank verse was partly due to the fact that he had not the southern ear and took many years to acquire it. The great and varied interest of the poem might well rescue it from the neglect into which even The Seasons has fallen. It was worthy of an age which was fertile in character-sketches, and like Gay's Welcome to Pope anticipates Goldsmith's Retaliation in the lifelike presentation of a noteworthy circle. There is in it the same strain of gentle burlesque which appears in Shenstone's Schoolmistress, whilst the tone and diction of the poem harmonize with the hazy landscape, the pleasant land of drowsy head, in which it is set. It is the last work by Thomson which appeared in his lifetime. He was walking from London to his house at Richmond when he became hysteric and took a boat at Hampton-smit; he thus caught a chill with fatal consequences and died on the 27th of August 1748. He was buried in Richmond churchyard. His tragedy Coriolanus was acted for the first time in January 1749. In itself a feeble performance, it is noteworthy for the prologue which his friend Lyttelton wrote for it, two lines of which—

"He loved his friends—forgive the gushing tear!"

"Alas! I feel I am no actor here!

were recited by Quin with no simulated emotion.

It seems, however, that Thomson himself ever quite realized the distinctive significance of his own achievement in The Seasons, or the place which criticism assigns him as the pioneer of a special literary movement and the precursor of Cowper and Wordsworth. His avowed preference was for great and worthy themes of which the world of nature was but one. Both the choice and the treatment of his next great subject, Liberty, indicate that he was imperfectly conscious of the gift that was in him, and might have neglected it but that his readers were wiser than himself. He has many audacities and many felicities of expression, and enriched the vocabulary of the poets who had preceded him, but it is difficult to believe that he was not the better for that training in refinement of style which he partly owed to Pope, who almost unquestionably contributed 'some passages to The Seasons. And, except in The Castle of Indolence, there is much that is conventional, much that is even vicious or vulgar in taste when Thomson's muse deals with that human life which must be the background of descriptive as of all other poetry; for example, his bumpkin who chases the rainbow is as unreal a being as Akenside's more sentimental rustic who has "the form of beauty smiling at his heart."

But if Thomson sometimes lacks the true vision for things human, he retains it always for things mute and material, and whilst the critical estimate of his powers and influence will vary from age to age, all who have read him will concur in the colloquial judgment which only candour could have extorted from the prejudice of Dr Johnson—

"Thomson had as much of the poet about him as most writers. Everything appeared to him through the medium of his favourite pursuit. He could not have viewed those two candles burning but with a poetical eye."

For the day of Thomson's birth see the Aldine edition of his poems (1897). In the same volume (pp. 189 seq.) is discussed the controversy between Pope and Thomson and the question if the handwriting be his, made in an interleaved edition of The Seasons dated 1738, and they were for the most part adopted by Thomson in the edition of 1744; the writer seldom makes more than verbal changes in passages of pure description, but sometimes strikingly enhances the scenes in which human character comes into play, adding, for example, in Autumn, of the fair lady in the Decameron of which the first suggestion for the words can be found in The Rape of the Lock. But whereas many years ago the opinion of experts at the British Museum pronounced the handwriting of these notes to be Pope's beyond a doubt, their successors at the present day are equally positive that it is not. Some account should be taken of the cramping of the hand, due to writing on a curved surface, and of the letter at Blenheim (see Pall Mall Magazine for August 1894), which bear a greater resemblance to the disputed handwriting than any specimens in the British Museum.

The first collected editions of The Seasons bear dates 1730, 1738. By 1746 Lyttelton was talking both with The Seasons and Liberty in editions after his friend's death. Among the numerous lives of the poet may be mentioned those by his friend Patrick Murdoch, by Dr Johnson in Lives of the Poets, by Sir Harris Nicolas (Ald. ed., 1860), by M. Morel, James Thomson, sa vie et ses œuvres (Paris, 1895), and James Thomson, in the English Men of Letters Series, by G. C. Macaulay (1868). See also Dr G. Schmeding's Leben, ein müder Tod, which was a revision of the life prefixed to the Aldine edition of his works in 1897; and an excellent edition of The Seasons in the Clarendon Press Series by J. Logie Robertson. (D. C. To.)

THOMSON, JAMES (1834-1882), British poet, best known by his signature "B.V.", was born at Port-Glasgow, in Renfrewshire, on the 23rd of November 1834, the eldest child of a mate in the merchant shipping service. His mother was a deeply religious woman of the Irvingite sect. On her death, James, then in his seventh year, was procured admission into the Caledonian Orphan Asylum. In 1850 he entered the model school of the Military Asylum, Chelsea, from which he went out into the world as an assistant army schoolmaster. At the garrison at Ballincollig, near Cork, he encountered the one brief happiness of his life: he fell passionately in love with, and was in turn ardently loved by, the daughter of the armour-sergeant of a regiment in the garrison, a girl of very exceptional beauty and cultivated mind. Two years later he suddenly received news of her fatal illness and death. The blow prostrated him in mind and body. Henceforth his health, his method, his gloom, his disenchantment, misfortune, poverty, rarely alleviated by episodes of somewhat brighter fortune. While in Ireland he had made the acquaintance of Charles Bradlaugh, then a soldier stationed at Ballincollig, and it was under his auspices (as editor of the London Investigator) that Thomson first appealed to the public as an author, though actually his earliest publication was in Tait's Edinburgh Magazine for July 1858, under the signature "Crepusculus." In 1860 was established the paper with which Bradlaugh was so long identified, the National Reformer, and it was here, among other productions by James Thomson, that Crepusculus made his appearance for the first time, as "The Ladies of Death," and (1874) his chief work, the sombre and imaginative City of Dreadful Night. In October 1862 Thomson was dismissed the army, in company with other teachers, for some slight breach of discipline. Through Bradlaugh, with whom for some subsequent years he lived, he gained employment as a solicitor's clerk. From 1866 to the end of his life, except for two short absences from England, Thomson lived in a single room, first in Pimlico and then in Bloomsbury. He contracted habits of intemperance, aggravated by his pessimistic turn of mind to dipsomania, which made a successful lawyer increasingly improbable. His "only reputable appearance in respectable literary society," in the acceptance of his long poem, "Sunday up the River," for Fraser's Magazine, on the advice, it is said, of Charles Kingsley.
THOMSON, J.

In 1872 Thomson went to the western states of America, as the agent of the shareholders in what he ascertained to be a fraudulent silver mine; and the following year he received a commission from the New York World to go to Spain as its special correspondent with the Carlisle. During the two months of his stay in that distracted country he saw little real fighting, and was himself prostrated by a sunstroke. On his return to England he continued to write in the Secularist and the National Reformer, under the initials "B.V." In 1875 he severed his connexion with the National Reformer, owing to a disagreement with its editor; henceforth his chief source of income (1875-1881) was from the monthly periodical known as Cope's Tobacco Plant.

Chiefly through the exertions of his friend and admirer, Bertram Dobell, Thomson's best-known book, The City of Dreadful Night, one of the first published in April 1836, and at once attracted wide attention; it was succeeded in the autumn by Vane's Story, and other Poems, and in the following year by Essays and Fantasies. All his best work was produced between 1855 and 1875 ("The Doom of a City," 1857; "Our Ladies of Death," 1861; Weddah and Om-el-Bonain; "The Naked Goddess," 1866-1867; The City of Dreadful Night, 1870-1874). He died at University College Hospital, in Gower Street, on the 3rd of June 1882, and was buried at Highgate cemetery, in the same grave, in unsegregated ground. As his friend Austin Holyoake says:

The productions of James Thomson already mentioned may be added the posthumous volume entitled A Voice from the Nile, and other Poems (1884), to which was prefixed a memoir by Bertram Dobell. This volume contained much that is interesting, but nothing to increase Thomson's reputation. If an attempt be made to point to the most apparent literary relationship of the author of the City of Dreadful Night, one might venture the suggestion that James Thomson was a younger brother of De Quincey. If he has distinct affinity to any writer it is to the author of Suspiria de profundis; if we look further afield, we might perhaps discern shadowy prototypes in Leopardi, Heine and Baudelaire. But, after all, Thomson holds so unique a place as a poet that the effort at classification may well be dispensed with. His was no literary pessimism, no assumed gloom. The poem "Insomnius" is a distinct chapter of biography; and in "Mater Tenebrarum" and elsewhere among his writings passages of self-revelation are frequent. The merits of Thomson's poetry are its imaginative power, its sombre intensity, its sonorous music; to these characteristics may be added, in his lighter pieces, a Heine-like admixture of strange gaiety, pathos and caustic irony. Much the same may be said of his best poems. His faults are few: too infrequent use of mere rhetoric and verbage; and perhaps a prevailing lack of the sense of form; besides an occasional vulgar recklessness of expression, as in parts of Vane's Story and in some of his prose writings.

See the Life, by H. S. Salt (1905 edition).

THOMSON, JAMES (1822-1892), British physicist and engineer, was born in Belfast on the 16th of February 1822, and, like his younger brother, Lord Kelvin, at an unusually early age began to attend the classes at Glasgow University, where his father had been appointed professor of mathematics in 1832. After his graduation he decided to study civil engineering, and for that purpose became a pupil in several engineering offices and works successively; but ill-health obliged him to leave them all, and he had finally to accept the fact that an occupation involving physical exertion was out of the question. Accordingly, from about 1843, he devoted himself to theoretical work and to mechanical invention. To this period belong his well-known researches in thermodynamics, which enabled him to predict by the application of Carnot's theorem that the temperature of the freezing point of substances which expand on solidification must be lowered by the application of pressure, the reverse being the case with substances which contract on solidification; and he was able to calculate the amount by which a given pressure lowers the freezing-point of water, a substance which expands on solidification. His results were experimentally verified in the physical laboratories of Glasgow University under Lord Kelvin's direction, and were afterwards applied to give the explanation of regelation. In 1857 he extended them in a paper on crystallization and liquefaction as influenced by stresses tending to change of form in the crystals, and in other studies on the change of state he continued Thomas Andrews's work on the continuity of the liquid and gaseous states of matter, constructing a thermodynamic model in three dimensions to show the relations of pressure, volume and temperature for a substance like carbonic acid. With regard to his inventions, he devised a clever feathering mechanism for the paddles of steamboats when only a boy of sixteen, and later turned his attention to water-engines. In 1850 he patented his "vortex wind-wheel," and during the next three or four years engaged on inquiries into the properties of "whirling fluids," which resulted in improved forms of blowing-fans and water-turbines (see HYDRAULICS). Settling in Belfast in 1851, he was selected to be the resident engineer to the Belfast Water Commissioners in 1853, and four years later became professor of civil engineering and surveying in Queen's College, Belfast. Thence he removed in 1873 to Glasgow as successor to Macquorn Rankine in the chair of engineering in the university, and retained this position until 1882, when the failure of his eyesight compelled him to resign. He died on the 8th of May 1882 at Glasgow. His contributions to geological science included studies of the parallel roads of Glen Roy and of the prismatic jointing of basalt, as seen at the Giant's Causeway. In 1876 and following years he studied the origin of windings of rivers in alluvial plains and made many experiments with the aid of artificial streams, and the currents of atmospheric circulation afforded him the material for the Bakerian lecture of 1892.

THOMSON, JOHN (1778-1840), Scottish landscape painter—Thomson of Duddingston, as he is commonly styled—was born 1778 at Dailly, Ayrshire. His father, grandfather and great-grandfather were clergymen of the Church of Scotland. He studied for the same vocation in the university of Edinburgh; and, residing with his elder brother, Thomas Thomson, afterwards celebrated as an anti-Jews and feudal lawyer, he made the acquaintance of Francis Jeffrey and other young members of the Scottish bar afterwards notable. During the recess he sketched in the country, and, while attending his final college session, he studied art for a month under Alexander Nasmyth. After his father's death he became, in 1800, his successor as minister of Dailly; and in 1805 he was translated to the parish of Duddingston, close to Edinburgh. He continued, however, to practise art as an amateur, apparently without any detriment to his pastoral duties. Thomson's popularity as a painter increased with his increasing artistic skill; and, having mastered his initial scruples against receiving artistic fees, on being offered £5 for a landscape—reassured by "Grecian" Williams's stout assertion that the work was "worth twice the amount"—the minister of Duddingston began to dispose of the productions of his brush in the usual manner. In 1830 he was made an honorary member of the Royal Scottish Academy. Thomson was also an accomplished performer on the flute, an exact and well-read student of physical science, and one of the writers on optics in the early numbers of the Edinburgh Review. He enjoyed a singularly wide and eminent circle of friends, including, among artists, Turner and Wilkie, and among men of letters, Wilson and Scott—the latter of whom desired that Thomson, instead of Turner, should have illustrated the collected edition of his works. He died at Duddingston on the 27th of October 1840 (not the 20th, as stated by some authorities). Thomson was twice married, and his second wife, the widow of Mr Dalrymple of Cleland, was herself also a skilful amateur artist.

Thomson is fairly represented in the Scottish National Gallery; and the "Aberdaly Bay" of that collection, with the soft infinity of
its clouded grey sky, and its sea which leaps and falls again in waves of sparkling and shadowed silver, is fit to rank among the triumphs of Scottish art.

THOMSON, JOSEPH (1818–1895), Scottish explorer in Africa, was born on the 14th of February 1818 at Penpont, Dumfries-shire, being the fifth son of William Thomson, originally a working stonemason, who had attained the position of a master builder. In 1868 his father removed to Gateheadbridge, where he rented a farm and a quarry. Joseph Thomson was soon attracted by the geological formation and historical associations of Nithsdale. For a short time he worked in his father’s quarry. In 1875 he went to Edinburgh University, where he paid particular attention to geology and botany, and after completing his course in 1878 he was appointed geologist and naturalist to the Royal Geographical Society’s expedition to East Central Africa under Keith Johnston. The latter died at Behobeho, between the coast and the north end of Lake Nyasa, on the 28th of June 1879, and Thomson then took command. Though only twenty-one his coolness and tact were remarkable, and he successfully conducted the expedition across the desolate region of Uhehê and Ubenita to the north end of Lake Nyasa, and then by a hitherto unexplored track to Lake Tanganyika, where he investigated the most question of the Lukuga outlet. From Tanganyika he started to reach the Congo, but troubles with his carriers, who dreaded the warlike Wanza, obliged him to retrace his steps. Going round the south end of Tanganyika he discovered Lake Rukwa, whence he marched via Tabera to the coast at Bagamoyo, reaching London in August 1880. In the following year he published an account of his travels under the title *To the Central African Lakes and Back*. About this time the sultan of Zanzibar, being anxious to develop certain supposed coal beds on the river Rovuma, was advised to obtain independent expert opinion as to their value. Application was made to Thomson, who undertook to survey them, and started from Mikindani, on the 17th of July 1881. The coal, however, turned out to be worthless, and the sultan of Zanzibar, having been sent to Zanzibar, had to endure much delay and vexation through the sultan’s chagrin. For a considerable time the explorer had directed his attention to Masailand, a region of East Africa occupied by a powerful tribe of warriors who had a reputation for savagery and intractability somewhat greater than their actions warranted. Through their territory ran the shortest route from the sea to the headwaters of the Nile. In 1882 the Royal Geographical Society took up the question, and requested Thomson to report on the practicability of taking a caravan through the Masai country, which at first sight the amount of travelling and the severity of the climate seemed to make beyond their power. By undaunted courage and great resourcefulness he succeeded in crossing the Najiri desert and exploring the eastern rift-valley. Thence he went with a picked company through Laikilia to Mt Kenya and Lake Baringo, afterwards traversing the unknown region lying between Baringo and Victoria Nyanza, reached on the 10th of December 1883. On his way back he visited Mt Elgon and discovered there a series of wonderful caves. The account of this adventurous journey appeared in 1884, under the title of *Through Masailand*, and it is a classic in modern travel literature. It was an anathema to Thomson to find that his name began to tell upon Thomson’s exceptionally hard constitution, but in 1885 he undertook an expedition to Sokoto for the National African (afterwards the Royal Niger) Company, and succeeded in obtaining the signatures of the sultans of Sokoto and Gando to treaties with which he had been entrusted by the company, treaties which did much to secure British interests in Nigeria. In 1888, by way of recreation, he travelled through southern Morocco and explored a portion of the Atlas range, and published the results in the following year, under the title *Travels in the Atlas and South-west Morocco*. In 1890 he entered the service of the British South Africa Company and in that and the following year, starting from Quelimane he traversed the region between lakes Nyasa and Bangweulu and the Zambezi. It was a period of great tension between the Portuguese and the British, and Thomson’s party on leaving the Portuguese frontier was fired on by the Portuguese who, too late, realized that they had allowed a treaty-making envoy to pass through their territory in the guise of a peaceful trader. Thomson concluded treaties with native potentates which gave to the Chartered Company political, trading, and indices, communicated to him of the district since known as North-East Rhodesia. This journey, in which he covered nearly a thousand miles of hitherto unexplored country, proved disastrous to a constitution already undermined. In 1893 he visited South Africa in search of health, but unavailingly. He died in London on the 2nd of August 1895. The accounts of his travels not recorded in the books mentioned were published in magazines or in the *Proceedings of the Royal Geographical Society*. Thomson was the last, as he was one of the most successful, of the great geographical pioneers in Africa. He had an extraordinarily keen topographical instinct which enabled him to comprehend at a glance the natural features of the countries he traversed. To undaunted courage and promptness of decision he added a forbearing and patient disposition. “Joseph Thomson,” wrote Sir Clements Markham, “had the high and glorious distinction of never having caused the death of a native. This is a proof of very rare qualities in the leader of an expedition, and places him in the very first rank of explorers.”


THOMSON, THOMAS (1773–1852), Scottish chemist, was born at Crieff, Perthshire, on the 12th of April 1773. He was educated at the universities of St Andrews and Edinburgh, and after taking the degree of M.D. at the latter place in 1799 established himself there as a teacher of chemistry. From 1828 he was professor of the science at the University of Edinburgh. On the death of his success to his elder brother, JAMES THOMSON (1768–1855), who filled that position in 1795–1796, and who in 1805 was ordained to the parish of Eccles, Berwickshire; and the chemical and mineralogical articles which he contributed to the supplement to the third edition formed the basis of his *System of Chemistry*, the first edition of which was published in 1802 and the seventh in 1831. At first this work was merely a compilation, but in the later editions many of his original results were incorporated; the third edition (1827) is noteworthy as containing the first edition of an analytical and theoretical treatise on the constitution of body by John Dalton himself. In 1811 he left Edinburgh, and after a visit to Sweden went to London, where in 1813 he began to edit the *Annals of Philosophy*, a monthly scientific journal which in 1827 was merged in the *Philosophical Magazine*. In 1817 he became lecturer in chemistry at Glasgow University, and in the following year was appointed to the regius professorship. This chair he retained until his death, which happened on the 2nd of July 1852 at Kilmarnock, Ayrshire; but from 1841 he was assisted by his nephew and son-in-law ROBERT DUNDAS THOMSON (1810–1866), who subsequently became medical officer of health for St Marylebone, London, and after 1846 he ceased active work altogether. He was a most energetic professor, and, according to his colleague, but no relation, Lord Kelvin (Sir William Thomson), founded the first chemical laboratory for students at a time when practical work was scarcely recognized as a necessary part of chemical education. He did much to spread a knowledge of Dalton’s atomic theory, and carried out many experiments in its support, but his strong predilections in favour of Prout’s hypothesis tended to vitiate his results, many of which were sharply criticized by J. J. Berzelius. In addition to various textbooks he published a *History of Chemistry* (1830–1851) which has provided material for many chemical biographers, but which, although it reads very plausibly, cannot be regarded as an authority of unimpeachable accuracy. His eldest son, THOMAS THOMSON (1817–1859) graduated as M.D. at Glasgow in 1839, accompanied
THOMSON, W.—THORBECKE

Sir J. D. Hooker on his travels in Sikkim in 1850, and collaborated with him in publishing his Flora indica in 1855 and in 1854 was appointed superintendent of the botanical gardens at Calcutta, also acting as professor of botany at the Calcutta medical college.

THOMSON, WILLIAM (1819-1890), English divine, archbishop of York, was born on the 11th of February 1819 at Whitehaven, Cumberland. He was educated at Shrewsbury and at Queen's College, Oxford, of which he became a scholar. He took his B.A. degree in 1840, and was soon afterwards made fellow of his college. He was ordained in 1842, and worked as a curate at Cuddesdon. In 1847 he was made tutor of his college, and in 1851 was made principal of the hall. In 1851 the subject being "The Atoning Work of Christ viewed in Relation to some Ancient Theories." These thoughtful and learned lectures established his reputation and did much to clear the ground for subsequent discussions on the subject. Thomson's activity was not confined to theology. He was made fellow of the Royal and the Royal Geographical Societies. He also wrote a very popular Outline of the Laws of Thought. He sided with the party at Oxford which favoured university reform, but this did not prevent him from being appointed provost of his college in 1855. In 1858 he was appointed preacher at Lincoln's Inn and there preached some striking sermons, a volume of which he published in 1861. In the same year he edited Aids to Faith, a volume written in opposition to Essays and Reviews, the progressive sentiments of which had stirred up a great storm in the Church of England. In December 1861 he was rewarded with the see of Gloucester and Bristol, and within a twelvemonth he was elevated to the archiepiscopate see of York. In this position his moderate orthodoxy led him to join Archbishop Tait in supporting the Public Worship Regulation Act, and, as president of the northern convocation, he came frequently into sharp collision with the lower house of the church. But he incurred the hostility of the High Church party among the clergy, he was admired by the laity for his strong sense, his clear and forcible reasoning, and his wide knowledge, and he remained to the last a power in the north of England. In his later years he published an address read before the members of the Edinburgh Philosophical Institution (1868), one on Design in Nature, for the Christian Evidence Society, which reached a fifth edition, various charges and pastoral addresses, and he was one of the projectors of The Speaker's Commentary, for which he wrote the "Introduction to the Synoptic Gospels." He died on the 29th of December 1890.

See the Quarterly Review (April 1892).

THOR, one of the chief deities of the heathen Scandinavians. He is represented as a middle-aged man of enormous strength, quick to anger, but benevolent towards mankind. To the harmful race of giants (demons), on the other hand, he was an implacable foe, and many stories are told in the poetic and prose Eddas of the destruction which he brought upon them at various times with his hammer. On the whole his figure is somewhat secondary in the mythology to that of Odin, who is represented as his father. But there is no doubt that in Iceland he was worshipped more than any other god, and the same seems to have been the case in Norway—indeed, perhaps, in all northern countries—except among the royal families. Even in the great temple at Upsala his figure is said to have occupied the chief place. There is evidence that a corresponding deity named Thoron or Thonar was worshipped in England and on the Continent, but little information is obtainable regarding him, except that he was identified with the Roman Jupiter. His name is identical with the Teutonic word for thunder, and even in Sweden the association of Thor with the thunder seems not to have been forgotten. Outside the Teutonic area he has close affinities not only with Jupiter or Zeus, but still more with the Lithuanian god Perkunas, whose name (which likewise means "thunder") appears to be connected with that of Thor's mother (Fiorgyn). The Vanangian god Perun was probably Thor himself under a Slavonic name (Russian perun, "thunderbolt").
been as fully recognized as his political genius has been. As an orator and writer his style was clear and forcible. His very dogmatism brought him many enemies, but at times, especially when he went in advance of his time, he was a much misunderstood man. These misunderstandings, frequently wilful, extended often beyond the domain of pure politics. Thus, by his enemies, Thorebecke was often held up as a pure materialist and no friend of the fine arts, because at a sitting of the states-general in 1862 he had said that it is not the duty of the state, nor in the true interest of art itself, for the government to "protect" art, since all state-aided art must be artificial, like any forced plant. This was popularly condensed into the aphorism, yet current in Holland, that "Art is not the business of the government," and Thorebecke was condemned as the author of it. Again, his adversaries used to call him a dangerous demagogue. As a matter of fact, there was no more ardent royalist than Thorebecke. He believed in constitutional monarchy, as offering the best guarantees both for sovereign and people, and he was bitterly opposed to all forms of state socialism. Long before his death he realized that he had outlived his own principles, and many of his former admirers had commenced to dub him a "rank conservative," whose political aims and reforms were no longer adequate. But Thorebecke's life-work will endure, and the Dutch constitution of 1889 practically embodied his principles, as laid down in the constitution of 1848. The former is the outcome of the latter and could not have been made without it.

The best biographical sketch of Thorebecke we owe to the late Professor Buys, his principal scholar and devoted friend, whose biography appeared in 1876 at Tiel. Another biography which deserves mention was issued in the same year at the Hague, from the pen of Dr. J. A. Levy, an Amsterdam lawyer. (H. Th.)

THOREAU, HENRY DAVID (1817–1862), American recluse, naturalist and writer, was born at Concord, Massachusetts, on the 12th of July 1817. To Thoreau this Concord country contained all of beauty and even grandeur that was necessary to the worshipper of nature; he once journeyed to Canada; he was long on one occasion to embark and explore a few rivers for the rest, he haunted Concord and its neighbourhood as faithfully as the stork does its ancestral nest. John Thoreau, his father, who married the daughter of a New England clergyman, was the son of a John Thoreau of the isle of Jersey, who, in Boston, married a Scottish lady of the name of Burns. This last-named John was the son of Philippe Thoreau and his wife Marie le Gallais, persons of pure French blood, settled at St Helier, in Jersey. From his New England Puritan mother, from his Scottish grandmother, from his Jersey-American grandfather and from his remoter French ancestry Thoreau inherited, distinctively, the least laboring man, a man; above and over and above, the "hauntings of Celtism" were prevalent and potent. The stock of the Thoreaus was a robust one; and in Concord the family, though never wealthy nor officially influential, was ever held in peculiar respect. As a boy, Henry threw his mother's cow to the pastures, and thus early became enamoured of certain aspects of nature and of certain delights of solitude. At school and at Harvard University he in no wise distinguished himself, though he was an intelligent receptive student; he became, however, proficient enough in Greek, Latin, and the more general academic science to enable him to add to a fundamental stock of knowledge. But long before he had become apprenticed to the learning of nature in preference to that of man: when only twelve years of age he had made collections for Agassiz, who had then just arrived in America, and already the meadows and the hedges and the stream-sides had become cabinets of rare knowledge to him. On the desertion of schoolmastering as a profession, Thoreau became a lecturer and author, though it was the labour of his hands which mainly supported him through many years of his life: professionally he was a surveyor. In the effort to reduce the practice of economy to a fine art he arrived at the conclusion that a man must live in Nature as Nature lives, and that the positive demands of necessity, the better for him and for the community at large; he would have had the order of the week reversed—six days of rest for one of labour. It was in 1845 he made the now famous experiment of Walden. Desirous of proving to himself and others that man could be as independent of this kind as the nest-building bird, Thoreau retired to a hut of his own construction on the pine-slope over against the shores of Walden Pond—a hut which he built, furnished and kept in order entirely by the labour of his own hands. During the ten years of his May 1845 to October 1846, Thoreau recorded the exercise of a little surveying, a little job-work and the tillage of a few acres of ground which produced him his beans and potatoes. His absolute independence was as little gained as if he had camped out in Hyde Park; relatively he lived the life of a recluse. He read considerably, wrote abundantly, thought actively if not widely, and came to know beasts, birds and fishes with an intimacy more extraordinary than was the case with St Francis of Assisi. Birds came at his call, and forgot their hereditary fear of man; beasts lipped and caressed him; the very fish in lake and stream would glide, unforear, between his hands. This exquisite familiarity with bird and beast would make us love the memory of Thoreau if his egotism were triply as arrogant, if his often meaningless paradoxes were even more absurd, if his sympathies were even less humanitarian than we know them to have been. His Walden, the record of this fascinating two years' experience, must always remain a production of great interest and considerable psychological value. Some years before Thoreau took to Walden woods he made the chief of his life's work, that with Emerson. He became one of the famous coterie of the transcendentalists, always keenly preserving his own individuality amongst such more or less potent natures as Emerson, Hawthorne and Margaret Fuller. From Emerson he gained more than from any man, alive or dead; and, though the older philosopher both enjoyed and learned from the association with the younger, it cannot be said that the gain was equal. There was nothing electrical in Thoreau's intercourse with his fellow men; he gave off no spiritual sparks. He absorbed intensely, but when called upon to illuminate in turn was found wanting. It is with a sense of relief that we read of his having really been stirred into active enthusiasm and the wrongs done the ill-fated John Brown. With children he was affectionate and gentle, with old people and strangers considerate. In a word, he loved his kind as animals, but did not seem to find them as interesting as those furred and feathered. In 1847 Thoreau left Walden Lake abruptly, and for a time occupied himself with lead-pencil making, the parental trade. He never married, thus further fulfilling his policy of what one of his essayist-biographers has termed "indulgence in fine renoncements." At the comparatively early age of forty-five he died, on the 6th of May 1862. His grave is in the Sleepy Hollow cemetery at Concord, beside those of Hawthorne and Emerson.

Thoreau's fame will rest on Walden; or, Life in the Woods (Boston, 1854) and The Excursions (Boston, 1863), though he wrote nothing which was not deserving of notice. Up till his thirtieth year he dabbled in verse, but he had little ear for metrical music, and he lacked the spiritual impulsiveness of the true poet. His weakness as a philosopher is his tendency to base the laws of the universe on the experience-born, thought-produced conceptions of one man—himself. His weakness as a writer is the too frequent striving after and praise of personal genius without the itch of appearing original, he would have made his fascination irresistible. As it is, Thoreau holds a unique place. He was a naturalist, but absolutely devoid of the pedantry of science; a keen observer, but no retailer of disjointed facts. He thus holds sway over two domains: he had the adherence of the lovers of fact and of the children of fancy. He must always be read, whether lovingly or interestingly, for he has all the variable charm, the strange saturninity, the contradictions, austerities and delightful surprises, of Nature herself.

After Thoreau's death were also published: The Maine Woods (Boston, 1863); Cape Cod (Boston, 1865); A Yankee in Canada (Boston, 1866). In the Atlantic Monthly, in 1862 appeared "Walking", "Autumn Tints" and "Wild Apples"; in 1863, "Night and
Moonlight." The standard editions of his works are The Writings of David Thoreau, Riverside edition (11 vols, Boston, 1894-1895), and Manuscript edition (12 vols, ibid, 1907).

See also W. E. Channing, Thoreau: The Poet Naturalist (Boston, 1873); R. W. Emerson, an introductory note to Excursions (Boston, 1866); F. B. Sanborn, Henry David Thoreau (Boston, 1886), in the "American Men of Letters Series"; H. S. Walt, Life of Henry David Thoreau (London, 1890); Some Unpublished Letters of H. D. and Sophia L. Thoreau, 1842-1860 (J. Russell Smith, My Study Windows; R. L. Stevenson, Familiar Studies in Men and Books; and F. H. Allen, Bibliography of H. D. Thoreau (Boston, 1908).

THORFINN KARLSEFNI, or Karlsefni (fl. 1002-1007), Scandinavian explorer, leader of the chief medieval expedition for American colonization. Thorfinn belonged to a leading Icelandic family and had great success in trading voyages. In 1001 he set sail for Greenland, married Godric, widow of Red Eric's son Thorstein, and put himself at the head of a great expedition now undertaken from Eriksfjord for the further exploration and settlement of the western Vinland (south Nova Scotia?) lately discovered by Leif Ericsson (Q. V.). Three vessels took part in the venture, with 160 men and some women, including Godrid, and Freydís, a natural daughter of Red Eric. They first sailed north-west to the Vesteryrd or "Western Settlement" of Greenland, thence to Bear Island, and thence away to the south till they reached a country they named Helluland (some part of Labrador?) from its great flat slabs of stone, and thence to a thick-wooded land they called Markland (i.e., Woodland, our Newfoundland). Two days after this they sighted land to the right hand, and came to a cape, where they found the keel of a ship—perhaps a relic of some earlier, possibly Scandinavian explorer—and which they called therefore Kialames (Keelness; Cape Breton, or some adjacent point?); the long bleak sandy shores of this coast they called the Wonderstrands (on the east coast of Cape Breton Island?). After passing the Wonderstrands and reaching a coast indented with bays, Thorfinn put in to another island, which he named Færey Islands; Spanish explorers called it Flatey. They explored southwards (see Leif Ericsson), but they returned with grapes and wild wheat, proofs that the Northmen were not far from Vinland. The fleet now stood in to a bay called by the explorers Strömford or Firth of Currents, and wintered there (1003-1004), suffering some privations, and apparently getting no more news of the fruitful country desired. Thorfinn's son Snorri was born this first autumn in the new world. Next spring nine of the party, headed by the chief malcontent Thorhall, Red Eric's huntsman, sailed off southward, intending to come to Vinland by rounding Keelness and thence working round west and north. Adverse winds drove them southward, and somewhere out, but they were enslaved. Meanwhile Thorfinn, with the rest of the venturers, sailed south "for a long time," till they reached a spot they called Hop, at the mouth of a river which flows from a lake into the sea (several estuaries near the southern extremity of Nova Scotia would do equally well here). Here they found the "self-sown" wheatfields and vines of Leif's Vinland, and here accordingly they settled and built their huts above the lake (1004-1005). After a fortnight's swarthy, swarthy and ill-looking, with ugly hair, great eyes and broad cheeks (Beothuk or Micmac Indians?) appeared with many skin canoes; they spring boarding the sailings came back and harried with their visitors. Terrified by a bull belonging to the latter they fled, and after three weeks returned to rest. They were beaten off, but the Northmen narrowly escaped destruction, and two of their number (one a leading settler) were slain. The colony at Hop was therefore abandoned and the whole force returned to Strömford. Thence Thorfinn revisited Hop, staying two months; and also made a voyage northward in search of Thorhall, rounding Keelness and sailing westward (along the north coast of Cape Breton Island?), and apparently southward also, till they came to the mouth of a river flowing from east to west. There Thorhall Ericsson was killed by a (Skraeling?) arrow, and the expedition came back to Strömford where they passed the next winter (1005-1006). Internal dissensions now broke out, mainly about the women of the colony, and in the next summer (1006) the entire project of Vinland settlement was abandoned and the fleet sailed to Markland. Two Skraeling children were captured here and the expedition divided, Thorfinn making Greenland and Ericsson in safety with his own vessel, while the other was lost in the Irish Sea, only half the crew escaping to Ireland in the ship's boat.

It may be noticed that the Flatey Book narrative gives a somewhat different but more slighter account of Thorfinn's expedition, making both Thorvald Ericsson and Freydís undertake separate Vinland ventures—one before, the other after, Karlsfni's enterprise—Thorvald being killed on his (as in Red Eric Saga, but with divergent details), and Freydís on her committing atrocities upon her comrades, the Icelanders Helgi and Finnogi, which are unnoticed in Red Eric. The latter, however, in its main value as the domestic story of which it was woven over the women of the colony in its third winter, points to something which may have been the germ of the highly elaborated Freydís story in Flatey.

On Flatey Book, Red Eric Saga and the whole bibliography for the Vinland voyages, including that of Thorfinn, see Leif Ericsson and Vinland. The six Vinland voyages of Flatey, we may repeat, Red Eric reduces to three, wholly omitting the alleged voyage of Birnir Herjulfsson, and grouping those of Thorvald Ericsson and Freydís with Thorfinn Karlsfni's in one great colonizing venture.

THORIANITE, a rare mineral, discovered by W. D. Holland, and found in the gem-gravels of Ceylon, where it occurs as small, heavy, black, cubic crystals, usually much water-worn. It was so named by W. R. Dunstan, on account of its high percentage of thorium (about 70% ThO₂). It also contains the oxides of uranium, lanthanum, cerium, and didymium. Helium is present, and the mineral is slightly less radio-active than pitchblende. It has been examined for new elements. Miss Evans (Journ. Chem. Soc., 1908, p. 666) obtained what is possibly a new element, whilst M. Ogawa (Journ. Coll. Sci. Tokyo, 1908, vol. 25) found indications of three new species: one which he named Thorocury, another Thoroide, and a third Thorosar.(16) It is a dark green to blue with atomic weight 100; the second with an equivalent of about 16-7; whilst the third yielded a radio-active oxide.

THORITE, a rare mineral consisting of thorium-silicate, crystallizing in the tetragonal system and isomorphous with zircon. The theoretical formula, ThSiO₄, requires 81-5% of thorium, but analyses show only 50-70%, there being also some uranium, cerium, &c. The mineral is almost always altered by hydration and is then optically isotropic and amorphous. Owing to differences in composition and to alteration, the specific gravity varies from 4.4 to 5.4. The colour is usually yellowish or orange, but in the variety known as "orangeite" it is orange-yellow. The mineral occurs as isolated crystals and small masses in the augite-syenite near Brevik in South Norway; also at Arendal, and in the gem-gravels of Ceylon. If found in larger amount it would be an important source of thorium for incandescent gas mantles.

(16) L. J. S.

THORIUM (symbol Th, atomic weight 232.42 [O=16]), a metallic chemical element. It belongs to the group of metals whose oxides are generally denominated "rare earths," and its history is bound up in the history of the group, which is especially interesting from the fact that their utilization for the manufacture of the mantles used in incandescent gas-lighting, and also that the radio-active substances are almost invariably associated with these oxides. The name thoria (after the Scandinavian god Thor) was first given in 1815 by Berzelius to a supposed new earth which he had extracted from several rare Swedish minerals. This "new earth" turned out to be nothing more nor less than a basis yttrium phosphate. In 1828 he gave the name thorite to an earth which he extracted from a mineral found at Lérön. This mineral is the modern thorite. Thorium has proved to be very widely, although extremely sparingly, distributed: pyrochlore, orangeite, monazite, euxenite, gadolinite, orthite, and in fact most of the rare minerals of this type contain it (see B. Szilard, Le Radium, 1909, 6, p. 233). The extraction of thorium salts from these minerals is a matter of much difficulty. Metallic thorium is obtained by
heating potassium thorium chloride or the tetrachloride with sodium.
(see W. von Bolton, R. J. Meyer and H. Karstens, Journ. Chem. Soc. 309, vol. 96). It forms microscopica hexagonal plates having a greenish-white streak. It is very heavy, its density being about 11; it inflames when heated in air and is not attacked by alkalis; readily dissolves in nitric acid and aqua regia, but with difficulty in hydrochloric acid.

In its salts, thorium is tetravalent, and in the periodical classification it occurs in the same sub-group as titanium, cerium and zirconium.

Thorium dioxide or thoria, ThO₂, is the most important compound, being manufactured commercially in comparatively large quantities from thorium oxide (see LIGHTING, GAS). It is an amorphous white powder; but it may also be obtained in crystals isomorphous with cassiterite by heating the ore in a vacuum, or with borax to a very high temperature. An oxide ThO₂ is formed by heating the dioxide.

Thorium fluoride, ThF₄, is obtained as a heavy white insoluble powder by dissolving the hydrate in hydrofluoric acid and evaporating, or precipitating a thorium salt with a fluoride, a gaseous fluoride, ThF₄·4H₂O, is obtained. Acid potassium fluoride precipitates K₂ThF₄·4ThF₄·H₂O from a solution of thorium chloride. Potassium thorofluoride, K₂ThF₄·4H₂O, is a heavy black powder formed by boiling the hydroxide with potassium fluoride and hydrofluoric acid. Thorium chloride, ThCl₄, is obtained as white shining crystals by heating a mixture of carbon and thorium in a current of oxygen at about 1400°. Thiocarbonyl fluoride, ThO₂·2C₃O₂, is not a compound, but a mixture of ordinary compounds, having an atomic weight of 255.6. E. Chauvenet (Compt. rend., 1908, 147, p. 1046) obtains it by heating thorium in a current of carbonyl chloride. Thorium chloride readily dissolves on exposure and forms double salts with alkaline chlorides.

Thorium sulphate, Th₂(SO₄)₄·9H₂O, is obtained by dissolving the oxide in sulphuric acid. It forms several crystalline hydrates. Evaporation of the solutions at ordinary temperatures gives colourless needles or crystals prisms of Th₂(SO₄)₄·9H₂O, which is isomorphous with uranium sulphate, U₂(SO₄)₃·9H₂O. Above 45°, Th₂(SO₄)₄·4H₂O is deposited. B. Ruzoeboom (Zest. phys. Chem., 1890, 5, p. 198) has described several hydrates of thorium sulphate from the alkali sulphates. Thorium nitrate, Th(NO₃)₄·12H₂O, forms white deliquescent tables very soluble in water. It forms double salts such as Mg₂[Th(NO₃)₄·8H₂O], which are isomorphous with the corresponding cerium compounds. Thorium sulphide, Th₂S₄, is obtained by burning the metal in sulphur. It cannot be produced by precipitation.

The atomic weight has been variously given. Berzelius found 235.5; Delafontaine, 229; Cleve, 232-6 by analyses of the sulphate, and 232.2 by analyses of the oxalate. Kruss and Nilson derived the value 230.7 (H.1) from analyses of the carefully purified sulphate.

For the so-called "disintegration of the thorium atom" and the relation of this element to the general subject of radio-active compounds of the alkali metals, see 4.

A number of salts of thorium have been prepared for therapeutic use, including the hydroxide, nitrate, salicylate, oleate and lactate. The oleate has been used in chronic eczema and psoriasis and locally in cancer. Inhalations of thorium oxinates produced from thorium nitrate through a wash-bottle inhaler are said to have a bactericidal action in diseases of the lungs. F. Soddy has used it in phthisis, and Louis Cheyney speaks favourably of the emansions in chronic and acute laryngitis and in tuberculous laryngeal ulcerations.

THORN (Polish Torun), a fortress town of Germany, in the Prussian province of West Prussia, situated on the right bank of the Vistula, near the point where the river enters Prussian territory, 83 m. by rail N.E. of Posen, 92 m. S. of Danzig and 12 m. from the Russian frontier at Alexandrovo. Pop. (1895), 30,314; (1906), 43,435. Its position as a bridge head commanding the passage of the Vistula makes it a point of strategic importance; it was strongly fortified in 1815, and in 1878 was converted into a fortress of the first class. The defensive works consist of a circle of outlying forts, about 25 m. from the centre of the town, the west being on the right and five on the left bank of the river. The "Wasserburg," or new town, was first very long ago to thirty-three years later, were united in 1454, and both retain a number of quaint buildings dating from the 17th and 16th centuries, when Thorn was a flourishing member of the Hanseatic League. The town-hall of the 14th and 16th centuries, the churches of St John of the Virgin, and of St James (all of the 13th-14th centuries), the ruined castle of the Teutonic order (a tower, the so-called "Danksor"), and a leaning tower, the sole remnant of the old environing walls, are among the most interesting of the ancient edifices. Among modern buildings may be mentioned the Artushof, containing concert and assembly halls, the newarrison church (1897), and the new concert hall erected in 1853 to Copernicus, who was a native of Thorn. The ancient wooden bridge, now burned down, at one time the only permanent bridge across the lower Vistula, has been succeeded by a massive railway viaduct, 3300 ft. long. Thorn carries on an active trade in grain, timber, wine, groceries and minerals, and has ironworks, saw-mills, and various other manufactures. It is famous for its Pfefferkuchen, a kind of gingerbread. Part of the trade is carried on by passenger and cargo vessels on the Vistula, which ship small quantities of flour and other provisions.

Thorn, founded in 1231 by the Teutonic order as an outpost against the Poles, was colonized mainly from Westphalia. The first peace of Thorn, between the order and the Poles, was concluded in 1411. In 1454 the townspeople revolted from the knights of the order, destroyed their castle, and attached themselves to the king of Poland. This resulted in a war, which was terminated in 1466 by the second peace of Thorn. In the 15th and 16th centuries Thorn was a Hanse town of importance, and received the titles of "Queen of the Vistula" and "the" Thorn. It opposed the Reformation in 1557, and in 1645 it was the scene of the famous "Torsdags" colloquium betwixt the doctors of the rival creeds, which, however, resulted in no agreement. In 1724 a riot between the Protestant and Roman Catholic inhabitants was seized upon by the Polish king as a pretext for beheading the burgomaster and nine other leading Protestant citizens, an act of oppression which is known as the "blood-bath of Thorn." The second partition of Poland (1793) conferred Thorn upon Prussia; by the treaty of Tilsit it was assigned to the duchy of Warsaw; but since the Congress of Vienna (1815) it has again been Prussian.

Wernicke, Geschichte Thorns (Thorn, 1839-1842); Hoburg, Die Belagerungen der Stadt und Festung Thorn (Thorn, 1860); and the Steinbrecht, Die Baukunst des deutschen Ritterordens in Preussen (1st part, Berlin, 1884); Uebrecht, Thorn (Danzig, 1903).

THORN (O. Eng. Jorn, cf. Du. doorn, Ger. Dorn, &c), in botany, a hard pointed structure, also termed a "spine," generally representing a small branch, as in hawthorn, where a normal branch arising in the axil of a leaf is replaced by a sharply pointed thorn; accessory buds on each side of the thumb and developed in the same leaf-axil will grow in the next season into ordinary leaves. The similarly developed thorns or "honey-locust" (Gleditschia) are branched. In other cases, as the syc or the wild pear, branches become spiny at the apex tapering into a stiff leafless point. On a cultivated tree these branches disappear owing to their more vigorous growth. Leaves may be modified into spines, as in barberry, the leaves of which show every gradation between a leaf with a spiny-toothed edge and those which have been reduced to simple or multiple spines. In some species of Astragalus the petiole of the pinnately compound leaf persists after the fall of the leaflets as a sharp spine. In the false acacia (Robinia) the stipules are represented by spines.

The reduction of the leaf-surface, of which the spiny habit is often an expression, is associated with growth in dry or exposed windy places. Thus, in the gorse, a characteristic plant of exposed localities such as open commons, the smaller branches, instead of being leaf-bearing shoots, are reduced to slender green spines, while the leaves on the main shoots are also more or less spiny in character. As the giving off of water from its surface is one of the chief functions of a leaf, this process is thus reduced to a minimum in such a leaf. This liability to be given off too rapidly. An extreme case is afforded by the cacti and cactus-like euphorbias, which are a characteristic type of desert vegetation where water is extremely scarce. The whole plant is reduced to a simple or branching succulent, leafless, columnar or flattened stem, the branches of which are represented by small clusters of thorns. Incidentally the
thorns protect the plant which bears them from the attacks of animals seeking food. Prickles are structures of less importance from the morphological point of view, being mere superficial outgrowths which may occur anywhere on stem or leaf, or even fruit.

**THORNABY-ON-TEES**

who within separate m. There is a church in the town of Thornaby, and it is also included in the parliamentary borough of Stockton (it is within the Cleveland division of the county), but was incorporated as a separate municipal borough in 1892. It is under a mayor, 6 aldermen and 18 councillors. Area, 1927 acres.

**THORNE**, a market town in the Doncaster parliamentary division of the West Riding of Yorkshire, 10 m. N.E. of Doncaster by the North-Eastern railway, served also by a branch of the Great Central railway. Pop. (1901), 3815. It lies near the river Don, about 4 m. from the North Sea. The river is a fishery and waste, resembling the fens of the eastern counties. Hatfield Chase, a portion of this tract south of Thorne, was partly drained by the Dutch engineer Vermuyden in the 17th century, and there were in the district numerous Dutch settlers. The Chase is generally considered to have been the scene of the battle of Heathfield in 1633, when King Edwin of Northumbria fell before the heathen King Penda of Mercia. The Levels, as this district is generally named, are of remarkable fertility, and Thorne, having water communication with Goole and the Humber, is consequently an agricultural centre of importance; while some large-building and a trade in peel fibre are also carried on. The church of St Nicholas is a fine building of various periods from the 12th century.

**THORNHILL, SIR JAMES** (1675–1734), English historical painter, was born at Melcombe Regis, Dorset, in 1676, of an ancient but impoverished county family. His father died while he was young, but he was befriended by his maternal uncle, the celebrated Dr Sydenham, and apprenticed to Thomas Highmore, sergeant-painter to King William III., a connexion of the Thornhill family. Little is known regarding his early career, except that he visited Holland, Flanders and France, and, having obtained the patronage of Queen Anne, he was in 1719–1720 appointed her sergeant-painter in succession to Highmore, and was ordered to decorate the interior of the dome of St Paul's with a series of eight designs, in chiaroscuro heightened with gold, illustrative of the life of that apostle—a commission for which Louis Laguerre had previously been selected by the commissioners for the repair of the cathedral. He also designed and decorated the saloon and hall of Moor Park, Herts, and painted the great hall at Blenheim, the princeps' apartments at Hampton Court, the hall and staircase of the South Sea Company, the chapel at Wimpole, the staircase at Easton-Neston, Northamptonshire, and the hall at Greenwich Hospital, usually considered his most important and successful work, upon which he was engaged from 1708 to 1727. Among his easel pictures are the altar-pieces of All Souls and Queen's College chapels, Oxford, and that in Melcombe Regis church; and he executed such portrait subjects as that of Sir Isaac Newton, in Trinity College, Cambridge, and the picture of the House of Commons in 1739, in the possession of the earl of Hardwicke, in which he was assisted by Hogarth, who married Jane, his only daughter. He also produced a few etchings in a slight and sketchy but effective manner, and executed careful full-size copies of Raphael's cartoons, which now belong to the Royal Academy. About 1724 he drew up a proposal for the establishment of a royal academy of the arts, and his scheme had the support of the lord treasurer Halifax, but government declined to furnish the needful funds. Thornhill then opened a drawing-school in his own house in James Street, Covent Garden, where instruction continued to be given till the time of his death. He acquired a considerable fortune by his art, and was enabled to repurchase his family estate of Thornhill, Dorsetshire. In 1715 he was knighted by George I., and in 1710 he represented Melcombe Regis in parliament, a borough for which Sir Christopher Wren had previously been member. Having been removed from his office by some court intrigue, and suffering from broken health and repeated attacks of gout, he retired to his country seat, where he died on the 4th of May 1734. His son James, also an artist, succeeded his father as sergeant-painter to George II. and was appointed "painter to the navy."

The high contemporary estimate of Sir James Thornhill's works has not since been confirmed; in the time of Dr Young, "late times do not understand how Raphael's pencil lives in Thornhill's hands." He is weak in drawing—indeed, when dealing with complicated figures he was assisted by Thomas Gibson; and, ignorant of the great monumental art of Italy, he formed himself upon the lower model of Le Brun.

**THORNHILL**, an urban district in the Morley parliamentary division of the West Riding of Yorkshire, England, 2 m. S. of Dewsbury, on the Great Northern, Lancashire & Yorkshire, and London & North Western railways. The church of St Michael has a modern nave, but the chancel with aisles are of good Decorated work, and the tower is Perpendicular. There are interesting monuments of the ancient family of Savile, the site of whose mansion, Thornhill Hall, may be traced near the church. The east window of the church contains fine fragments of stained glass of the 15th century. The large industrial population is employed in the woolen mills and manufactures of shoddy, carpets, &c., which are numerous in this locality.

**THORNBURGH**, a village of the parish of Morton, Nithsdale, Dumfriesshire, Scotland, 14 m. N.N.W. of Dumfries by the Glasgow & South-Western railway. Pop. (1901), 1132. It is beautifully situated in the midst of tree-clad hills and watered by the bountiful Nith and such streams as the Carron, Cample and Crichtoche. Morton parish church lies in the village, and among other buildings are the library and the natural history museum, in the grounds of which there is a statue of Richard Cameron, the covenanter (1686). The weekly sales of livestock are important, and an agricultural show is held every September. Three miles N.N.W. stands Closeburn Castle, a seat of the duke of Buccleuch, a vast edifice of red sandstone in the form of a hollow square, and has 145 ft. of outer walls, which are surmounted with turrets, and capped and spired at the angles. The castle was begun in 1679 and finished in 1689, and cost the first duke of Queensberry an immense sum. He is believed to have spent but a single night under its roof. The fourth duke of Queensberry, Old "Q.," incurred the wrath of Robert Burns and Wordsworth by his wanton destruction of the magnificent woods. On the death of "Old Q." without issue in 1810, Henry, third duke of Buccleuch, succeeded to the dukedom of Queensberry, and the property has since been adequately cared for. Trees, planted on the most extensive scale, have been laid out with exquisite taste; and the vast policy, intersected by the Nith, is one of the finest parks in Scotland. The ruins of Tibber's Castle, dismantled in 1311 by Robert Bruce, stand in the grounds, about 1 m. from the ducal mansion. Two miles and a half N.E. of Thornhill is found another ruined fortress, that of Morton Castle, interesting as the residence of Thomas Randolph, earl of Moray, regent during the early years of the minority of David II., and as belonging afterwards to a branch of the Douglases, who derived from it the title of earl. About 3 m. south-east of Thornhill stands the ruined castle of Closeburn, once a stronghold of the Kirkpatricks. It was Sir Roger of that ilk who helped "mak sikker" the death of John, "Red" Comyn, of Badenoch (1306). In Closeburn parish (pop. 1275) occur cairs, tumuli and a stone circle, besides Roman and prehistoric remains. Two mineral wells give the place the
THORPE, the divided 1873. in Durban) 1798, (Westminster). "It is a great February 1850, (at 1886); a group statues following He from conventional the fountain in favour of a graduated system, and indeed paid his own income tax "on the scale of his ideal, not his legal debt." He was one of the founders of the Sierra Leone Company (see SIERRA LEONE) and its chairman until the colony was taken over by the English government.

THORNTON, THOMAS (1813-1880), English economist, was born at Burnham, Buckinghamshire, on the 14th of February 1813. In 1836 he obtained a clerkship in the London house of the East India Company. In 1838 he became a member of the staff towards the realization of the India Office, which he held till his death. He was created a C.B. in 1873. His works include Over-population and its Remedy (1846), in which he put forward a plan for colonizing Irish wastes by Irish peasants; A Plea for Peasant Proprietors (1848), in which his views were developed in greater detail; On Labour (1860); and Old-fashioned Ethics and Commonsense Metaphysics, a volume of essays, published in 1873.

THORNYCROFT, WILLIAM HAMO (1839- ), British sculptor. A pupil of his father, Thomas Thornycroft, and of the Royal Academy schools, Thornycroft was called upon to assist his father in carrying out the important fountain in Park Lane, London. He accordingly returned in 1871 to England from Italy, where he was studying, and modelled the figures of Shakespeare, Fame and Clio, which were rendered in marble and in bronze. In the following year he exhibited at the Royal Academy "Professor Sharples," in marble, for the memorial in University College; and "Mordant," a relief—a form of art to which he has since devoted much attention. The Fame, already mentioned, was shown in 1873. Believing that the pendulum had overshot its swing from classicism to modernism, Thornycroft turned away from the "fleshy" school towards the Greek, while realizing the artistic necessity for modern feeling. In 1875 his "Warrior Bearing a Wounded Youth from the Field of Battle" gained the gold medal at the Royal Academy schools, and when exhibited in 1876 it divided public attention with the "Tennyson" of Woolner and "Wellington monument," sculptures of Alfred Stevens, now in St Paul's Cathedral. Then followed the dramatic "Lot's Wife," in marble (1878), and "Artemis" (1880), which for grace, elegance and purity of taste the sculptor never surpassed. He was thereupon elected a member of the Royal Academy, and more than justified his election by his "Tennyson" of the following year, a bronze figure of extraordinary distinction which, bought for the Chantrey collection, is now in the National (Tate) Gallery of British Art. It is simple and severe, classic yet instinct with life and noble in form; and in it he touched the high-water mark of his career. Turning to the ideal, in works entirely modern in motive and treatment, Hamo Thornycroft produced "The Mower" (1884) and "A Sower" (1886); the "Stanley Memorial" in the old church at Holyhead partakes of the same character. Among the sculptor's principal statues are "The Bishop of Carlisle" (1895; Carlisle Cathedral), "General Charles Gordon" (Trafalgar Square, London). "Oliver Cromwell" (Westminster), "Dean Colet" (a bronze group—early Italianate in feeling—outside St Paul's School, Hammersmith), "King Alfred" (a colossal memorial for Winchester), the "Gladstone Monument" (in the Strand, London) and "Dr Mandell Creighton, Bishop of London" (bronze, erected in St Paul's Cathedral). Mr Thornycroft's other memorials, such as the "Queen Victoria Memorial" (Karachi), the "War Memorial" (at Dunblane, and the "Armstrong Memorial" (at Newcastle), are well known, and his portraity and statuary and medallions are numerous. He was elected a full academician in 1888, and an honorary member of the Royal Academy of Munich. He was awarded a medal of honour at the Paris Exhibition, 1900. See M. H. Spielmann, British Sculpture and Sculptors of To-day (London, 1901).

THORODDSEN, JON PUR CARSON (1819-1868), Icelandic poet and novelist, was born in 1819 at Reykhol in western Iceland. He studied law at the university of Copenhagen, where he met the Danish sculptor Thoroton, with whom he later lived as a pupil. He has a coat-of-arms, a veritable portrait of Thoroton. His first novel, "Næstróðingur," which was published in 1848, was an immediate success. It was translated into German by H. Holstein, and is a charming picture of Icelandic country life. Still better is Möður og konu ("Man and Wife"), published after his death by his brother, Thoroton, in the Danish language. His other works were not published until after his death, and the best part of his work is in verse. His poems are essentially Icelandic in their character, and so true in their descriptions, that he is justly considered by most of his countrymen not only as the father of the Icelandic novel, but as the best novelist Iceland has produced. His poems, mostly satirical, are deservedly popular; he follows Jónas Hallgrímsson closely in his style, although he cannot reach him in lyrical genius. (S. BL.)

THOROTON, ROBERT (1623-1678), English antiquary, belonged to an old Nottinghamshire family, which took its name from Thoroton, near Newark. He resided mainly at another Thoroton, in the same neighbourhood, in the army, where he practised as a physician and where he lived the life of a country gentleman. He took very little part in the Civil War, although his sympathies were with the royalists, but as a magistrate he was very active in taking proceedings against the Quakers. In 1667 Thoroton, aided by a band of helpers, began to work upon his elaborate Antiquities of Nottinghamshire. This was published in London in 1677; it was dedicated to Gilbert Sheldon, archbishop of Canterbury, and was illustrated by engravings by W. Hollar.

THOROTON, ROBERT (1615-1693), British antiquary. His book Antiquities was published by John Throsby (1740-1803), who added an additional volume. In 1697 the Thoroton Society was founded in honour of the antiquarian, its object being to promote the study of the history and antiquities of Nottinghamshire. The first issues of its Transactions and several volumes of Records have been published and much valuable work has been done. A brass tablet to the memory of Thoroton has been placed in Carl Colston church. See J. T. Godfrey, Robert Thoroton, Physician and Antiquary (1890).

THORPE, BENJAMIN (1782-1879), English Anglo-Saxon scholar, was born in 1782. After studying for four years at Copenhagen University, under the Danish philologist Rasmus Christian Rask, he returned to England in 1830, and in 1832 published an English version of Cædmon's metrical paraphrase of portions of the Holy Scriptures, which at once established his reputation as an Anglo-Saxon scholar. In 1834 he published Analecta Anglo-Saxonica, which was for many years the standard textbook of Anglo-Saxon in English, but his best-known work is a Northern Mythology in three volumes (1851). His was the first complete good translation of the elder Ædda (1866). His other works include Ancient Laws and Institutes of England (1840), an English translation of the laws enacted in the Anglo-Saxon Kings; The Holy Gospels in Anglo-Saxon (1842); Codex Exoniensis (1842), a collection of Anglo-Saxon poetry with English translation; an English translation of Dr Lappenburg's History of England under the Anglo-Saxon Kings (1845); Anglo-Saxon Poems of Beowulf (1855), a translation; an edition for the "Rolls" series of the Anglo-Saxon Chronicle (1861); and Diplomatarius Anglicum oevi saxonici (1865), a collection of
early English charters. Thorpe died at Chiswick on the 10th of July 1870. The value of his work was recognized by the great to him, in 1835, of a civil list pension.

THORPE [or Thork], JOHN (b. 1530–1618), English architect. Little is known of his life, and his work is dubiously inferred, rather than accurately known, from a folio of drawings in the Soane Museum, to which Horace Walpole called attention, in 1780, in his *Anecdotes of Painting*; but how far these were his own is uncertain. He was engaged on a number of important English houses of his time, and several, such as Longleat, have been attributed to him on grounds which cannot be sustained. He was probably the designer of Kirby Hall, Northamptonshire; the Longleat House, Wiltshire; and the oriel in Lord Holland's House, Kensington; and he is said to have been engaged on Rushton Hall, Northamptonshire, and Audrey End, Essex (with Bernard Janssens).


THORWALDSEN, BERTEL (1770–1844), Danish sculptor, the son of an Icelandic who had settled in Denmark, and there carried on the trade of a wood-carver, was born in Copenhagen on the 10th of November 1770. While very young he learnt to assist his father; at the age of eleven he entered the Copenhagen school of art, and soon began to show his exceptional talents. In 1792 he won the highest prize, the travelling studentship, and in 1796 he started for Italy as a Danish man-of-war. On the 8th of March 1797 he arrived in Rome, where Canova was at the height of his popularity. Thorwaldsen’s first success was the model for a statue of Jason, which was highly praised by Canova, and he received the commission to execute it in marble from Thomas Hope, a wealthy English art-patron. From that time Thorwaldsen’s success was assured, and he did not leave Italy for twenty-three years. In 1819 he returned to Denmark, where he was commissioned to make the colossal statues of Christ and the twelve apostles which are now in the Fruenkirche in Copenhagen. These were executed after his return to Rome, and were not completed till 1838, when Thorwaldsen again returned to Denmark. He died suddenly in the Copenhagen theatre on the 24th of March 1844 and bequeathed a great part of his fortune for the building and endowment of a museum in Copenhagen, and also left to fill it all his collection of works of art and the models for all his sculpture—a very large collection, exhibited to the greatest possible advantage. Thorwaldsen is buried in the courtyard of this museum, under a bed of roses, by his own special wish.

On the whole Thorwaldsen was the most successful of all the imitators of classical sculpture, and many of his statues of pagan deities are modelled with much of the antique feeling for breadth and purity of design. His attempts at Christian sculpture, such as the tomb of Pius VII. In St Peter’s and the “Christ and Apostles” at Copenhagen, are less successful, and were not in accordance with the sculptor’s real sympathies, which were purely classic. Thorwaldsen worked sometimes with feverish eagerness; at other times he was idle for many months together. A great number of his best works exist in private collections—especially in England. His not very successful statue of Lord Byron, after being refused a place in Westminster Abbey, was finally deposited in the library of Trinity College, Cambridge. The most widely popular among Thorwaldsen’s works have been some of his bas-reliefs, such as the “Night” and the “Morning,” which he is said to have modelled in one day.

See Eugène Fion, *Thorwaldsen, sa vie, etc.* (Paris, 1868); Andersen, B.: *Thorvaldsen* (Kopenhagen, 1893); Köster, *Der Kupferstich Thorwaldsen’s Abendland* (Copenhagen, 1892); Thiele, “Thorwaldsen’s Leben” (Leipzig, 1852–1856); C. A. Rosenberg, *Thorwaldsen . . . mit 146 Abbildungen* (1869); Künstlermonographien, No. 16; S. Trier, *Thorvaldsen* (1905); A. Wilde, *Erinnerungen an Jerichaos og Thorvaldsen* (1884).

THOTH, the Greek name of the Egyptian god of letters, invention and wisdom (i.e. Thot, Zéthu), the mouthpiece and recorder of the gods, and arbiter of their disputes. Thoth is found on the earliest monuments symbolized by an ibis (Ibis aethiopica, still not uncommon in Nubia), which bird was sacred to him. In the Pyramid texts Thoth is already closely associated with the Osiris myth, having aided the god by his science and knowledge of magic, and demonstrated the justice of his claims in the contest with Set. Thoth presided over writing, measuring and calculation, and is prominent in the scene of the weighing of the soul. He was often identified with the moon as a divider of time, and in this connexion, during the New Empire, the ape first appears as his sacred animal.

Thoth was identified by the Greeks with Hermes, and Hermes Trismegistus (q.v.) is a late development of the Egyptian god. Geographically the worship of Thoth in Lower Egypt centred in [the Hermopolite nome, contiguous to the Busiris and Meïdenian nomes. There is the district, anciently called Zebat, in which his name Zebet was simply “the God of Zebat.” In the ancient Egyptian Thames or Napata, the new capital, and in Hermopolis Magna in Upper Egypt, now Eshmunain, was a city of greater political importance than Hermopolis in Lower Egypt. See E. A. W. Budge, *The Gods of the Egyptians*; and especially *Egypt: Ancient*, § Religion. (F. L. L. G.)

THOU, JACQUES AUGUSTE DE [THOUANUS] (1553–1617), French historian, was the grandson of Augustin de Thou, president of the parlement of Paris (d. 1594), younger son of Christophe de Thou, “first president” of the same parlement, who began to collect a number of books and notes for a history of France which he was never to write (d. 1582), and nephew of Nicolas de Thou, who was bishop of Chartres (1563–1598). In these family surroundings he imbibed a love of letters, a firm and orthodox, though enlightened and tolerant, piety, and an attachment to the traditional power of the Crown. At the age of seventeen he began his studies in law, first at Orleans, later at Bourges, where he made the acquaintance of Hotman, and finally at Valence, where he had Cujas for his master and Scaliger as a friend. He was at first intended for the Church; he received the minor orders, and on the appointment of his uncle Nicolas to the episcopate succeeded him as a canon of Notre-Dame. But his tastes led him in a different direction; not content with a knowledge of books, he wished to know the world and men. During a period of ten years he seized every opportunity for profitable travel. In 1573 he accompanied Paul de Foix on an embassy, which enabled him to visit most of the Italian courts; he formed a friendship with Arnaud d’Ossat (afterwards bishop of Rennes and Bayeux and cardinal, d. 1604), who was secretary to the ambassador. In the following year he formed part of the brilliant cortège which brought King Henry III. back to France, after his flight from his Polish kingdom. He also visited several parts of France, and at Bordeaux met Mme. de Setie. On the death, however, of his elder brother Jean (April 5, 1579), who was *maître des requêtes* to the parlement, his relations prevailed on him to leave the Church, and he entered the parlement and married (1588). In the same year he was appointed conseiller d’état. He served faithfully both the effeminate, bigoted and cruel Henry III. and Henry IV., a sceptic and given to love-intrigues, because they were both the representatives of legitimate authority. He succeeded his uncle Augustin as président à mortier (1595), and used his new authority in the interests of religious peace, negotiating, on the one hand, the Edict of Nantes with the Protestants, while in the name of the principals of the Gallican Church he headed the revolution of the Council of Trent. This attitude exposed him to the animosity of the League party and of the Holy See, and to their persecution when the first edition of his history appeared. This history was the work of his whole life. In a letter of the 31st of March 1611 addressed to the president Jeannin, he himself describes his long labours in preparation of it. His materials for writing it were drawn from his rich library, which he established in the Rue des Poitevins in the year 1587, with the two brothers, Pierre and Jacques Dupuy, as librarians. His object was to produce a purely scientific and unbiassed work, and for this reason he wrote it in Latin, giving it as title *Historia sui temporis*. The first 18 books, embracing the period from 1545–1560, appeared in 1604 (1 vol. folio), and the work was at once attacked by those whom the author himself calls les envieux et les furieux. The second part, dealing with the first wars of religion (1560–1572), was put on the Index librorum prohibitorum
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(1657). The third part (up to 1574), and the fourth (up to 1584), which appeared in 1607 and 1608, caused a similar outcry, in spite of the author’s efforts to remain just and impartial. He carried his scruples to the point of forbidding any translation of his book into French, because in the process there might, to use his own words, “be committed great faults and errors against the intention of the author”; this, however, did not prevent the Jesuit Father Machault from accusing him of being “a false Catholic, and worse than an open heretic” (1614); de Thou, we may say, was a member of the third order of St. Francis. As an answer to his detractors, he wrote his Mémoires, which are a useful compilation of the whole history of France up to the death of Henry IV. de Thou met with another disappointment; the queen-regent refused him the position of first president of the parlement, appointing him instead as a member of the Conseil des finances intended to take the place of Sully. This was to him a distinct downfall; he continued, however, to serve under Marie de Medici, and took part in the negotiations of the treaties concluded at Ste Menehoule (1614) and Loudun (1616). He died at Paris on the 7th of May 1617.

Three years after the death of de Thou, Pierre Du Ryer and Nicolas Rigaud, published (1619) a French translation of the second part of the Historia sui temporis, comprising 138 books; they appended to it the Mémoires, also given in Latin (1620). A hundred years later, an Englishman, Samuel Buckley, published a critical and emended version of the third part of the work, in which he ignored the dédication (i.e., the preface) of Thuanus, and, under the pseudonym of Carte, gave a new and enlarged edition of the Mémoires, also in Latin (1620). De Thou was treated as a classic, an honour which he deserved. His history is a model of exact research, drawn from the rich and abundant sources at his command, and it is not great, unfortunately, even for the men of the Renaissance, Latin was a dead language; it was impossible for de Thou, however, to find exact equivalents for technical terms of geography or of administration. As the reason which led de Thou to forbid the translation of his monumental history disappeared with his death, there soon arose a desire to make it accessible to a wider public. It was translated first into German. A Protestant pastor, G. K. L. von Linstow, who had already translated Hittorff’s translation into French, but could not find a publisher. The first translation printed was that of Pierre Du Ryer (1657), but it is mediocre and incomplete. In the following century the abbé Prévost, who was a conscientious collaborator with the Benedictines of Saint-Maur before he became the author of the more profane work Manon Lescaut, was in treaty with a Dutch publisher for a translation which was to consist of ten volumes; only the first volume appeared (1733). But competition, perhaps of an unfair character, sprung up. A group of translators, who had the good fortune of being able to avail themselves of Buckley’s fine edition, succeeded in bringing out a work which was six times that of the first (De Thou, Histoire universelle, Fr. trans. by Le Beau, Le Mascrifer, the Abbé Des Fontaines, 1734). As to the Mémoires themselves, they had been translated as early as 1620, and in this form they have been reprinted in the collections of Petitot, Michaud and Buchon. To de Thou we owe certain other works: a treatise De re accipitoria (1784), a Life, in Latin, of Pamphili, the last of the Popes sacrae.

For his life may be consulted the recollections of him collected by the brothers Dupey (Thoua, vie Excepria J. A. Thouani per f. F. P., 1665; reprinted in the edition of 1735), and the biographies by J. A. Collinson (The Life of Thuanus, 1807), and Dunstan (De Thou’s Leben, 1837). Finally, see Henry Harriese, Le Président de Thou et ses descendants, leur célèbre bibliothèque, leurs armoiries et la traduction française de J. A. Thouani Historiarum sui Temporis (1905).

THOUARS, a town of western France, in the department of Deux-Sévres, on the right bank of the Thouet, 24 m. S. by W. of Saumur on the railway to Bordeaux. Pop. (1906), 5321. A massive stronghold built in the first half of the 17th century by the La Trémoïlle family, and now used as a prison, stands on a rocky eminence overlooking the river, towards which it has a frontage of nearly 400 ft. The adjoining Sainte-Chapelle dating from the early years of the 16th century is in the Gothic style with Renaissance details, and was built by Gabrielle de Bourbon, wife of Louis II. of La Trémoïlle. The church of St. Médard, rebuilt in the 15th century, preserves a doorway of the 12th, and a capital of the church of St. Laurens (14th and 15th centuries) was formerly attached to an abbey, the buildings (17th century) of which serve as town-hall. It has a fine square tower in the Romanesque style and contains the sculptured tomb of the abbot Nicholas. Remains of the ramparts of the town dating from the 13th century and flanked by huge towers are still to be seen, and a bridge of the same period crosses the Thouet. The manufacture of furniture and wooden shoes, and the preparation of veterinary medicine and lime, are carried on. Wine, livestock and agricultural produce are the chief articles of trade.

Thouars, which probably existed in the Gallo-Roman period, became in the 9th century the seat of powerful viscounts, who in later times were zealous supporters of the English. In 1372 the latter were expelled from the town by Bertrand de Guesclin. In 1363 Charles IX. created Louis III., the head of the family of La Trémoïlle, duke of Thouars. In 1793 the Vendeans took the town from the royalists.

THOURET, JACQUES GUILLAUME (1746-1794), French revolutionary, was born at Pont J’Evêque. He was the son of a notaire, and became an avocat at the parlement of Rouen. In 1789 he was elected deputy to the states-general by the third estate of Rouen, and in the Constituent Assembly his eloquence gained him great influence. Like so many lawyers of his time, he was violently opposed to the clergy, and strongly supported the secularization of church property. He also obtained the suppression of the religious orders and all ecclesiastical feudal rights, and contributed to the change of the judicial and administrative systems. He was one of the promoters of the decree of 1790 by which France was divided into departments, and was four times president of the Constituent Assembly. After its dissolution he became president of the court of cassation. He was included in the proscription of the Girondists, whose political opinions he shared, and was executed in Paris. Besides his speeches and reports he wrote an Abrégé des révolutions de l’ancien gouvernement français and Tableau chronologique de l’histoire ancienne et moderne.

His brother, MICHÉL AUGUSTIN THOURET (1748-1810), a pupil of d’Alembert, was a keen advocate of the ideas of Mesmer and a promoter of vaccination in France.


THOUSAND AND ONE NIGHTS. The Thousand and One Nights, commonly known in English as The Arabian-Nights’ Entertainments, is a collection of tales written in Arabic, which first became generally known in Europe in the early part of the 18th century through the French translation by Antoine Galland, and rapidly attained universal popularity. In the Journal asiatique for 1827, p. 273, von Hammer (J. von Hammer-Purgstall) drew attention to a passage in the Golden Meadows of Mas’ud’i (ed. Barbier de Meynard, iv. 89 seq.), written in A.D. 943, in which certain stories current among the old Arabs are compared with “the books which have reached us in translations from Persian, Indian and Greek, such as the book of Hēdr Afṣafnī, a title which, translated from Persian into Arabic, means ‘the thousand tales.’ This book is popularly called The Thousand and One Nights, and contains the story of the king and his vizier and of his daughter Shirazad and her slave girl Dzhāzā. Other book of the same kind are the book of Pers. and Sinās, containing stories of Indian kings and avatars of the book of Sindibād, &c.” Von Hammer concluded that the Thousand and One Nights were of Persian or Indian origin. Against this conclusion Silvestre De Sacy protested in a memoir (Mém. de l’acad. des inscr., 1833, x. 30 seq.), demonstrating that the character of the book we know is genuinely Arabian, and that it must have been written in Egypt at a comparatively recent date. Von Hammer in reply added, in Journ. as. (1839), ii. 173 seq. a passage in the Fihrist (A.D. 987), which is to the following effect—

“...the ancient Persians were the first to invent tales and make books of them, and some of their tales were put in the mouths of animals. The Ashghanians, or third dynasty of Persian kings, and after them the Sassanians, had a special part in the development of this literature, which found Arabic translators, and was taken up by accomplished Arabic litterati, who edited it and improved it. The earliest book of the kind was the Hēdr afṣafnī or Thousand Tales, which had the following origin. A certain Persian king was..."
acquiesced to kill his wives on the morning after the consummation of the marriage. But once he married a clever princess called Shahrazad, who spent the marriage night in telling a story which in the morning reached a point so interesting that the king spared her, and she was permitted to live for another night for the sequel. This went on for a thousand nights till Shahrazad had a son, and ventured to tell the king of her device. He admired her intelligence, loved her, and spared her life. In all this the princess was assisted by the king's vizier, in whose books she has been portrayed as the princess Ḥomāʾī (MSS. Ḥomāʾī), daughter of Bahman. . . . It contains nearly two hundred stories, one story often occupying several nights. I have repeatedly seen the complete book, but it is really a meagre and uninteresting production (Flügel, ed. Flügel, p. 304).

Persian tradition (in Firdousi) makes Princess Ḥomāʾī the daughter and wife of Bahman Ardāshir, i.e. Artaxerxes I. Longimanus. She is described as a great builder, a kind of Persian Semiramis, and is a half-mythical personage already mentioned in the Avesta, but her legend seems to be founded on the history of Atossa and of Parysatis. Firdousi says that she was also called Shahrazad (Mohl v. 11). This name and that of Dinaṭzād both occur in what Masʿūdī tells of her. According to him, Shahrazad was Ḥomāʾī’s mother (ii. 129), a Jewess (ii. 123). Bahman had married a Jewess (i. 118), who was instrumental in delivering her nation from captivity. In ii. 121 this Jewish mother is helped by the Jewess Dinaṭzād, and “the accounts,” says our author, “vary.” Plainly she is the Esther of Jewish story. Tabari (i. 688) calls Esther the mother of Bahman, and, like Firdousi, gives to Ḥomāʾī the name of Shahrazad. The story of Esther and that of the original Nights have in fact one main feature in common. In the former the king is offended with his wife, and divorces her; in the Arabian Nights he finds her unfaithful, and kills her. But both stories agree that thereafter a new wife was brought to him every night, and on the morrow passed into the second house of the women (Esther), or was slain (Nights). At length Esther or Shahrazad wins the king’s favours and becomes queen. The issue in the Jewish story is that Esther saves her people; in the Nights the gainers are “the daughters of the Moslems,” but the old story had, of course, some other word than “Moslems.” Esther’s foster-father becomes vizier, and Shahrazad’s father is also vizier. Shahrazad’s plan is helped forward in the Nights by Dināzād, who is, according to Masʿūdī, her slave girl, or, according to other MSS., her nurse, and, according to the Fihrist, the king’s stewardess. The last account comes nearest to Esther ii. 15, where Esther gains the favour of the king’s chamberlain, keeper of the women. It is also to be noted that Aḥasuerus is read to his queen at night when he cannot sleep (Esther vi. 1). And it is just possible that it is worth notice that, though the name of Aḥasuerus corresponds to Xerxes, Josephus identifies him with Artaxerxes I.

Now it may be taken as admitted that the book of Esther was written in Persia, or by one who had lived in Persia, and not earlier than the 3rd century B.C. If now there is real weight in the points of contact between this story and the Arabian Nights—and the points of difference cannot be held to outweigh the resemblances between the two legends, each of which is necessarily so far removed from the hypothetical form in which the inference is important for both stories. On the one hand, it appears that (at least in part) the book of Esther draws on a Persian source; on the other hand, it becomes probable that the Nights are older than the Sasanian period, to which Lane (ii. 677) refers them.

It is a piece of good fortune that Masʿūdī and the Fihrist give us the information cited above. For in general the Moslems, though very fond of stories, are ashamed to recognize them as objects of literary curiosity. In fact, the next mention of the Nights is found only after a lapse of three centuries. Maqrizi, describing the capital of Egypt, quotes from a work of Ibn Saʿd (c. A.D. 1250), who again cites an older author (Al-Kortob), who, in speaking of a love affair at the court of the caliph Al-ʿAmir (997–1130), says “what is told about it resembles the romance of Al-Bāṭṭāl, or the Thousand and One Nights” (Hitj, Būṣāṣ ed., i. 485, ii. 181).

That the Nights which we have are not the original translation of the Ḥaḍrāʾ Afṣāne is certain, for the greater part of the stories are of Arabian origin, and the whole is so thoroughly Mahommedan that even the princes of remote ages who are introduced speak and act as Moslems. It might be conceived that this is due to a gradual process of modernization by successive generations of story-tellers. But against this notion, which has been entertained by some scholars, Lane has remarked with justice that, much as MSS. of the Nights differ from one another in points of language and style, in the order of the tales, and the division into nights, they are all so much at one in essentials that they must be regarded as derived from a single original. There is no trace of a recursion of the text that can be looked on as starting new “Hāḍrāʾ Afṣāne.” Aid the whole local colour of the work, in point of dialect and also as regards the manners and customs described, clearly belongs to Egypt as it was from the 14th to the 16th century. Some points, as De Sacy and Lane have shown, forbid us to place the book earlier than the second half of the 15th century. Galland’s MS. copy, again, was in existence in 1548. Lane accordingly dates the work from the close of the 15th century or the beginning of the 16th, but this date appears to be too late. For Abūl-Maṣḥān, an Egyptian historian who died in 1470, writing of ʿḤamdi, a famous highwayman of Bagdad in the 10th century, remarks that he is probably the figure who used to be popularly spoken of as Ahmad al-Danaf (ed. Juybni l. 303). Now in the Nights Ahmad al-Danaf really plays a part corresponding to that of the historical Ḥamdi, being now a robber (Lane ii. 404) and again a captain of the guard (Lane ii. 249). It would seem that Abūl-Maṣḥān had read or heard the stories in the Nights, and was thus led to compare the historical with the fictitious character. And, if this be so, the Nights must have been composed very soon after 1450.

No doubt the Nights have borrowed much from the Ḥaḍrāʾ Afṣāne, and it is not improbable that even in the original Arabic text of the Educational work some of the Persian stories were replaced by Arab ones. But that our Nights differ very much from the Ḥaḍrāʾ Afṣāne is further manifest from the circumstance that, even of those stories in the Nights which are not Arabian in origin, some are borrowed from books mentioned by Masʿūdī as distinct from the Ḥaḍrāʾ Afṣāne. Thus the story of the king and his son and the damsel and the seven viziers (Lane, ch. xxl. note 51) is in fact a version of the Book of Sind∂āb,2 while the story of Jalīl ʿĀʾd and his son and the vizier Shammast (M. Naqrīṭen iv. 366 seq.; cf. Lane iii. 530) corresponds to the book of Sin∂āb and another of the same name.3

Not a few of the tales are unmistakably of Indian or Persian origin, and in these poetical passages are rarely inserted. In other stories the scene lies in Persia or India, and the source is foreign, but the treatment thoroughly Arabian and Mahommedan. Sometimes, indeed, traces of Indian origin are perceptible, even in stories in which ʿḤārīn al-Rashīḍ figures and the scene is Bagdad or Baṣra.4 But most of the tales, in substance and form alike, are Arabian, and so many of them have the capital of the caliphs as the scene of action that it may be guessed that the author used as one of his sources a book of tales taken from the era of Bagdad’s prosperity, when the Persian stories were translated by Arab ones.

The late date of the Nights appears from sundry anachronisms. In the story of the men transformed into fish—white, blue, yellow or red according as they were Moslems, Christians, Jews or Magians (Lane i. 99)—the first three colours are those of the

1 The hypothesis of gradual and complete modernization is also opposed to the fact that the other romances used by Cairene storytellers (such as those of Antar and of ʿSaʿīf) retain their original local colour through all variations of language and style.
2 The Soṭarj Sin∂āb, the Greek Sin∂alos, and the Seven Sages of the European West.
3 De Sacy and Lane suppose that the original title of the Arabic translation of the Ḥaḍrāʾ Afṣāne was The Thousand Nights. But MSS. of Masʿūdī already have The Thousand and One Nights, which is also the name given by Maqrizi. Both clichers perhaps mean only “a very great number,” and Fleischer (De glossis Habichtianis, p. 4) has shown that 1001 is certainly used in this sense.
4 Gildemeister, De rebus indicis, p. 89 seq.
the turbans which, in 1501, Mahommeh b. Kala'um of Egypt commanded his Moslem, Christian and Jewish subjects respectively to wear. 1 Again, in the story of the humpback, whose scene is laid in the 9th century, the talkative barber says, “this is the year 653” (= A.D. 1255; Lane, i. 332, writes 653; but see his note), and mentions the caliph Mansur (d. 1242), who is incorrectly called son of Mostad. 2 In the same story several places in Cairo are mentioned which did not exist till long after the 9th century (see Lane i. 379). 3 The very rare edition of the first 200 nights published at Calcutta in 1814 speaks of cannon, which are first mentioned in Egypt in 1383; and all editions sometimes speak of coffee, which was discovered towards the end of the 14th century; but not generally used till 200 years later. 4 One particularly interesting point is the mention of a mosque founded in 1501 (Lane iii. 608), we detect the hand of later interpolators, but the extent of such interpolations can hardly perhaps be determined even by a collation of all copies. For the nature and causes of the variations between different copies the reader may consult Lane, iii. 678, who explains how transpositions actually arise by transcribers trying to make up a complete set of the tales from several imperfect copies.

Many of the tales in the Nights have an historical basis, as Lane has shown in his notes. Other cases in point might be added: the chronicle of Ibn al-Jauzi (d. A.D. 1200) contains a narrative of Kamar, slave girl of Shagb, the mother of Moqtadir, which is the source of the tale in Lane i. 316 seq., and of another to be found in M'Naughten iv. 557 seq.; the latter is the better story, but departs so far from the original that the author must have had no more than a general recollection of the narrative he drew on. 4 There are other cases in the Nights of two tales which are only variations of a single theme, or even in certain parts agree almost word for word. Some tales are mere compounds of different stories put together without any attempt to reconcile them, and occasional cases are found in which the material is added to the book; yet the collector himself was no great literary artist. We must picture him as a professional storyteller equipped with a mass of miscellaneous reading, a fluent power of narration, and a ready faculty for quoting, or at a push improvising, verses. His stories became popular, and were written down as he told them—hardly written by himself, else we should not have so many variations in the text, and such insertions of "the narrator says," "my noble sire," and the like. The frequent coarseness of tone is proper to the condition of Egyptian society under the Mameluke sultans, and would not have been tolerated in Baghdad in the age to which so many of the tales refer. Yet with all their faults the Nights have beauties enough to deserve their popularity, and to us their merit is enhanced by the pleasure we feel in being transported into so entirely novel a state of society.

The Thousand and One Nights became known in Europe through A. Galland's French version (12 vols. 12mo, Paris, 1704-1712): the publication was an event in literary history, the influence of which can be traced far and wide. This translation, however, left much to be desired in point of accuracy, and especially failed to reproduce the colour of the original with the exactness which those who do not read merely for amusement must desire. It was with a special view to the remedying of these defects that E. W. Lane undertook in 1830 this infinitely more elaborate, if somewhat stilted translation, enriched with most valuable notes and a discussion of the origin of the work (new edition, with some additional notes, 3 vols. 8vo, London, 1859). Lane's translation omits the tales which he deemed uninteresting or unfit for a European public. Sir Richard Burton's unexpurgated English translation, with elaborate notes, was issued in 10 vols., 1855-1866, with six supplementary vols., 1867-1880. A new and much more accurate translation undertaken by Herr Max Freyberg was published at Leipzig, 1836): (3) the first Bulaq edition (4 vols., 1862-1863). See also by Edin. Review (July 1886), p. 191 seq.

1 Quatremère, Sultans Mamelouks, ii. p. 177 seq.
2 Lane i. 332, writes "Moustad." for "Mostadir."
3 See also Edin. Review (July 1886), p. 191 seq.
4 See De Goege in Gids (1876), i. 397-411.

THRACE, a name which was applied at various periods to areas of different extent. For the purposes of this article it will be taken in its most restricted sense, as signifying the Roman province which was so called after the district that intervened between the river Ister (Danube) and the Haemus Mountains (Balkan), and the region between the rivers Strymon and Nestus, which included Philippopolis, had been added to Macedonia. The boundaries of this were—towards the N. the Haemus, on the E. the Euxine Sea, on the S. the Propontis, the Hellespont and the region of the Ister; on the W. the Danube. The most distinguishing features of the country were the chain of Rhodope (Despoto-dagh) and the river Hebrus (Maritza). The former separates at its northernmost point from the Haemus, at right angles, and runs southward at first, nearly parallel to the Nestus, until it approaches the sea, when it takes an easterly direction (see Virg. Georg. iii. 351). Several of the summits of this chain are over 7000 ft. in height. The Hebrus, together with its tributaries which flow into it from the north, east and west, drains almost the whole of Thrace. It starts from near the point of junction from Haemus and Rhodope, and at first takes an easterly direction, the chief town which lies on its banks in the earlier part of its course being Philippopolis; but when it reaches the still more important city of Hadrianopolis it makes a sharp bend towards the south, and enters the sea nearly opposite the island of Samothrace. The greater part of the country is hilly and irregular, though there are considerable plains; but besides Rhodope two other tolerably definite chains intersect it, one of which descends from Haemus to Adrianople, while the other follows the coast of the Euxine at no great distance inland. One district in the extreme north-west of Thrace, the Thracian Chersonese, was the most famous of all, Byzantium was the meeting-point of that sea and the Bosporus. Another place which proved attractive to colonists of that race was the curious narrow strip of ground, called the Thracian Chersonese, that intervened between the Hellespont and the Bay of Melas, which penetrates far into the land on its northern side. Among the cities that occupied it the most important were Sestos and Callipolis (Gallipoli). In order to prevent the invasions of the Thracians, a wall was built across its isthmus, which was less than 5 m. in breadth. The north-eastern portion of the Aegean, owing to its proximity to the coast of Thrace, was known as the Thracian Sea, and in this were situated the islands of Thasos, Samothrace and Imbros.

History.—The most striking archaeological monuments of the prehistoric period are the sepulchral mounds, which are found by thousands in various parts of the country, especially in the neighbourhood of the ancient towns. As Roman implements
and ornaments have been found in some of them, it is plain that this mode of burial continued to be practised until a late period. The country was overrun several times by Darius and his generals, and the Thracian Greeks contributed 120 ships to the armament of Xerxes (Herod. vii. 185). The most powerful Thracian tribe was that of the Odrysae, whose king, Teres, in the middle of the 5th century B.C. extended his dominion so as to include the greater part of Thrace. During the Peloponnesian War his son Sitalces was an ally of some importance to the Athenians, because he kept in check the Macedonian monarch, who opposed the interests of the Athenians in the Chersonese. When, in accordance with his own inclinations, we find Cersobleptes, who ruled the southern-eastern portion of the country, exercising an important influence on the policy of Athens. During the early period of the Roman Empire the Thracian kings were allowed to maintain an independent sovereignty, while acknowledging the suzerainty of Rome, and it was not until the reign of Vespasian that the country was reduced to the form of a province (Kalopatathas, De Thracia, provincia romana, 1894; Mommsen, Roman Provinces, Eng. trans., 1880). From its outlying position in the northern part of the Balkan peninsula it was exposed to the inroads of invaders. It was overrun by the Goths on several occasions, and subsequently by the Huns; but its proximity to Constanti- nople caused its fortunes to be closely connected with those of that city, from the time when it became the capital of the Eastern Empire. In the course of the middle ages the northern parts of Thrace and some other districts of that country were occupied by a Bulgarian population; and in 1301 the Turks made themselves masters of Adrianople, which for a time became the Turkish capital. When Constantinople fell in 1453 the whole country passed into the hands of the Turks, and in their possession it remained until 1878, when, in accordance with the provisions of the Treaty of Berlin, the northern portion of it was placed under a separate administration, with the title of Eastern Rumelia; this province has now become, to all intents and purposes, a part of the principality of Bulgaria. The population is composed of Turks, Greeks and Bulgarians. (H. F. T.)

Ancient Peoples.—The name “Thracians,” from being used both ethnically and geographically, has led to confusion. There were the true indigenous Thracians and also Celtic tribes such as the Trebi in the early period, the Getae and Trausi later, and the Gallic it was in contact exposed to the incursions of barbarian Thracians of Greek writers, and they differed not merely in physic and complexion, but also in their customs and religion from the native Thracians (Herod. v. 14). The native ‘Thracians’ were inferior in morals, allowing their girls complete licence till marriage. The chief native deities were Dionysus, Ares and Bendis (Artemis), but many of these tribes had Celtic chiefs, who traced their descent from and worshipped a god called Hermes by the Greeks, but possibly Odin. The substantial features of the ancient Dionysiac rites, including a ritual play by ‘goat-men’ carrying a wooden phallos, may still be seen at Bizye, the old residence of the Thracian kings (see R. M. Dawkins in Hellenic Journal, 1906, p. 191). The true Thracians were part of that dark-complexioned, long-skulled race, which had been in the Balkan peninsula from the Stone Age, closely akin to the Pelasgians (q.v.), the aborigines of Greece, to the Ligurians, the aborigines of Italy, and to the Iberians. The name “Illyrian” (see ILLYRIA) was applied to all the tribes of this stock who dwelt west of the northern extensions of the Findus range and in what was termed Upper Macedonia in later times, and who extended right up to the head of the Adriatic. In Homer the name Macedonia is not yet known, and the term Thracian is applied to all the tribes dwelling from Pteria to the Euxine. There is no well-defined difference between aboriginal Thracians and Illyrians. Thus there was an Illyrian tribe Brygi, a Thracian one Bryges; some of the latter had passed into Asia and settled in the land called from them Phrygia, whence some of them later passed into Armenia; some of the Mysians (regarded by Strabo as Thracians) had also crossed into what was later known as Mysia: closely connected with the Mysians were the Dardanii, of Trojan fame, who had a city Dardania or Dardanus. In Strabo’s time a tribe called Dardanii, then reckoned Illyrian, living next the Thracian Bessi (in whose land was the oldest oracle of Dionysus), were probably as much Thracian as Illyrian. All the Thracian and Illyrian tribes tattooed, thus being distinguished from the Celtic tribes who had conquered many of them. The Thracians differed only dialectically from the Illyrians (Strabo), their tongue being closely allied to Greek. The Thracians of the region from Olympus to the Pangaeian district, usually regarded as rude tribes, had from a very early time worked the gold and silver of that region, and began to strike coins as early as the Greeks, and displayed on them much artistic skill and originality of types. The most famous were the Bisalitae, the Orescii, Odomantes and Edoni. Alexander I. of Macedon on his conquest of the Bisalitae adopted the native coinage, merely placing on it his own name (see, further, NUMISMATICS: Greek, §§ Thrace and Macedonia). They were famous for their skill in music and literature. Orpheus, Linus, Thamyris and Eumolpus were theirs, and in later days the Dardani were noted for their love of music as well as for their uncleanness.

See Herodotus v. 3-8; H. Kiepert, Lehrbuch der alten Geographie (Berlin, 1878); A. Bouët, La Turquie d’Europe (4 vols., Paris, 1840); W. Ridge- way, Early Age of Greece, i. 351 seq. (Cambridge, 1892); Tomasz- chek, Die alten Thraher (1893-1895); Hiller von Gaertingen, De Graecorum fabulis ad Thraes pertinensibus (1886). (W. R.)

THRALL, a slave, a captive or bondman, a term especially applied to the serfs (Lat. servi) of the early northern Teutonic peoples. It only occurs in Old English as a word borrowed from the Norse, the proper term in Old English being “thow” (lowa); the Icel. þoral (Dan. trael, Swed. trul) is probably represented by O. H. Ger. dregel, irisil, shrikel, a slave, and would therefore be derived from the root meaning “to run,” seen in O. Eng. þrunjan, Goth. thagian, Gr. ῥωπενε; Skeat (Eym. Dict., 1889) compares the “trochilus” (Gr. τροχιλος), the small bird that according to Herodotus waits or attends on the crocodile and picks insects out of his teeth.

THRAEA PAETUS, PUBLIUS CLOTIDUS, Roman senator and Stoic philosopher, lived during the reign of Nero. He was the husband of Arria the daughter of Arria (q.v.), father-in-law of Helvidius Priscus, and a friend and kinsman of the poet Persius. He was born at Patavium, and belonged to a dis- tinguished and wealthy family. The circumstances under which he came to settle in Rome are unknown. At first he lived with great consideration by Nero, probably owing to the influence of Seneca, and became consul in A.D. 56 and one of the keepers of the Sibylline books. In 57 he supported in the senate the cause of the Cilician envoys, who came to Rome to accuse their late governor, Cossutianus Capito, of extortion. In 59 Thrasea first openly showed his disquiet at the behaviour of Nero and the obsequiousness of the senate by retiring without voting after the emperor’s letter justifying the murder of Agrippina had been read. In 62 he prevented the execution of the praetor Antistius, who had written a libel upon the emperor, and persuaded the senate to pass a milder sentence. Nero showed his displeasure by refusing to receive Thrasea when the senate went in a body to offer its congratulations on the birth of a princess. From this time (63) till his death in 66 Thrasea retired into private life and did not enter the senate-house again. But his death had been decided upon. The simplicity of his life and his adherence to Stoic principles were looked upon as a reproach to the frivolity and debaucheries of Nero, who “at last yearned to put Virtue itself to death in the persons of Thrasea and Soranus” (Tacitus). Cossutianus Capito, the son-in-law of Tigellinus, who had never forgotten Thrasea for securing his condemnation, and Eprius Marcellus undertook to conduct the prosecution. Various charges were brought against him, and the senate, awed by the presence of large bodies of troops, had no alternative but to condemn him to death. When the news was brought to Thrasea at his house, where he was entertaining a number of friends, he retired to his chamber, and had the veins of both his arms opened. The narrative
of Tacitus breaks off at the moment when Thrasea was about to address Demetrius, the Cynic philosopher, with whom he had previously on the fatal day held a conversation on the nature of the soul. Thrasea was the subject of a panegyric by Anicius Rusticus, one of the tribunes, who, apparently moved to tears by his eloquence, but Thrasea refused to allow him to throw his life away uselessly. Thrasea’s own model of life and conduct was Cato of Utica, on whom he had written a panegyric, one of Plutarch’s chief authors in his biography of Cato.

See Tacitus, Annales (ed. Furneaux), III, 49; XII, 12, 48, XV, 20–22, 24, 21–35; contamitam, contamitus, contaminitam and contaminitum, Hid. in Ap. Noribu.; Dio Cassius lxii. 15, lxii. 26; Juvenal v. 36; W. A. Schmidt, Geschichte der Denk- und Glaubensfreiheit (Berlin, 1847); Mervis, Hist. of the Romans under the Empire, ch. 33; P. F. de Vries, De Zweep, a Dutch word of Sino-European origin (Lucerne, 1865); monographs by A. S. Hofsöm (Groningen, 1852); and G. Joachim (Lahr, 1858); see also Pauly-Wissowa’s Realencyclopaedie der klassischen Altertumswissenschaft (1900), iv. pt. 1.

THRESHING, or THRASHING (from “to thrash.” O. Eng. herscan, cf. Ger. dreschen, Du. dorschen, &c.), the process by which the grain or seed of cultivated plants is separated from the husk or pod which contains it.

Historical.—It is probable that in the earliest times the light grain that was raised was shelled by hand, but as the quantity increased doubtless the grain was beaten out with a stick or the sheaf beaten upon the ground. An improvement on this, as the quantity further increased, was the practice of the Egyptians and Israelites of spreading the grain in a wind and driving oxen 25 to 50 or 100 ft. in diameter, and driving oxen, sheep or other animals round and round over it so as to tread out the grain. This enclosure was placed on an elevated piece of ground so that when the straw was removed the wind blew away the chaff and left the corn. This method, however, damaged part of the grain, and as civilization advanced it was partially superseded by the threshing sledge—the charatus of Egypt and the morag of the Hebrews—a heavy frame mounted with three or more rollers, sometimes spiked, which revolved as it was drawn over the ground corn by two oxen. A common sledge with a ridged or grooved bottom was also used. Similar methods to these were used by the Greeks and are still employed in backward countries.

In Italy a tapering roller fastened to an upright shaft in the centre of the threshing floor and pulled round from the outer end by oxen is still in vogue and would seem to be a descendant of the Roman tribulum or roller sledge.

Doubtless the flail was evolved from the early method of using the stick. It seems to have been the threshing implement in many of the northern European countries, and was the chief means of threshing grain as late as 1860. It was known to the Japanese from the earliest times, and was probably used in conjunction with the stripper, an instrument somewhat resembling a scythe, and used as a sheaf to be carried about and used when the finisher end to allow for the hole for the thong to bind it to the beater. The length of the finisher enabled the operator to stand in an upright position while working. The beater is a wooden rod about 30 in. long, made of ash, though a more compact wood such as horn is less likely to split. This also has a hole at one end for the thong to bind it to the finisher. The shape of the beater was cylindrical, of about 1 in. diameter and constructed so that the edge of the grain of the wood received the force of the blow; 30 to 40 blows or strokes per minute was the average speed.

After the grain had been beaten out by the flail or ground out by rollers, the chaff was raked away and the corn and chaff collected to be separated by winnowing when there was a wind blowing. This consisted of tossing the mixture of corn and chaff into the air so that the wind carried away the chaff while the grain fell back on the threshing floor. This method fell nearest while the lightest grain was carried some distance before falling, thus a very rough-and-ready grading of the grain was obtained. It was also performed when there was no wind by fanning while pouring the mixture from a vessel. Later on a fanning or winnowing mill was invented. All ancient barns were constructed with enclosed areas giving a space to allow the wind and remained that direction of the prevailing winds so that the wind could blow right through the barn and across the threshing floor for the purpose of winnowing the corn. The flail is still in use for special purposes such as winnowing seeds and the wind is so small as to render it not worth while to use a threshing mill.

With regard to the amount of grain threshed in a day by the flail, a fair average of the best heads of corn is in twenty bales of barley, 20 bushels of beans, 8 bushels of rye, and 20 bushels of buckwheat.

There seem to have been many attempts to devise some form of power-driven machine for threshing. In 1732 Michael Meikle, a Scotsman, obtained a patent for a power-driven machine. This was a contrivance arranged to drive a large number of flails operated by water power, but though worked for a time it did not prove successful. The first distinct machine in the right direction was made by a Scottish farmer named Leckie about 1758. He invented what was described as a rotary machine consisting of a set of cross arms attached to a horizontal shaft and ending in a cylindrical case. This machine did not work very well, but it demonstrated the superiority of the rotary motion and pointed out the lines on which threshing machines should be constructed.

Of the really successful of these power-driven threshing machines the most notable is that invented by Joseph Meikle, which is embodied in modern threshers—was invented by another Scotsman named Andrew Meikle in 1786. In this the loosed sheaves were led, first, from a feeding board between two rollers, and beating the grain as it was driven between them. This cylinder or “drum” was armed with four iron-shod beaters or spars of wood parallel to its axle, and these striking the ears of corn as they protruded from the rollers knocked them from the stalks to the revolving drum, which revolved at 200 to 250 revolutions per minute and carried the loose grain and straw on to a concave sieve beneath another revolving drum or rake with pegs which rubbed the straw on to the concave and caused the grain to separate from it. Another revolving rack tossed the straw out of the machine. The straw thus passing under one peg drum and over the next was subjected to a thorough rubbing and tossing which separated the grain and chaff from it. These fell on to the floor, ready for the upcoming part of the process.

A later development of the beater-drum was to fix iron pegs on the framework, and thus was evolved the Scottish “peg-drum,” which speedily became the most popular type for threshing in Great Britain and is found at nearly every farmstead in Scotland as a fixed machine in the barn to the present day, though in many cases unused since the advent of the portable thrasher. Further, it is the type of mechanical part of the “West” are simply modifications of the peg-drum principle. In Great Britain, however, a reversion has been made to the beating or rubbing principle, where the arms of the “drum” rub the straw against an encircling concave framework and thus the grain is separated, and the portable threshing machines now taken from farm to farm are all constructed on this principle. It may be said that about 1860 there was a machine for winnowing, with a beating or rubbing principle, simply a fixed table which worked with a machine to work as part of Meikle’s peg-drum thrasher, and this made a complete separator or thrasher which thrashed, cleaned and delivered the grain at one operation. Still, these machines were stationary, being too heavy to be used on the farm, and the unthreshed corn had to be brought to them. Portable threshing machines operated by horse power were used to a small extent, but the work was very hard on the horses and they were removed when their services were otherwise required on the farm. When steam was developed as a motive power the portable threshing machine became more general.

When Meikle had brought together the peg-drum and concave he had solved the difficulty of mechanical threshing. The development of the machine to the efficiency of the modern thrasher is very gradual, and was in the direction of greater speed to the drum and separation of the wheat and chaff, and the gathering of a clean sample of grain. It is generally supposed that each part was invented and perfected singly, but in reality the early experimenters had tried to make a complete separating machine. In fact they covered the whole ground in theory before any main features were made practical.

The Modern Threshing Machine.—The present-day threshing machine embodies the main features of Meikle’s machine and will thresh up to 16 quarters of oats per hour, depending on the size of the same. There are no fluted rollers, but the beaters are fed straight to the drum; and as the working of these high-speed drums was attended with considerable risk, the Threshing Machine Act 1878 now provides for some sort of guard or safety feature.

In the most modern threshing machine the ordinary routine is as follows: The loosened sheaf is fed in at the feed mouth under the drum guard and passes between the drum beaters.
and the concave; most of the corn falls through the concave on to the corn and chaff receiving board, but some of the corn and chaff remain among the straw; as the “cavings” (the short broken straw and leaf) need to be separated from the straw it is given a thorough tossing up on the shakers, which have an upwards and onwards peristaltic action, and deliver the straw at the end of the machine. The corn, chaff and cavings fall on to a reciprocating board or “upper shoe,” which carries them back to the middle of the machine, where they meet the corn that fell through the concave. The upper shoe passes the cavings, &c., over the end into a “lower shoe,” which thoroughly sifts the corn and chaff from the cavings. The cavings are then carried along to the outside of the machine and emerge at an opening beneath the point where the straw passes out. The corn and chaff fall through the lower shoe or caving riddle on to a receiving board

machine in a roughly dressed condition. The elevator delivers the corn into the awner or “hummeller,” which is fitted with helical blades to rub off the awns or beards which may still adhere to the grain. From here the grain falls on to a second series of sieves, where it meets the blast of air from the second fan, which blows and sifts the light and coarse foreign matter from the grain, delivering this débris on the first corn and chaff receiving board to undergo separation again along with that just fallen from the concave. The corn falls from the sieve of this second dresser into a rotary screen where separations are made producing the clean sample and the tail corn, which are delivered at separate openings below. There are modifications on the machine described—such as single fan-blust instead of double, &c.—but the general principles are the same.

The concave which surrounds the drum is made adjustable, so that it can be regulated according to the nature of the crop to be thrashed. An ordinary machine will thresh all usual farm crops, but great care has to be taken in adjusting the concave or the seed will be injured. Clover, however, is twice passed through a machine of this description, to free the seed from the haulm and afterwards to rub the seed clear from the chaff, but special machines to thresh it all in one operation are made.

The drum is carried on the main shaft and all other pulleys take their motion from it directly or indirectly. Sometimes the main shaft is lengthened to accommodate another pulley and so drive a chaff-cutter behind and chaff up the straw as it leaves the thrasher. In some districts an elevator is driven behind to stack the straw. Others use a truss, which ties the straw into large bundles before delivering it for stacking.

American Machines.—In American machines the straw, cavings, &c., are caught in a blast at the rear end of the machine and blown up in a light iron pipe of about 18 in. diameter on to the top of the stack, and the grain is delivered loose at the side through a spout into a box wagon. As the payment for threshing is per bushel the grain is usually passed through a self-registering weighing apparatus, so that accurate account is kept of the bushels threshed. In Great Britain payment is per quarter of 8 bushels, and as the machine delivers into 4-bushel

sacks this rough-and-ready measure is accepted. On American machines self-feeders are adopted, in which the sheaves are thrown on to a travelling web which carries them under revolving knives to cut the bands and deliver them loose into the
THRASYBULUS

THRASYBULUS, an Athenian general, whose public career began in 411 B.C., when by his resolute behaviour he frustrated the oligarchic rising in Samos (see PELOPONNESIAN WAR), and secured the Athenian armament to the cause of democracy. Elected general by the troops, he effectually the recall of Alcibiades and assisted him in the ensuing naval campaigns. By his brave defence at Cynossema (411) he won the battle for Athens, and in 410 contributed towards the brilliant victory of Cyzicus. In 406 he fought at Arginnae as a simple ship's captain, but after the engagement was commissioned with Thermomenes (q.v.) to rescue some drowning crews. In the subsequent inquiry Thrasybulus successfully disclaimed responsibility for the losses.

In 404, when exiled by the Thirty Tyrants for his services to the democracy, he retired to Thebes and there prepared for a desperate attempt to recover his country. Late in the year, with seventy men, he seized Phyle, a hill fort on Mt Parnes. A force sent by the Thirty was repulsed and routed by a surprise attack. Thrasybulus now gained the Pelopaeus, 1000 strong, and successfully held the steep hill of Munychia against the oligarchs' full force. After this repulse the Thirty gave way to a provisional government of moderate oligarchs. Meanwhile a Spartan fleet, which the latter had summoned, blockaded the Peiraueus, but king Pausanias, commanding the land force, after some skirmishes effected a general reconciliation by which the democracy was restored (October 403). Thrasybulus was now the hero of the people; but a decree by which he secured the franchise for all his followers, including many slaves, was rescinded as illegal.

In 395 Thrasybulus induced Athens to join the Theban league against Sparta, but did not himself take the field till 389, when he led a new fleet of 40 ships against the Spartans at Rhodes. Sailing first to the Bosphorus he effected a democratic revolution at Byzantium and renewed the corn-toll. After a successful descent on Lesbos and the renewal of the 5% import tax at Thasos and Clazomenae he sailed south in quest of further contributions, but met his death in a night surprise by the people of Aspendus. By his executions he had forfeited the confidence both of the allies and of Athens; but after his death the ill-feeling subsided, and he was ever remembered as one of the saviours of his country.

See Thucydides, viii. 75-105; Xenophon, Hellenica; Lysias, c. Erotatis. 55-51 and c. Ergol. 5, 8; and Const. alt. xI. DioDORUS XIII. xiv. Justin v. 9, 10, and Nepos depend almost wholly on Xenophon. Corpus inscr. att. ii. 118 and 142.

THRASYMEDES, of Paros, a Greek sculptor. Formerly he was regarded as a pupil of Pheidias, because he set up in the temple of Asclepius at Epidaurus a seated statue of that deity made of ivory and gold, which was evidently a copy of the Zeus of Pheidias. But an inscription recently found at Epidaurus proves that the temple and the statue belong to the fourth century. (See EPIDAURUS.)

THRESHING, (i) Eng. Pratts, a kind of mill which is twisted, Jute, to 4 twist, or to twist, &c. (ii) 'Throwster', a silk-winder, Ger. drehen, to twist, turn, Du. draad, Ger. Draht, thread, wire), a thin or fine cord of two or more yarns of fibrous substance, such as cotton, silk, wool or flax, tightly twisted together (see SPINNING and COTTON AND COTTON MANUFACTURE).

Thread, whether as silk or cotton thread, is particularly used for sewing, but it is also used in weaving. Lisle thread, a hand-twisted linen thread, originally made at Lille in France, is specially used in the manufacture of stockings (see HOSIERY).

Apart from the figurative sense of that which runs through the body of a subject, there is no speck, cast connecting throughout ideas or purpose, the term is also applied specifically to the spiral part of a screw (q.v.).

THREAT, a menace or intimidation. At common law the employment of threats or other forms of intimidation to induce a person to enter into a contract will give the right to sue for its rescission or avoidance, or to plead the special form of intimidation in answer to any action brought, or to sue for damages occasioned by entering into the contract. (See such headings as CoERCION; CONTRACT; Extortion, &c.)

In criminal law the sending of threatening letters (or causing them to be received), demanding with menaces and without reasonable cause money or other valuable thing, is a felony. So is the sending a letter threatening to burn or destroy any house, barn or other building or to kill or maim cattle. It is also a felony to threaten to accuse a person of a crime for the purpose of extorting money, or merely to demand money or other property, without having any claim to it, by means of a threat.

THREE BODIES, PROBLEM OF, the problem of determining the motion of three bodies moving under no influence but that of their mutual gravitation. No general solution of this problem is possible. As practically attacked it consists in the problem of determining the perturbations or disturbances in the motion of one of the bodies around the principal or central body, produced by the attraction of the third. Examples are the motion of the moon around the earth as disturbed by the action of the sun, and of one planet around the sun as disturbed by the action of another planet.

THREE RIVERS, or Trois Rivières, a city and port of entry of Quebec, Canada, and capital of St Maurice county, situated at the confluence of the rivers St Maurice and St Lawrence. The St Maurice flows in from the north, and, being divided at its mouth by two islands, the channels give the town its name. It is on the line of the Canadian Pacific railway, 78 m. S.W. of Quebec and 92 m. N.E. of Montreal. Founded in 1634 by Champlain, Three Rivers is one of the oldest towns in Quebec. It is the centre of a large lumber trade, which is carried on along the St Maurice and its tributaries. Some miles from the city are the St Maurice forges, where iron wares were manufactured as early as the 17th century. Other industries are furniture- and cabinet-making, boot and shoe making, and those carried on in the brass and lead foundries, saw-mills, and carriage factories. The city is the seat of a Roman Catholic bishopric. A large trade is carried on in lumber, grain, cattle, &c., which are shipped to South America, the West Indies, Great Britain and the United States, and a great development has been caused by the utilization of the water-power of the St Maurice at Shawanegan, Grand Meré and other falls, for the manufacture of wood pulp. As a result, the population, long

Drum, so that while many more bushels of grain are passed per day through an American machine than is done in Great Britain, only about half the men are required at the work.

Threshing Work.—The minimum number of hands required in Great Britain are: An engine-driver, a feeder, a sackman, and ten other men to handle the sheaves, straw, chaff, grain, &c., while half as many more may be needed where the grain has to be carted, as when the threshing is done in the field in harvest time. An 8-h.p. steam engine is the usual motive power, but the development of the oil engine has provided a very satisfactory substitute. The engine is usually of the "traction" type, so that it can move the threshing machine or "crawling" or "walking" a little way over the corn or straw from place to place. The usual quantities threshed with a "double blast finishing machine," as described, in the United Kingdom are, with a 5 ft. wide drum, from 60 to 80 bushels per hour of wheat, and one-third to one-half more of oats and barley.

Sometimes the straw is stacked loose, while sometimes it is tied up with twine by a tier exactly like that on a "string binder" and then stacked up. Where all the straw is used at the farm for fodder, &c., the fixed threshing machine set up in the barn is the most convenient. The sheaf corn has to be carried to it, but, on the other hand, everything is under cover, the work can be done on a wet day, and all the products of threshing in the shape of grain and straw are kept dry. In the great corn districts, however, the portable threshers is most convenient; it is set alongside the stack and only the grain and chaff are carried under a "sackman," who is specially equipped up so that as the work goes on. The farmer finds the coal and the men and horses to cart water to the stack and corn to the barn and pays the proprietor of the threshing outfit, who finds all the other men, about the following rates: wheat, 1s. 10d., oats and barley, 1s. 6d. per quarter.

(P. McC.)
THRENODY, a lament written in verse, a dirge, a funeral ode composed in honour of a dead personage. The word is an adaptation of the Greek θρηνος, a funeral dirge, from θρέω, lamentation, wailing, θρήνος, I cry aloud, and θρήνος, a song, ode, διγραυ, to sing.

THRESHOLD, the door-sill, the piece of stone or wood which is placed at the bottom of a door, gate, or entrance to a house or the building. The word is derived from the Old French, the equivalent of Ger. Schwellde and of Lat. limen, i.e., the lowest limit of sensation, the point at which the intensity of sensation becomes just noticeable. Etymologically threshold (O. Eng. hersold, M. Eng. herswold) has usually been divided into "thresh," i.e., thresh, beat, and weld, weld, weld, wood; the word meaning the pieces of wood beaten or trampled by the feet. The termination, as is shown by the Old English form, has probably no connexion with wald, but is merely a suffix, as in O. H. Ger. driscäfti, threshold. The first part is certainly "thresh," beat; some have supposed that in early times the entrance to a house was used as a threshing-floor.

THRIFT, economy in personal or domestic expenditure, the habit and practice of saving, careful or frugal management in money matters. The word, which is borrowed from Scandinavian languages, meant the condition of one who thrives or prospers (M. Eng. thriwen, Icel. thrifja, to clench, seize, Norw. triva, seize). There are several species of plants, such as the sea-pink, Armeria maritima, or March rosemary (Statice) which from their vigorous growth are often termed "thrift." THRING, EDWARD (1821–1887), English schoolmaster, was the son of John Gale Dalton Thring, rector of Alford, Somerset, and was born on the 19th of November 1821. His elder brother was Henry, afterwards Lord, Thring (1818–1907) the distinguished Parliamentary counsel (1865–1886), who was made a peer in 1886. Edward was educated first at Ilminster grammar school and afterwards at Eton, where he became head of the school, and Captain of Montem in 1841, the last occasion on which that ancient festival was celebrated. He then entered King's College, Cambridge, won the Porson Prize for Greek Verse, and was elected fellow. At that time King's College scholars retained the privilege of proceeding to a degree without examination, but Thring thought the maintenance of this usage inexpedient in the interests of learning and wholly indefensible in principle, and his vigorous protests against it aroused lively academic controversy, and became effective in 1851, when it was abolished. On leaving the university in 1846 he was ordained, and served for a short time as curate in Gloucester. Here he took remarkable interest in the elementary school of the parish, and ever afterwards attributed much of his professional success and his insight into educational principles and methods to the experience he had acquired in imparting the humble rudiments of learning to the children of the poor. After an interval of two or three years, spent partly in private tuition and partly as curate at Cookham Dean, he married in 1853 a daughter of Carl Koch, commissioner of customs at Bonn, and was elected to the mastership of Uppingham School, a post which he retained until his death in 1887. That school had been founded in 1584, was slenderly endowed, poorly housed, and little known. Thring found only twenty-five boys in it, but he succeeded in raising it, both in numbers and repute, to a position in the first rank among English public schools. He had a strong conviction that there should be a limit to the number of pupils entrusted to the care of one head master, and he fixed that limit at 300, although, owing to the increasing popularity of the school, he was under strong temptation to exceed it. Little by little he surrounded himself with a loyal staff of masters, raised money for the building and equipment of a noble schoolroom and chapel, besides class-rooms and eleven boarding-houses. Among the distinctive features of his plans and achievements were: (r) his strong sense of the need for a closer study of the characteristics of individual boys than is generally found possible in large public schools; (2) his absolute adherence to the discipline of the ancient languages, in connexion with English, as the staple of a liberal education; (3) his careful provision of a great variety of additional employments and interests, in studies and in games, to suit the aptitudes of different pupils; (4) the value he attached to the aesthetic side of school training, as evinced in the encouragement he gave to music and to drawing and to the artistic decoration of the schoolrooms; and above all (5) his rebellion against mere routine, and his constant insistence on the moral purpose of a school as a training ground for wholesome habits, rather than as a place solely concerned itself with the acquisition of knowledge. The vigour and intrepidity of his character were conspicuously shown in 1875, when an outbreak of fever made Uppingham for a time untenable, and when, at a few days' notice, he took a disused hotel and some boarding-houses at Borth, on the Cardiganshire coast, and transported the whole 300 boys, with 30 masters and their households, to it, to a city of refuge. Here the school was carried on with undiminished and even fresh zest and efficiency for fourteen months, during which needful sanitary measures were taken in the town. A man of Arnold's stamp and with Arnold's strength and lofty educational aims he was in strong sympathy, he took little or no part in outside controversies, political or ecclesiastical. All the activity of his life centred round the school. His was the first public school to establish a gymnasium, and the first to found a town mission in a district of South London, with a view to interest the boys in an effort to improve the social condition of the poor. He took the first step in 1869 in the formation of the Head Masters' Conference, an institution which has ever since done much to suggest improvements in method and to cultivate a sense of corporate life and mutual helpfulness among the teachers in the great schools of the country. In 1868, he took the bold and unprecedented step of inviting the Association of Head Mistresses to Uppingham, and giving to them a sympathetic address. He also formed an association in Uppingham, with lectures, cookery classes, concerts, and other aids to the intellectual and social improvement of the residents of the little town. He gave valuable evidence before the Schools Inquiry Commission of Lord Taunton in 1866, but it was very characteristic of him that he dreaded the intrusion of public authority, whether of royal commissioners or of the legislature, into the domain of the school. In his view, the term "public school," the liberty and personal inventiveness and enthusiasm of teachers should have full scope and be hindered by no official regulations. His contributions to literature were not numerous, but were all closely connected with his work as a schoolmaster. They were: Thoughts on Life Science (1869), written under the assumed name of Benjamin; Place; Education and School (1864); The Theory and Practice of Teaching (1882); Uppingham School Sermons (1885); The Child's Grammar (1852); The Principles of Grammar (1886); Exercises in Grammatical Analysis (1886); School Songs (1885); Birth Lyrics, poems and translations (1887); and a volume of Miscellaneous Addresses, published after his death in 1887.

The fullest account of his life is that written by G. R. Parkin (1890), containing copies extract from his diary and letters, A Life of Edward Thring. This was followed, in 1887, by a life written by J. H. Skrine, the warden of Glenalmond, who was first a pupil and afterwards an assistant master at the school, presents a vivid and unflattering picture of Thring's active life, and an affectionate and yet discriminating estimate of his character. Other particulars may be found in the chapter devoted to his biography in Sir Joshua Fitch's Educational Aims and Methods, and in Edward Thring, Teacher and Poet, by Canon H. D. Rawnsley. (J. G. F.)

THROAT (O. Eng. frot, prole or brole, possibly from freliam, to press, whence throat, or, with loss of initial s, connected with frin to swell). The term is applied to the front external part of the neck from below the chin to the collar-bone in human and animal anatomy, and to the internal parts, which include the gullet, viz. the faucae, pharynx and oesophagus, and the windpipe, viz. the larynx and trachea (see PHARYNX, ALIMENTARY CANAL, and RESPIRATORY SYSTEM: Anatomy; and for diseases see PHARYNGITIS, LARYNGITIS, DIPHTHERIA, TONSILITIS and OESOPHAGUS).
THROCKMORTON (or THROGMORTON), FRANCIS (1554—1584), English conspirator, was the son of Sir John Throckmorton of Feckenham in Warwickshire, and his wife Margery Puttenham. Sir John had been concerned in Wyatt's rebellion against Queen Mary Tudor, but was afterwards known as a sympathizer with the Roman Catholic party in the reign of Queen Elizabeth, and in 1580 was removed from his office of chief justice of Chester for irregularities in his office, but probably because he was suspected of disloyalty by the government. Francis was educated at Hart Hall, Oxford, which he entered in 1572. In 1576 he was enrolled in the Inner Temple. At Oxford he had come under the influence of the Roman Catholics, whose power was still great in the university, and must have heard of the intrigues of their leaders when he himself entered the university. When Campian and Parsons came to England in 1580 to conduct the Jesuit propaganda against Queen Elizabeth, Francis Throckmorton was one of a society of members of the Inner Temple who united to hide and help them. In that year he went abroad, first to join his brother Thomas, who was engaged with the exiled Roman Catholics in Paris, and then to travel in Italy and Spain. While abroad he consorted with exiled papists, and was undoubtedly engaged in treasonable intrigues. In 1583 he returned to act as the confessional agent of his elaborate conspiracy. After his flight from England he had got his object the invasion of England by a French force under command of the duke of Guise, or by Spaniards and Italians sent by Philip II, for the purpose of releasing the imprisoned Mary Queen of Scots and restoring the authority of the pope. Throckmorton possessed, or occupied, a house on Paul's wharf, London, which served as a meeting-place for the conspirators. Many plots were being carried on alongside of the chief one, and the suspicions of the government were aroused. Throckmorton's constant visits to the Spanish ambassador, Bernardino de Mendoza, attracted attention, and he was arrested in October 1583. He was deciphering a letter to Queen Mary when the constables came upon him suddenly, but he found time to send a casket of compromising papers to a trustworthy maid-servant to Mendoza, and a card in cipher in which he promised to reveal nothing. As he refused to confess when brought before the council, he was put on the rack in the Tower. He resisted a first application of the torture, but his strength and courage failed when he was threatened with a second, and he made a full confession. At a later period he retracted and asserted that his avowals were false and had been extorted from him by pain, or had been put into his confession by the constables. It is possible he made a full confession of his own accord, however, all that is known of his confessions of the conspirators. Many of the conspirators were hanged, but many others escaped, and the conspiracy was not detected until 1586 when the queen was informed of the names of those who had conspired. The queen, however, was not satisfied that they had been sufficiently punished, and she ordered the constables to be searched, and the constables found out a plot to carry off the queen and her attendants. The queen was thus saved from the plot. The queen was saved from the plot, and the conspirators were executed. Throckmorton was executed on the 17th of April 1584. He was brought to trial at the Guildhall on the 17th of April of that year. By eloquence, readiness of wit, and adroit flattery of the jury he contrived to secure his acquittal in the face of the unequivocal statement of the judge—a unimpeachable achievement at a time when the condemnation of prisoners whom the authorities wished to convict was a mere matter of course. The jurymen were fined and sent to prison, and Throckmorton was detained in the Tower till the following year. There was some talk of bringing him to trial again, but he made his peace, and was employed by Queen Mary. After the accession of Elizabeth he rose rapidly into favour. He became chamberlain of the exchequer, and from May 1559 to April 1564 he was ambassador in France. During the latter part of this period he was associated with the English ambassador Sir Thomas Smith, who had at least partly to watch and check his fellow-ambassador. It was in these years that Throckmorton became acquainted with Mary Queen of Scots. He had to conduct the delicate negotiations which accompanied her return to Scotland, and though he was a supporter of the reformers on political grounds, he became her personal friend and was always willing to do her service. As ambassador in France he exerted himself to induce Elizabeth to aid the Huguenots, and took part in the war of religion. He was taken prisoner by the Catholic leader, the duke of Guise. After his return to England he was sent as ambassador to Scotland in May 1565. The principal object of his mission was to prevent Queen Mary's marriage with Darnley, which however he was unable to do. After the murder of Darnley he was again sent to Scotland in June 1567 on a still more hopeless mission than the first. He was instructed to persuade the Scottish barons who had just imprisoned the queen to restore her to her authority. His known friendship for Queen Mary and his constant support of her claim to be recognized as Elizabeth's successor, made him a very unwelcome representative of England in that crisis. Moreover, the queen of England intended to go abroad, and he had to send official messages to the barons, and by contradictory instructions. He cannot have undertaken his task with much zeal, for his own opinion was that Elizabeth would consult her interests best by supporting the barons. In Edinburgh Throckmorton could effect little, but he exerted himself to secure the personal safety of the queen. He offended his mistress by showing his instructions to the Scottish barons, and was recalled in August. In 1569 he fell under suspicion during the duke of Norfolk's conspiracy in favour of Mary, and was imprisoned for a time at Windsor, but was not further proceeded against. He died on the 17th of February 1571. Sir Nicholas married Anne Carew, and his daughter Elizabeth became the wife of Sir Walter Raleigh.

THORNE, a royal, vice-regal, or episcopal chair of state standing upon a dais or platform. Formerly the platform, with the steps leading up to it, was comprised in the significance of the word—hence the familiar expression to "mount the throne." The ceremonial induction of a sovereign into his throne is one of the usual solemnities of a coronation, while enthronization of the bishop in his cathedral is the final observance in the making of a diocesan. The throne, which is of innumerable antiquity, is the universal ancestor of all chairs, which were for long symbols of authority and rule. In early days and in Oriental countries thrones were of barbaric magnificence. Solomon's was of ivory "overlaid with the best gold." There were two figures of lions at the sides, with two other lions on each of the six steps. The remains of a throne in rock-crystal were found in the ruins of Sennacherib's palace. The Persian throne made for Abbas the Great was of white marble. This monarch appears to have had a nice taste in thrones, for in 1605 he presented one to the Russian tsar Boris which is covered with sheets of gold and decorated with precious stones and pearls. Tsar MichaelFeodorovitch, grandfather of Peter the Great, outdid even this magnificence, for his "golden throne" is set with eight thousand turquoises, fifteen hundred rubies, four great amethysts and two large topazes. One of the glories of Delhi, until it was sacked by Nadir Shah, was the "peacock throne," the value
of which was estimated, perhaps with some Eastern exuberance, at twelve millions sterling. It was ascended by silver steps and stood on golden feet set with jewels. It obtained its name from the two open peacocks' tails composed of magnificent diamonds, rubies, and other stones which formed part of its appurtenances. Apparently it was made for Shah Jahan by the French designer of the Taj Mahal. According to that veracious chronicler, Sir John Mandeville, the seven steps of the throne of Prester John were respectively of onyx, crystal, green jasper, amethyst, sardonyx, cornelian and chrysolite. They were bordered with gold and set with pearls. The throne itself was of gold enriched with jewels. Ranjit Singh's golden throne—it is of wood covered with plates of gold—is in the possession of the British Crown. European thrones were usually more ornate and fanciful than the Persian's, and occupied a real or legendary, of the East. The medieval emperors of Byzantium had, however, imbued a good deal of the Orient, and their famous throne, which is supposed to have been imitated from, as well as named after, that of Solomon, was guarded by golden lions, which rose to their feet and roared when some artful mechanism was set in motion. An exceedingly ancient chair of state is the so-called throne of Dagobert (see CHAIR). The most recent writers on this remarkable relic suggest that it is a bronze copy of Dagobert's golden throne. However that may be, there can be no doubt that it possesses at least one illustrious modern association, for Napoleon sat in it when he distributed the first decorations of the Legion of Honour in his camp at Boulogne in 1804. The throne which Napoleon had made for himself was a heavy gilded chair with an abundance of Egyptian ornament, lions' heads and imperial eagles. One of the many curiosities of a conclave for the electing of a Pope is that every cardinal present occupies a throne, since, during the vacancy of the Holy See, each member of the Sacred College is a potential sovereign. When the election has taken place the canopy of every throne is lowered, with the exception of that occupied by the pape. The papal chair—of the great Roman nobles contained—and still in some cases contain—a throne for use in the event of a visit from the pope. The papal throne itself is an antique bronze chair which stands in St Peter's. Embassies frequently contain a throne for the use of the sovereign in whose territory the building technically stands. No ancient throne-chair pertains to the British monarchy; the coronation chair is not, properly speaking, a throne, since it is used only during a portion of the coronation ceremonies. The actual throne of Great Britain is the oaken Gothic chair in the House of Lords occupied by the sovereign at the opening and prorogation of parliament.

THRUM-EYED, a botanical term for flowers which occur in two forms, one of which shows the stamens in the mouth of the corolla, as in the primrose, contrasted with pin-eyed (q.v.).

THRUSH (A. S. Drussca, Icel. Drstr, Norw. Trast, O. H. Ger. Drsche, whence the mod. Ger. Drossel, to be compared with the analogous English form Throstle,¹ now almost obsolete, both being apparently diminutives), the name that in England seems to have been common to two species of birds, the first now generally distinguished as the song-thrush, but known in some districts as the mavis, the second called the mistletoe-thrush, but having many other local designations, of which more presently.

The former of these is one of the finest songsters in Europe, but it is almost everywhere so common that its merits in this respect are often disregarded, and not unfrequently its melody, when noticed, is ascribed to the prince of feathered vocalists, the nightingale (q.v.). In the spring and summer there is hardly a field, a copse or a garden that is not the resort of a pair or more of song-thrushes; and the brown-backed bird with its spotted breast, hopping over the grass for a few yards, then pausing to detect the movement of a worm, and vigorously seizing the same a moment after, is one of the most familiar sights. Hardly less well-known is the singular nest built by this bird—a deep cup, lined with a thin but stiff coating of fragments of rotten wood, ingeniously spread, and plastered so as to present a smooth interior—in which its sea-green eggs spotted with black are laid. An early breeder, it builds nest after nest during the season, and there can be few birds more prolific. Its ravages on ripening fruits, especially strawberries and gooseberries, excite the enmity of the imprudent gardener who leaves his crops unprotected by nets, but he would do well to stay the hand of revenge, for no bird can or does destroy so many snails, set among the ripe berries. To the curious observer on inspection of the stones that it selects against which to dash its capture—interlaced with leaves that are besmeared with the slime of the victims and bestrewn with the fragments of their shattered shells. Nearly all the young thrushes reared in the British Islands—and this expression includes the storm-swept isles of the Outer Hebrides, though not those of Shetland—seem to emigrate as soon as they are fit to journey, and at a later period they are followed by most of their parents, so that many parts of the kingdom are absolutely bereft of this species from October to the end of January. On the continent of Europe the autumnal influx of the birds bred in the North is regarded with much interest, for they are easily ensnared and justly esteemed for the table, while their numbers make their appearance in certain districts a matter of great importance.

The second species to which the name applies is distinguished as the mistletoe-thrush, or, by corrupt abbreviation, the missel-thrush.² It is known also in many districts as the "storm-cock," from its habit of singing in squally weather that silences almost all other birds, and "holm- (i.e. holly-) thrush"; while the harsh cries it utters when angry or alarmed have given it other local names, as "screech," "shrike" and "skirike," all traceable to the Anglo-Saxon Seric.³ This is a larger species than the last, of paler tints, and conspicuous in flight by the white patches on its outer tail-feathers. Of bold disposition, and fearless of the sleet storms of spring, as of predatory birds, the cock will take his stand on a tall tree, "like an enchanter calling up the gale" (as Knapp happily wrote), and thence with loud voice proclaim in wild and discontinuous notes the fervour of his love for his mate; nor does that love cease when the breeding-season is past; since this species is one of those that appear to pair for life, and even when, later in the year, it gathers in small flocks, the North is regarded with much interest, for they have little use for nest and offsprung, too, few birds are more resolute, and the dawn, pie or jay that approaches with an ill intent speedily receives treatment that causes a rapid retreat, while even the marauding cat finds the precincts of the "master of the coppice," (Pen y Bryn), as the Welsh name this thrush, unsuitable for its stealthy operations. The connexion of this bird with the mistletoe, which is as old as the days of Aristotle, is no figment, as some have tried to maintain. Not only is it exceedingly fond of the luscious viscid berries, but it seems to be almost the only bird that will touch them.

The thrushes form a distinct family, Turdidae, of the Oscines division of perching birds, and are now generally divided into sub-families (q.v. Turdinae, or true thrushes and their immediate allies, the ouzel (q.v.), the fieldfare (q.v.), the redwing (q.v.), the rock-thrushes (Monticola), the wheatears, stonechats, willowbirds (see Wheateara), the redstarts (q.v.), robins (see Redbreast), and

¹ There is no doubt of the bird taking its name from the plant mistletoe (Viscum album), about the spelling of which there can be no doubt—A. S. Drossca, Icel. Drstr. etc., "plucked," originally signifying "twig," and surviving in the modern "tine," as of a fork or of a deer's antler.

² It seems quite possible that the word thrush, though now commonly accepted as the equivalent, in an ornithological sense, of Lanius, may have been originally applied to the mistletoe-thrush. In several of the Anglo-Saxon Vocabularies dating from the 8th to the 11th century, as printed by Thomas Wright, the word Seric, which can be hardly anything else than the early form of "shrike," is glossed Turdus.
hedge-sparrows (see Sparrow). In these, as opposed to the warblers, the young are spotted. (2) Myiolecinae, a small group, chiefly South American, with strong bristles round the gape. (3) Sylvinae (see Warblers). (4) Poliopitidae or gnat-catchers of North and South America. Myiarchinae (q.v.), called "babbbling-thrushes" which occur throughout the Old World are usually referred to a distinct family, the Timelidae, characterized by strong bills and feet, and short, rounded and incurved wings. The "ant thrushes" belong to a different family (see Pitta).

(A. N.)

THUCYDIDES (Θουκυδίδης), Athenian historian. Materials for his biography are scanty, and the facts are of interest chiefly as aids to the appreciation of his life's labour, the History of the Peloponnesian War. The old view that he was probably born in or about 471 B.C., is based on a passage of Aulus Gellius, who says that in 431 Hellanicus "seems to have been" sixty-five years of age, Herodotus fifty-three and Thucydides forty (Not. att. xv. 23). The authority for this statement was Pamphila, a woman of Greek extraction, who compiled biographical and historical notices in the reign of Nero. The value of her testimony is, however, negligible, and modern criticism inclines to a later date, about 461 (see Busolt, Gr. Gesch. iii., pt. 2, p. 621). Thucydides' father Olorus, a citizen of Athens, belonged to a family of the highest in the race, and from the possession of gold-mines at Scapté Hyle, on the Thracian coast opposite Thasos, and was a relative of his elder namesake, the Thracian prince, whose daughter Hegesipyle married the great Miltiades, so that Cimon, son of Miltiades, was possibly a connexion of Thucydides (see Busolt, ibid., p. 618). It was in the vault of the Cimonian family at Athens, and near the remains of Cimon's sister Elpinice, that Pindar saw the grave of Thucydides. Thus the fortune of birth secured three signal advantages to the future historian: he was rich; he had two homes—one at Athens, the other in Thrace—so small a aid to a comprehensive study of the conditions under which the Peloponnesian War was waged; and his family connexions were likely to bring him from his early years into personal intercourse with the men who were shaping the history of his time.

The development of Athens during the middle of the 5th century was, in itself, the best education which such a mind as that of Thucydides could have received. The expansion and consolidation of Athenian power was completed, and the inner resources of the city were being applied to the embellishment and ennoblement of Athenian life (see Cixon; Pericles). Yet the History tells us nothing of the growth in the art or the science of life under whose influence its author had grown up. The "Funeral Oration" contains, indeed, his general testimony to the value and the charm of those influences. But he leaves us to supply all examples and details for ourselves. Beyond a passing reference to public "festivals," and to "beautiful surroundings in private life," he makes no attempt to define those "recreations for the spirit" which the Athenian genius had provided in such abundance. He alludes to the newly-built Parthenon only as containing the treasury; to the statue of Athena Parthenos which it enshrined, only on account of the gold which, at an extreme need, could be detached from the immovable. The Protesilaos and other buildings with which Athens had been adorned under Pericles, only as works which had reduced the surplus of funds available for the war. He makes no reference to Aeschylus, Sophocles, Euripides, Aristophanes; the architect Ictinus; the sculptor Phidias; the physician Hippocrates; the philosophers Anaxagoras and Socrates. Herodotus, if he had dealt with this period, would have found countless occasions for invaluable digressions on men and manners, on letters and art; and we might almost be tempted to ask whether his more genial, if lazier, method does not indeed correspond better with a liberal conception of the historian's office. No one can do full justice to Thucydides, or appreciate the true completeness of his work, who has not faced this question, and found the answer to it.

It would be a hasty judgment which inferred from the omission of the History that its author's interests were exclusively political. Thucydides was not writing the history of a period. His subject was an event—the Peloponnesian War—a war, as he believed, of unequalled importance, alike in its direct results and in its political significance for all time. To his task, thus defined, he brought an intense concentration of all his faculties. He worked with a constant desire to make each successive incident of the war as clear as possible. To take only two instances: there is nothing in literature more graphic than his description of the plague at Athens, or than the whole narrative of the Sicilian expedition. But the same temper made him resolute in excluding irrelevant topics. The social life of the Athenian state at that period is not belon to his subject.

The biography which bears the name of Marmelinos states that Thucydides was the disciple of Anaxagoras in philosophy and of Antiphon in rhetoric. There is no evidence to confirm this tradition. But Thucydides and Antiphon at least belong to the same rhetorical school and represent the same early stage of Attic prose. Both writers used words of an antique or decidedly poetical cast; both point verbal contrasts by insisting on the precise difference between terms of similar import; and both use metaphors somewhat bolder than were congenial to Greek prose in its riper age. The deficiencies of the style of Thucydides and that of Antiphon arise chiefly from two general causes. First, Antiphon wrote for hearers, Thucydides for readers; the latter, consequently, can use a degree of condensation and a freedom in the arrangement of words which would have been hardly possible for the former. Again, the thought of Thucydides is often more complex than any which Antiphon undertook to interpret; and the greater intricacy of the historian's style exhibits the endeavour to express each thought. Few things in the history of literary prose are more interesting than to watch that vigorous mind in its struggle to mould a language of magnificent but immature capacities. The obscurity with which Thucydides has sometimes been reproached often arises from the very clearness with which a complex idea is present to his mind, and his strenuous effort to present it in its entirety. He never sacrifices thought to language, but he will sometimes sacrifice language to thought. A student may always be consoled by the reflection that he is not engaged in unravelling a mere rhetorical tangle. Every light on the sense will be a light on the words; and when, as is not seldom the case, Thucydides comes victoriously out of this struggle of thought and language, he is the other hand, by the elegance of his meaning in a sufficiently lucid form, then his style rises into an intellectual brilliancy—thoroughly manly, and also penetrated with intense feeling—which nothing in Greek prose literature surpasses.

The uncertainty as to the date of Thucydides' birth renders futile any discussion of the fact that before 431 he took no prominent part in Athenian politics. If he was born in 455, the fact needs no explanation; if in 471, it is possible that his opportunities were modified by the necessity of frequent visits to Thrace, where the management of such an important property as the gold-mines must have claimed his presence. The treatment in which he refers to his personal influence in that region is such as to suggest that he had sometimes resided there (iv. 195, 1). He was at Athens in the spring of 430, when the plague broke out. If his account of the symptoms has not enabled physicians to agree on a diagnosis of the malady, it is at least singularly full and vivid. He had himself been attacked by the plague; and, as he briefly adds, "he had seen others suffer." The tenor of his narrative would warrant the inference that he had been one of a few who were active in ministering to the sufferers.

The turning-point in the life of Thucydides came in the winter of 424. He was then forty seven (or, according to Busolt, about thirty-six), and for the first time he is found holding an official position. He was one of two generals entrusted with the command of the regions towards Thrace (rā ἐπὶ Θηραίων), a phrase which denotes the whole Thracian seaboard from Macedonia.

1 Christ (Gesch. der griech. Litt.) gives the date of birth as "about 455."

2 See Jebb's Attic Orators, i. 35.
eastward to the vicinity of the Thracian Chersonese, though
often used with more special reference to the Chalcidice penin-
sula. His colleague in the command was Eucleus. About the
end of November 424 Eucleus was in Amphipolis, the stronghold
of Athenian power in the north-west. To guard it with all
possible vigilance was a matter of peculiar urgency at that
moment. The abest of Spartan leaders, Brasidas (q.v.), was in
the Chalcidice peninsula, where he had already gained rapid
success; and part of the population between that peninsula and
Amphipolis was known to be disaffected to Athens. Under
such circumstances we might have expected that Thucydides,
who had the beard of a king—his hair was piled high and
co-operate with Eucleus. It appears, however, that, with his
ships, he was at the island of Thasos when Brasidas suddenly
appeared before Amphipolis. Eucleus sent in all haste for Thucy-
dides, who arrived with his ships from Thasos just in time to
beat off the enemy from Eion at the mouth of the Strymon, but
not in time to save Amphipolis. The profound vexation and
dismay felt at Athens found expression in the punishment of
Thucydides, who was exiled. Cleon is said to have been the prime
mover in his condemnation; and this is likely enough.

His Predecessors.

His Greek predecessors in the recording of events had
been, he conceived, of two classes. First, there were
the epic poets, with Homer at their head, whose characteristic
work was the lyra—Odyssey and Iliad, in the evocative
power, the charm, the splendour of things past. Secondly, there
were the Ionian prose writers whom he calls “chroniclers” (see
Logographos), whose general object was to diffuse a knowledge of
legends preserved by oral tradition and of written documents—usually lists of
officials or genealogies—preserved in public archives; and they published
their materials as they found them, without criticism. Thucydides
approached the study of history by the way of the "γραφή, the difference between the terms answering to that
between compilation of a somewhat mechanical kind and historical
composition in a higher sense. The vice of the "chroniclers,
was that they were more interested in personal details and took no pains to
make their narratives trustworthy. Herodotus was presumably
regarded by him as in the same general category.

In contrast with these predecessors Thucydides has subjected
his materials to the most searching scrutiny, the ruling principle
of his work has been strict adherence to carefully
verified facts. As to the deeds done in the war,
Hearsay from the first informant or on arbitrary
conjecture. My account rests either on personal knowledge or on
the closest possible scrutiny of each statement made by others.
The method of research and the mode of presentation was the
same so far as their cases were given by those who had witnessed the several events, as
partiality swayed or memory served them.

It might be supposed that the speeches which Thucydides has
introduced into his history have this stamp of scientific accuracy; it is,
therefore, well to consider their nature
and purpose rather closely. The speeches constitute
between a fourth and a fifth part of the History. If
they were eliminated, an admirable narrative would indeed remain,
with a few comments, usually brief, on the more striking characters
and events. But we should lose all the most vivid light on the
inner workings of the Greek political mind, on the motives of the actors
and the arguments which they used—all, a word, on the whole
play of contemporary feeling and opinion. To the speeches is due in
particular measure the imperishable intellectual interest of the
History; it is, to use a word, the soul of the
Peloponnesian War. They are so ltit up with keen thought as to become
illustrations of general laws, and to acquire a permanent suggestive-
ness for the student of politics. When Herodotus and Thucydides
hold conversations or deliver speeches, he was following the
precedent of epic poetry; his tone is usually colloquial rather than
rhetorical; he is merely making thought and motive vivid in
the words of a actor or by a word, to a sense of the tradition by which historians were so long held to be warranted in
introducing set speeches of their own composition. His own
account of his practice is given in the following words: "As to
the speeches I made up of the war or in its course, I have
found it difficult to retain a memory of the precise words which
I had heard spoken; and so it was with those who brought me reports

1 Freeman, Historical Essays, 2nd series, vol. iii.; on the general
questions of the structure of the work and the view of the
other which it represents see PELOPONNESEAN WAR; and GREECE;
Ancient History, § Authorities.
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But I have made the persons say what it seemed to me most opportune for them to say in view of each situation; at the same time I have adhered as closely as possible to the general sense of what was actually said. So far as the language of the speeches is concerned, Thucydides himself, or rather his informants, used the type of language which he found in his sources, or which the historian has given to no other speaker. Such strongly marked characteristics as the curt bluntness of the Spartan ephors Sthenelaidas, or the insolent vehemence of Alcibiades, are also indicated. In the speeches of Thucydides, more than in those of any other writer, the speech is the matter, not in the form. In regard to those speeches which were delivered at Athens before his banishment in 424—and seven such speeches are extant—Thucydides never relies either on his own recollection or on the sources accessible to a resident citizen. In these cases there is good reason to believe that he has reproduced the substance of what was actually said. In other cases he had to trust to more or less imperfect reports or the "general sense"; and in some instances, no doubt, the speech represents simply his own conception of what it would have been "most opportune" to have been said. It is most evident of such instances on the addresses of leaders to the people. The aim in these military harangues—which are usually short—is to bring out the points of a strategical situation; a modern writer would have himself better fitted for the task. Thucydides did not take the speeches of Pericles as the model, or as the parallel to his own, but he used them for the purpose of introducing the battle. The comparative indifference of Thucydides to dramatic verisimilitude in these military orations is curiously shown by the fact that the speech of the general on the sea is written without any reference to the fate of the other general on the other as if they had been delivered in debate. We may be sure, however, that, wherever Thucydides had any authentic clue to the actual words of a speech, he preferred to follow that clue rather than to derive on his own invention.

Why, however, did he not content himself with simply stating, in his own person, the arguments and opinions which he conceived to be essential to the division? The reason must be sought from the standpoint of a Greek in the 5th century B.C. Epic poetry had then for many generations exercised a powerful influence over the Greek mind. Homer had accumulated a wealth of information in his poetry, and the expression of human energy—first, an account of a man's deeds, then an image of his mind in the report of his words. The Homeric heroes are exhibited both in action and in speech. Perhaps the contemporary readers of Thucydides were more habituated to a civic life in which public speech played an all-important part. Every adult citizen of a Greek democracy was a member of the assembly which debated and decided great issues. The law courts, the festivals, the drama, the market-place itself, ministered to the Greek love of animated description. To a Greek of that age a written history of political events would have seemed strangely inappropriate. Poetry had been an established vehicle of expression, especially if it did not offer some mirror of those debates which were inseparably associated with the central interests and the decisive momentousness of the life of the body politic. And, moreover, the reading public might have said, Thucydides confined that oratorical licence to the purpose which is its best justification: with him it is strictly dramatic, an aid to the complete presentation of action, by the vivid expression of ideas and arguments which were really current at the time. Among later historians who continued the practice, Polybius, Sallust and Tacitus most resemble Thucydides in this particular; while in the Byzantine historians, as in some moderns who followed classical precedent, the speeches were usually mere occasions for rhetorical display. Botta's History of Italy from 1780 to 1814 affords one of the latest examples of the practice, which is confined to the wars of Napoleon.

The present division of the History into eight books is one which might well have proceeded from the author himself, as being a natural and convenient disposition of the contents. Book II. contains the speeches of the Peloponnesian War. The first nine years of the war are contained in the second, third and fourth books—three years in each. The fifth book contains the text of the book of Thucydides, for in the first year of the Sicilian expedition fills the sixth and seventh books. The eighth books opens that last chapter of the struggle which is known as the "Peloponnesian Peace." Far more speeches end off abruptly—in the middle of a sentence, indeed—in the year 411.

The principal reason against believing that the division into eight books was made by Thucydides himself is the fact that a division of this kind, or any similar one, did not exist in antiquity, as appears from Marcellinus (§ 58). It is very improbable—indeed hardly conceivable—that this should have been the case if the eight-book division had come down from the hand of the author. We may infer, then, that the division of the work into eight books was introduced at Alexandria—perhaps in the 3rd or 2nd century B.C. That division was already familiar to the grammarians of the Augustan age. Dionysius of Halicarnassus, who recognizes it, has also another mode of indicating the eight-book division by the number of the lines which they contained. Thus, in the MS. which he used, the first 57 chapters of book i. contained about 1700 lines (divalent to about 1700 lines in Bekker's stereotyped text). (On the first division see ALBRECHT DURER'S APOLOGIA, 1525; THUCYDIDES, Ad Init.; and GREECE: Ancient History, § Authorities.)

The division of the war by summers and winters (σαράνθος καὶ ξυνάθροι)—the end of the winter being considered as the end of the season—is perhaps the other which Thucydides himself used, for there is no indication that he made any division of the History into books. His "summer," "autumn" and "winter" were generally speaking, from March or April to the end of September of the following year. His "winter."—November to February inclusive—means practically the period during which military operations, by land and sea, usually or partly suspended. When he speaks of "summer" and "winter" as answering respectively to "half" the year (v. 20, 3), the phrase is not to be pressed: it means merely that he divides his year into these two parts. The mode of reckoning is essentially a rough one, and is not to be viewed as if the commencement of summer or of winter could be precisely fixed to constant dates. For chronology, besides the festivals, he uses the Athenian list of names on the Spartan list of ephors and the Argive list of priests of Hera.

There is no reference to the History of Thucydides in the extant Greek writers of the 4th century B.C.; but Lucian has preserved a tradition of the enthusiasm with which it was studied by Demosthenes and the great orator of Aphiæa for having read it, or even to have learnt it by heart. The Alexandrian critics acknowledged Thucydides as a great master of Attic. Sallust, Cornelius Nepos, Plutarch and Quintilian are among the authors whose admiration for him can be traced in their work, or has been expressly recorded. The most elaborate ancient criticism on the division and composition of Thucydides is contained in three essays by Dionysius of Halicarnassus.

Among the best MSS. of Thucydides, the Codex vaticanus 126 (11th century) represents a recension made in the Alexandrian or Roman age. In the first six books the number of MSS. is almost the same to which the Codex vaticanus belongs, but in book vii. it is somewhat larger; in book viii. it is so large that here the Vaticans, as compared with the other MSS., acquires the character of a revised text. Other important MSS. are the Palatinus 252 (11th century); the Cassianus (A.D. 1752); the Augustanus monacensis 450 (A.D. 1901). A collation, in books i., ii. of two Cambridge MSS. of the 15th century (W. 3. 18; Kx. 5. 19) has been published by Shilleto. Several French MSS. (H. C. A. F.), and a Venetian MSS. (V.) collated by Arnold, also deserve mention. The Aldine edition was published in 1502. It was formerly supposed that there had been two editions. Now, however, it is thought that the first pointed out that the only Juntine edition was that of 1526, and that the belief in an earlier Juntine, of 1506, arose merely from the accidental omission of the word nixema in the Latin translation, made by Rene of Grignion de Montbrun in 1602, as well as from the fact that the editions in Grenfell and Hunt's Oxyrhynchus papyri (1908), vi., which also contains an anonymous commentary (pub. 1st century) on Thuc.

The most generally useful edition is Classen's, in the Weidmann Series (1862-1878; new ed. by Steup, 1882-1892); each book can be obtained separately. Arnold's edition (1848-1851) contains much that is still valuable. For books i. and ii. Shilleto's edition (1872-1877) is a valuable commentary, though not full, and deals admirably with many difficult points. Among other important complete editions, it is enough to name those of Duker, Bekker, Goeller, Popoff, Krüger, and Dippel. For collations and selections of the late (1905) see J. B. Mayor's Guide to the Greek Text (1905). Special mention may be made of those by E. C. Marchant. Latest editions of the text are by H. Stuart Jones (1900-1901), in the Oxford Classical Texts (1919), by C. H. Hutton (1901; ed. minor, 1903). Béâtant's lexicon to Thucydides (1843) is well executed. Jowett's translation (1853) is supplemented by a volume of notes. Dale's version (Bohn) also deserves mention (London, 1859). Lastly, Jowett's edition (London, 1880) contains an essay on "The Speeches of Thucydides," which has been translated into German (see Eduard Meyer, Forschungen zur alten Geschichte, Bd. ii. pp. 426-436). The best clue to Thucydidean names is in E. B. Schemmann, Thucydides in Ancient History (1893), and supplemented by the articles by G. Meyer, in Bursian's Jahrbücher, (1895) lxix., (1897) lxviii. Busolt, Griechische Geschichte, iii. (1912), and E. C. Marchant, "Thucydides," in Witz-Moellendorf, "Die Thukydidische-Legende," Hermes, (1878) xliii., is all important. All works on ancient Greek History contain discussions of Thucydides, and an interesting criticism is that of J. B. Bury, Ancient Greek Historians (1905). F. M. Cornford.
THUGS—THUGUT, BARON

Thucydides myhistoricus (1907), sought to prove that the History is really only an historical tragedy, i.e. a dramatized version of the facts, but this view has not been adopted. (R. C. J.; J. M. M.)

THUGS. That the Sanskrit root stho (Pali, thak), to cover, to conceal, was mainly applied to fraudulent concealment, appears from the noun sthaga, a cheat, which has retained this significance in the modern vernaculars, in all of which it has assumed the form tha (commonly written thug), with a spelling-common in Thugs. The Thugs were a predatory fraternity of professional assassins, who in gangs of whom 10 to 100 travelled in various guises through India, wormed themselves into the confidence of wayfarers of the wealthier class, and, when a favourable opportunity occurred, strangled them by throwing a handkerchief or nose round their necks, and then plundered and buried them. All this was done according to certain ancient and rigidly prescribed forms and after the performance of special religious rites, in which the consecration of the pickaxe and the sacrifice of sugar formed a prominent part. From their using the noose as an instrument of murder they were also frequently called Phansighars, or "noose-operators." Though they themselves trace their origin to seven Mahomedan tribes, Hindus appear to have been associated with them at an early period; at any rate, their religious creed and practices as stanch worshippers of Kalî (Devi, Durga), the Hindu goddess of destruction, had certainly no flavour of Islam in them. Assassination for gain was with them a religious duty, and was considered a holy and honourable profession. They had, in fact, no idea of doing wrong, and their moral feelings did not come into play. The will of the goddess by whose command and in whose honour they followed their calling was revealed to them through a very complicated system of omens. In obedience to these they often travelled hundreds of miles in company with, or in the wake of, their intended victims before a safe opportunity presented itself for executing their design; and, when the deed was done, rites were performed in honour of that tutelary deity, and a goodly portion of the spoil was set apart for her. The fraternity possessed also a jargoon of their own (Ramosai), as well as certain signs by which its members recognized each other in the remotest parts of India. Even those who from age or infirmities could no longer take an active part in the operations continued to aid the cause as watchers, spies, or dressers of food. It was owing to their thorough organization, the secrecy and security with which they went to work, but chiefly to the religious garb in which they showered their murders, that they could, unmolested by Hindu or Mahomedan rulers, recognized as a regular profession and paying taxes as such, continue for centuries to practise their craft. Both the fractions into which they were divided by the Nerbudda river laid claim to antiquity; while the northern, however, did not trace their origin further back than the period of the early Mahomedan kings of Delhi, the southern fraction not only claimed an earlier and purer descent, but adhered also with greater strictness to the rules of their profession.

The earliest authenticated mention of the Thugs is found in the following passage of Ziau-d din Barni's History of Firoz Shah (written about 1356): "In the reign of that sultan, that is, about 1290, some Thugs were taken in Delhi, and a man belonging to that fraternity was the means of about a thousand being captured. But not one of these did the sultan have killed. He gave orders for them to be put into boats and to be conveyed into the lower country, to the neighbourhood of Lakhnauti, where they were to be set free. The Thugs would thus have to dwell about Lakhnauti till they could not troubles written thugs of Delhi any more." (Sir H. M. Elliot's History of India, iii. 147.) The first European travellers who speak of them without mentioning their name are Thévenot (1665) and Fryer (1753). Though instances of Thagi (Thuggee) had been known to the English rulers in India for many years, and sporadic efforts had been made by them towards the extinction of the gangs, it was not till Lord W. Bentinck (1828-1833) took vigorous steps in this matter that the system was gradually unmasked, and finally all but stamped out. His chief agent, Captain (afterwards Sir William) Sleeman, with several competent assistants, and the co-operation of a number of native states, succeeded in completely grappling with the evil, so that up to October 1835 no fewer than 1562 Thugs had been committed, of which number 382 were hanged and 986 transported or imprisoned for life. According to the Thuggee and Dacoity Report for 1879, the number of registered Punjabi and Hindustani Thugs then still amounted to 344; but all of these had already been registered as such before 1852. Thuggee in the United Provinces of the Gangetic Provinces in 1852, 1837-1838. The Thuggee and Dacoity department continued to exist until 1904, though its operations had long been confined to the suppression of organized robbery in native states. Its place is now taken by the Central Criminal Intelligence Department.


THUGUT, JOHANN AMADEUS FRANCIS DE PAULA, BARON (1736-1818), Austrian diplomatist, was born at Linz on the 24th of May 1736. His origin and name have been the subject of legends more or less malicious and probably the inventions of enemies. It has been said that the correct form of his name was Thumichtgut, or Thenichtgut (do no good), and was altered to Thugut (do good) by Maria Theresa. Tunicotta has been given as a variation. But Thugut was the name of his grandfather, who belonged to Budweiss in southern Bohemia. He was the legitimate son of Johann Thugut, an army paymaster, who married Eva Maria Mösbauber, daughter of a miller near Vienna. The paymaster, who died about 1760, left his widow and children in distress, and Maria Theresa took charge of them. Johann Amadeus was sent to the school of Oriental languages. He entered the Austrian foreign office as an interpreter and was appointed dragoman to the embassy at Constantinople. In 1769 he was appointed Chargé d'Affaires, and in that capacity secured a grant of money and a promise of the territory of Little Wallachia from the Turks during the negotiations connected with the first partition of Poland (see Poland: History). In 1771 he was appointed Intermnunci at Constantinople and was actively engaged, under the direction of Prince Kaunitz, in all the diplomacy of Austria in Turkey and Poland until he secured the cession of the Bukovina on the 7th of May 1775. During these years Thugut was engaged in a mean intrigue. His salary as dragoman was small, and his needs great. He therefore agreed to receive a pension of 13,000 livres, a brevet of lieutenant-colonel, and a promise of a safe refuge in case of necessity from the king of France, Louis XV. The condition on which the pension was granted was that he took advantage of his position as an Austrian official to render secret services to France. The only excuses to be made for him are that such hidden arrangements were not uncommon before and in his time, and that as a matter of fact he never did render France any real service, or betray his masters at Vienna. Yet the terror of discovery disturbed him at several periods of his life, and when Louis XV. died in 1774 he showed a strong disposition to take refuge in France, and would have done so if Louis XVI. would have given him a promise of employment. His pension was continued. It seems to be tolerably certain that an interval of a few years belonged to the emperor Francis II. His services at Constantinople were approved by Prince Kaunitz (q.v.), who may possibly have been informed of the arrangement with the French secret diplomatic fund. It is never safe to decide whether these treasons were single or double. When Thugut was appointed Intermunici he was also ennobled, being raised to the Ritterstand. After 1775 he travelled in France and Italy, partly on diplomatic service. In 1778 he was the agent through whom Maria Theresa entered into direct negotiations with Frederick the Great, in order to stop the Bavarian War. In 1790 he was Austrian envoy in
Warsaw, but in 1783 he applied for leave and satisfied his hankering after France by living for four years in Paris. It was in this time that his savings, made during his years of service at Constantinople, by means which would probably not bear investigation, were invested, and in France, Thugut became acquainted with many of the leaders in the Revolution. From 1787 to 1789 he was minister at Naples, and showed great tact in managing the queen, Maria Carolina, a daughter of Maria Theresa. In 1790 he was sent by the emperor Joseph II. to Bucharest, nominally as commissioner with the hospodar of Wallachia, but in reality in order that he might open negotiations for peace with the Turks. Until 1792 he was much in France and Belgium, partly as a diplomatic agent, but largely because he was anxious to secure his investments, which were ultimately lost. His personal grievances may have had a share in creating the hatred of the Revolution and the Jacobins, for which he was afterwards famous. In 1792 he was associated with Mercy Argenteau, formerly Austrian ambassador in France, as diplomatic agent at the headquarters of the allied army. The mismanagement of the invasion of France excited his anger. He came back to Vienna to report the facts to Francis II., to whom he presented a statement on the 27th of December. On the 19th of January 1793 he was appointed armé-diplomat at headquarters, largely, it is said, by the intrigues of Philip Cobenzl and Spielmann, who wished to have him out of the way. But he never invested, for at this time Russia and Prussia were parts of Poland. Austria, entangled in the war with France, was left empty-handed (see POLAND: History). The emperor, dissatisfied with the ministers who had not prevented this misfortune, dismissed them, and after some delay Thugut was named "director of the foreign affairs of Austria" on the 23rd of March 1793. When Prince Kaunitz died in the following year Thugut was appointed to "discharge the duties of the office of house, court, and state chancellor." His promotion to the foremost place in the Austrian administration met with much opposition, from which he was rescued by the return of Maria Theresa of Naples. The Austrian government was by tradition very aristocratic. The empress Maria Theresa, mother of Francis II., though she valued the services of Thugut, had consented with reluctance to make him commander of the order of St Stephen, and had only yielded to the urgent requests of Kaunitz and of her son Joseph II. She thought the promotion excessive for a man of his plebeian origin. The nobles, who thought that the great offices of state should go to themselves, were of the same opinion. Thugut, who had a large fund of vanity, resented their insolence, and did nothing to disarm their hostility. He was unimportant, dull in conversation, and the discharge of his duties he took counsel with nobody. All the confidential work of his department was done by himself with the help of two clerks he could trust, and he took all important papers directly to the emperor, keeping no copies in his own office. He had his own experience to teach him how easy it was to baffle the officials of Austria. The nobles, who regarded themselves with good cause as the supporters of the Crown, and who expected to be consulted, resented his indifference and secrecy as the arrogance of an upstart. They were his constant enemies and critics. A bitter quarrel broke up between Thugut and his opponents on personal grounds, but with these exceptions Thugut had no friends in Austria. Out of it, he was commonly regarded as the representative of all that was most unscrupulous and self-seeking in the methods of the Austrian government. He had inherited from his master Prince Kaunitz the firm conviction that Prussia was the worst enemy of Austria. From him, too, he had learnt that the first duty of an Austrian minister was to be an increaser of the empire, even at the expense of allies, and that excuses for annexation were to be made when they could not be found. His hatred of France, and of the Revolution, was no doubt sincere. But while prepared to defend Europe from French aggression, it was with the implied intention that Austria should be rewarded for her exertions by increases of territory, and should be made the absolute mistress of Germany. The history of his policy from 1793 to 1800 is the history of Europe. The conflicting objects which he kept before him, resistance to French aggression on the west, and to Russian and Prussian aggressions on the east, and the pursuit of more territory for Austria, compelled him to divide his exertions and his forces. Thus in 1793-94 he recalled troops from the west to participate in a partition of Poland, thereby taking pressure off Austria doing much to open the way for her subsequent victories. Some of his actions cannot be described as other than criminal. He was certainly responsible for the murderous attack on the French envoys at Rastadt in April 1799. He may have intended that they should only be robbed, but he must be held responsible for the acts of his agents. So again he has to answer for the perverse policy of Austria in 1799 when Suvarov (q.v.) and the Russians were recalled from northern Italy for no visible reason except that Austria should be left in sole possession of the dominions of the king of Sardinia, with a good excuse for retired from public life. The correspondence of Joseph de Maistre shows how bitterly the continental allies of Austria resented her selfishness, and how firmly they were persuaded that she was fighting for her own hand. That Thugut believed that he was doing his duty, and that he was carrying on the traditional policy of Austria, may be true. Yet his methods were so extreme, and his attitude so provocative as to justify the judgment passed on him by Kaunitz—namely, that he required the control of a strong hand if good results were to be obtained from his ability. After the defeats of Austria in Italy in 1796-97 and the Peace of Campo Formio, it became fixed object of the French, and with a growing party in Austria who held him responsible for the disasters of the war, to secure the removal of Thugut. He found no support, except from the British government, which considered him as a sure ally and had great influence at Vienna as paymaster of subsidies. The death of the empress Catherine of Russia deprived him of a friend at court. During the campaigns of 1799 and 1800 Thugut was the advocate of war "to the knife." At the end he was kept in office only by the vigorous support of England. The battle of Hohenlinden on the 3rd of December 1800 made his position untenable. He retired from public life.

THUIN, a town of Belgium, in that part of the province of Hainaut called "entre Sambre et Meuse." Pop. (1904), 6198. It is situated on the Sambre about 9 m. S.W. of Charleroi. The old part of the town, which dates back to the 10th century, occupies a narrow promontory between the Sambre and a small stream called the Biesmelle. The ruined tower called after him is all that remains of the fortress constructed by Bishop Notger of Liége. It was successfully defended against the Normans and long afterwards against the French under Marshal de Lorges in 1654. Although the town itself retains something of its medieval appearance it is the centre of a great manufacturing and mining district, the banks of the Sambre being lined with factories and coal-yards.

THULE, the Greek and Roman name for the most northerly known land in the north Atlantic. The first to use the name was the Greek navigator Pytheas (about 300 B.C. probably). He called it the most northerly of the British Isles and says that he reached it after six days' sail from Britain: it was inhabited, but produced little; corn grew there sparingly and ripened ill; in summer the nights were long and bright. This account of his travels is lost save for fragments, and the few surviving fragments
do not determine where his Thule was, but Müllenhoff is probably right in thinking it was the Shetlands. The Faeroes, Iceland and Norway have also been suggested, but are for various reasons much less likely. After Pythagoras, the name of the Thule is lost for the fact that local Thules Agricolae’s first in u. B.C. sailing up the east coast of Scotland is said to have espied but not to have reached Thule (“dispecta est Thule”) but the phrase is merely literary. The actual point meant to be the Orkneys or the Shetlands, or even some fragment of Scotland seen across the water. In some later writers (Procopius, &c.) Thule seems sometimes used to denote Scandinavia. The phrase “ultima Thule” is commonly used to describe the farthest limit possible.

(Th. B. C.)

THÜMML, MORITZ AUGUST VON (1738–1817), German humorist and satirical author, was born on the 27th of May 1738 at Schönhof near Leipzig. Educated at Rossleben and the university of Leipzig, where he studied law, he held from 1761 till 1783 various offices in the ducal court of Saxo-Coburg, where he became privy councillor and minister of state. He retired in 1783 and died at Coburg on the 26th of October 1817. He wrote a comic prose epic, Wilhelmine, oder der vomäßliche Pedant (1764); and Die Invasion der Liebe (1771), a tale in verse. His most famous work is his Reise in die mitländischen Provinzen von Frankreich, Holland, Norwegen (1795), in six volumes, in which the influence of Wieland is unmistakable. Schiller, who found this work wanting in aesthetic dignity, yet allowed that the keen knowledge of men and things it displays makes it a valuable contribution to literature. Thümmel’s other writings are unimportant.

His collected works were published at Leipzig in six volumes (1812), and again in 1820 (7 vols), with a biography by E. von Gruner. The most recent edition is that of 1855 (8 vols). See also F. Bobertag, Erzählende Prosa der klassischen Periode vol. i. (Kürschner’s Deutsche Nationalliteratur, vol. cxxxi., 1886). Wilhelm von Gruner has also been edited by R. Rosenbaum (1894). (Th. B. C.)

THUN (Fr. Thoune), a picturesque little town in the Swiss canton of Bern, built on the banks of the Aar, just as it issues from the Lake of Thun, and by rail 15 m. S.E. of Bern, or 17½ m. N.W. of Interlaken. It is the capital of the Bernese Oberland, the snowy peaks of which are well seen from it. It has 6,600 inhabitants, mostly German-speaking and Protestants. The 18th-century parish church and the 15th-century castle rise in a striking fashion above the town, in the chief street of which are arcades (locally called Lauben) as in Bern. There is a museum in the tower of the castle, while in and near the town (in the Heimberg, the Belp, the Aar, etc.) there are fine old homes. It is the capital of the lords it belonged to 1127 to the house of Zähringen, and on its extinction (1218) to the counts of Kyburg. The heiress of that family brought Thun (and Burgdorf) in 1273 to the cadet or Laufenburg line of the Habsburg family, her mother having (1264) granted the town a charter of liberties that confirmed an earlier grant of 1256. In 1375 the town was mortgaged to Bern, to which it was sold outright in 1384. From 1708 to 1802 Thun was the capital of the canton Oberland of the Helvetic Republic. (W. A. B. C.)

THUN, LAKE OF, in the Swiss canton of Bern, the second lake (after Lake Neuchâtel that of Brienz) into which the river Aar (q.v.) expands. It lies in a deep hollow between (N.W.) the town of Thun (q.v.) and (E.) the plain on which Interlaken (q.v.) is built between this lake and that of Brienz. It is 11½ m. in length, 2 m. in width, and its maximum depth is 712 ft., while its area is 18½ sq. m., and its surface is 1837 ft. above sea-level. Most splendid views of the great snowy peaks of the Bernese Oberland range are obtained from the lake, while the beauty of its shores renders it a formidable rival in point of picturesque ness to the Lake of Lucerne. Its chief feeder is the Kander (swollen shortly before by the Simme), which in 1714 was diverted by a canal into the lake (south-western end). On or above the south-western shore (along which runs the railway from Thun to Interlaken, 17½ m.) are Spiez (a picturesque village with an ancient castle, and the starting-point of railways towards the Gemini and Montreux) and Aeschi (admirably situated on a high ridge). On the other shore of the lake are Oberhofen and Gunten (above which is Sigriswil), and Meriligen, while above the lake, near its east end, are the wooded heights of St Beatenberg, well known to summer visitors. The first steamer was placed on the lake in 1815. (W. A. B. C.)

THUNBERG, KARL PETER (1743–1828), Swedish naturalist, was born at Jönköping on the 11th of November 1743, and became a pupil of Linnaeus at the university of Upsala. After graduating in medicine there in 1770 he obtained an appointment as surgeon in the Dutch East India Company, and sailed to the Cape of Good Hope in 1772. He spent three years there, and then went to Japan, where he remained till 1776, engaged in making collections of plants. On his return in 1779 he visited England, and made the acquaintance of Sir Joseph Banks. Thunberg was appointed to the professorship of botany in 1784. He published his Flora japonica in 1784, and in 1788 he began to publish his travels. He completed his Prodromus plantarum in 1800, his Icones plantarum japonicarum in 1805, and his Flora capensis in 1813. He published numerous memoirs in the transactions of many Swedish and other scientific societies, of sixty-six of which he was an honorary member. He died near Upsala on the 8th of August 1828. A genus of tropical plants (Thunbergia), of the natural order Acanthaceae, which are cultivated as evergreen climbers, is named after him.

THUNDER, the noise which accompanies or follows a flash of lightning, due to the disturbance of air by a discharge of electricity (see LIGHTNING; ATMOSPHERIC ELECTRICITY and METEOROLOGY). The Old English word is thaner, also the name of the Scandinavian god Thor (q.v.), which is cognate with Dutch donder, German Donner. The root is than-, Indo-European tan-, cf. Latin tonare, teniru. This root is apparently another form of stam, as in skr. stam, to sound, thunder, Gr. στηνησ, to grunt, Eng. "stam.

THUN-HOHENSTEIN. The family of Thun-Hohenstein, one of the wealthiest of the Austrian nobility, which has for more than 200 years settled at Tetschen, in Bohemia, has given several distinguished members to the Austrian public service. Of the three sons of Count Franz, the eldest, FRIEDRICH (1810–1881), entered the diplomatic service; after holding other posts he was in 1850 appointed president of the restored German Diet at Frankfort, where he represented the anti-Prussian policy of Schwarzenberg, and often came into conflict with Bismarck, who was Prussian envoy. He was afterwards ambassador at Berlin and St Petersburg. After his retirement from the public service in 1863 he supported in the Bohemian Landtag and the Austrian Reichsrat the federal policy of his brother Leo. In 1879 he was made hereditary member of the Upper House. In this position he was on his death, on the 24th of September 1881, succeeded by his eldest son FRANZ ANTON (b. 1847). Like the rest of his family, he belonged to the Federalist party, and his appointment in 1885 as governor of Bohemia was the cause of grave dissatisfaction to the German Austrians. He took a leading part in the negotiations of 1860 for the Bohemian settlement, but the elections of 1891, in which the young Czechs who were opposed to the feudal party gained a decisive victory, made his position a very difficult one. Contrary to expectation, he showed great energy in suppressing disorder; but after the proclamation of a state of siege his position became untenable, and in 1895 he had to resign. On the resignation of Badeni in 1896 he was made minister president, an office which he held for little more than a year, for, though he succeeded in bringing to conclusion the negotiations with Hungary, the support he gave to the Czechs and Slovenians increased the opposition of the Germans to such a degree that parliamentary government became impossible, and at the end of 1899 he was dismissed.

The third son of Count Franz, LEOPOLD or LEO (1811–1888), was one of the leading Austrian statesmen. After studying at the university of Prague he travelled through Europe, and among other countries he visited England, where he became acquainted with James Hope (afterwards Hope-Scott) and other leaders of the Tractarian party. He was much affected by the romantic
movement and the Ultramontane revival, and after his return home interested himself greatly in the revival of Czech language and literature and the growth of the Bohemian national feeling. He formed a personal friendship with Palacky and others of the Czech leaders; he helped in the foundation of schools in which Czech should be taught, and set himself to acquire some knowledge of the language. He was also interested in prison reform, on which he wrote, and other philanthropic work. After serving under Stadion in Galicia, he was in 1848, after the outbreak of the revolution, appointed president of the administration and acting Stadthalter in Bohemia. He had scarcely entered on his duties when the rebellion of June broke out in Prague. In order to avoid bloodshed, he went down to the insurgents on the barricade, but was seized by them, imprisoned, and for some time his life was in danger. On his release he vigorously supported Windsichgrätz, who was in command of the troops, in the restoration of order, but thereby lost his popularity and was superseded. He still defended the Bohemian national movement, and in one of his writings laid down the principle that nationality was one of the greatest and first claims of the people, and was the controlling force of the state. Notwithstanding this, in 1849 he accepted the office of minister of religion and education, which he held in 1850 under the autocratic and centralizing administration of Schwarzenberg and Bach. At first he threw himself with great energy into the task of building up an adequate system of schools. He summoned experienced teachers, Protestant as well as Catholic, from Germany, established middle and higher schools in all parts of the empire, superseded the antiquated textbooks and methods of instruction, and encouraged the formation of learned societies, for the growth of a professional spirit and independence among the teachers. It is noticeable that at this time he insisted on the use of German in all schools of higher education. As minister of religion he was to a certain extent responsible for the concordat which again subjected the schools to the control of the Church: to a certain extent he thereby undid some of his work for the extension of education, and it was of him that Grillparzer said, "I have to announce a suicide. The minister of religion has murdered the minister of education." But during his administration the influence of the church over the schools was really much less than, by the theory of the concordat, it would have appeared to be. The crisis of 1860, by which the office he held was abolished, was the end of his official career; for the rest of his life he was very prominent as the leader of the Federalist party in Bohemia. His high social position, his influence at court, his character, as well as his undoubted abilities and learning, not often in Austria found in a man of his rank, gave him great influence. He supported the claims of Bohemia to a full autonomy; he strongly attacked both the February constitution and the Ausgleich with Hungary; what he desired was a common parliament for the whole empire based on a settlement with each one of the territories. With the old Czechs he refused to recognise the constitution of 1867; he helped to draft the declaration of 1868 and the fundamental articles of 1871, and took a leading part in the negotiations during the ministry of Potocki and Hohenwar. In order to found a strong Conservative party he established a paper, the Vaterland, which was the organ of the Clerical and Federalist party. It is needless to say that he protested against the ecclesiastical legislation of 1867 and 1873. He married in 1847 the countess Clâm-Martinc, but there was no issue of the marriage. He died in Vienna on the 17th of December 1888.

See the very full article by Freuchenberg in the Biographie, which superseded his earlier biography. (J. W. He.)

THURET, GUSTAVE ADOLPHE (1817-1873), French botanist, was born in Paris on the 23rd of May 1817. He came of an old Huguenot family, which had sought refuge for a time in Holland after the revocation of the Edict of Nantes. A trace of Dutch influence still persists in the pronunciation of the family name in which the final t is sounded. Thuret's mother was brought up in England; English was the first language that he learnt, and he appears to have retained strong sympathies with Great Britain throughout life. As a young man he studied for the law; in his leisure time he was an ardent musician, and it was from a musical friend, de Villers, that he received, in 1837, his first initiation into botany. Beginning simply as a collector, he soon came under the influence of Joseph Decaisine (1809-1882), whose pupil he became. It was Decaisine who first encouraged him to undertake those botanical studies which were to become the chief work of his life. Thuret twice visited Constantinople in company with the French ambassador, M. de Pontois, and was for a time attached to the French embassy there. His diplomatic career, though of short duration, gave him a valuable opportunity of studying the Oriental flora. After travelling in Syria and Egypt in the autumn of 1841, he returned to France. Giving up his intention of entering the civil service, he retired to his father's country house at Rentilly, and thenceforth devoted himself to scientific research. He had already, in 1840, published his first scientific paper, "Notes sur l'antherè de Chara et les animalcules qu'elle renferme," in which he first accurately described the organs of motion of the "animalcules" or spermatozoïds of these plants. He continued his studies of the zoözoïds of such cells of algae and other Cryptaephyrae, and the exact knowledge of these remarkable motile stages in vegetable life is largely due to his labours. He spent a great part of his time, up to 1857, on the Atlantic coast of France, assiduously observing the marine Algae in their natural habitat and at all seasons. In conjunction with his friend Édouard Borne, he became the recognized authority on this important group of plants, of which the two colleagues acquired an unrivalled knowledge. Their work, while remarkable for taxonomic accuracy, was more especially concentrated on the natural history, development and modes of reproduction of the plants investigated. The discovery of sexual reproduction in seaweeds is almost wholly the work of these two men. The researches on the fecundation of the Fucaceae were published by Thuret in 1853 and 1855; the complicated and difficult question of the sexual reproduction in Florideae was solved by the joint work of Thuret and Borne (1867). These great discoveries—of far-reaching biological significance—stand out as the chief, but every group of marine Algae was elucidated by the researches of Thuret and his colleague. There are few scientific authors whose work has so completely stood the test of subsequent investigation and criticism. Thuret's style in expounding his results was singularly clear and concise; he was a man of wide education, and possessed the power of expressing his ideas with literary skill. Unfortunately, much of his best work remained unpublished during his life. A portion of the material accumulated by himself and his colleague was embodied in two magnificent works published after his death—the Notes algologiques (1876-1880), and the still fuller Études physiologiques (1878). These volumes, as well as earlier memoirs, are illustrated by drawings of unequalled accuracy and beauty by the hand of the artist Ricour, whom Thuret employed. In 1857 Thuret removed to Antibes on the Mediterranean coast, where, on a once barren promontory, he established a botanical garden which became famous throughout the scientific world. Since his death the Antibes establishment has been placed at the disposal of botanical workers as an institute for research. Thuret died suddenly, while on a visit to Nice, on the 10th of May 1875, when he had scarcely completed his fifty-eighth year. He was a man of considerable wealth, who devoted his money as freely as his time and labour to the advancement of science, but his high reputation rests on the brilliancy of his personal investigations.

The best and fullest account of Thuret's career is that by his friend and fellow worker Borne, published in the Annales des sciences naturelles for 1876. An English notice of his life, by Professor W. G. Farlow, will be found in the Journal of Botany for the same year. (D. H. S.)

THURGAU (Fr. Thurgovie), one of the cantons of north-eastern Switzerland, bordering on the Lake of Constance and the Rhine as it issues from that lake. Its total area is 399-9 sq. m., of which 326-9 sq. m. are reckoned as "productive" (forests covering 69-3 sq. m. and vineyards 4-4 sq. m.); of the "unproductive"
Thurible

portion most (593 sq. m.) consists of the cantonal share of the Lake of Constance. The canton is partly made up of the central portion of the valley of the Thur (which rises in the Toggenburg), with its affluent the Murg, and partly of the level stretch along the west shore of the Lake of Constance and left bank of the Rhine. Low ranges of wooded hills separate the lake from the Thur valley and the latter from that of the Murg, as well as from the cantons of Zürich and of St. Gall, the highest point in the canton being situated at its southern extreme. The area is much increased by the donation of the 13th century, of 1272, Hörnli (1727 ft.), itself wholly in Zürich. The small outlying district of Horn is an "enclave" in the canton of St. Gall, because it was acquired in 1463 by the bishop of Constance, who incorporated it with the bailiwick of Arbon, the fate of which it has followed. In 1798 the lower portion of the Stammheim glein was given to Zürich, as well as the Diessenhofen region to Schaffhausen, but the latter region came back to Thurgau in 1800. The main railway line from Winterthur to Romanshorn (with a branch to St. Gall) runs right through the canton, while on its north edge the direct line along the left bank of the Rhine from Constance to Schaffhausen. A network of well-made roads traverses the canton in every direction, some of them being now served by public motor cars. It is a prosperous region, the population being mainly engaged in agriculture, and in cotton-spinning, which is often combined with it at home. The orchards are so splendid that Thurgau has been called "the garden of Helvetia." The vineyards produce a number of highly esteemed wines (the best known is the red Bachtobler), which are said to retain their strength for eight or ten years, this being attributed to the influence of the east wind to which the vineyards are much exposed. In 1800 the population was 11,221, of whom 119,845 were German-speaking, 18,677 Italian-speaking, and 332 French-speaking, while there were 17,210 Protestants, 33,824 Romanists and 113 Jews. Its capital is Frauenfeld (q.v.), while other important places are Arbon (pop. 5,677), Kreuzlingen (1,752), practically a suburb of Constance, and Romanshorn (q.v.), the chief port of the canton on the Lake of Constance. Till 1814 it was in the diocese of Constance, and since 1828 in that of Basel. The canton is divided into eight administrative districts, which comprise 212 communes. In 1869 the very advanced College of Constance was adopted, by which the "initiative" (or right of 250 electors to propose a law to the cantonal assembly to take any subject into consideration), and the "obligatory referendum," taking place twice a year (by which all laws passed by the cantonal assembly, and all financial resolutions involving a capital expenditure of 50,000 francs or an annual one of 10,000, must be submitted to a popular vote), were introduced. The cantonal government consists of a legislative assembly or Grossrat (one member to every 250 electors, or fraction over 125) and a Regierungsrat or executive council of five members, both elected directly by the people and holding office for three years; 3,000 electors can at any time call for a popular vote on the question of the dismissal of either one or the other. Further, to show the very democratic character of the (1869) constitution, it may be added that members of both houses of the Federal assembly are in Thurgau elected directly by the people, and hold office for three years. The "communes" in Thurgau are of no less than eleven or twelve varieties. The division of the lands, &c., of the old "burgher communes" between them and the new communes, consisting of all residents (with whom political power rests), was carried out (1572) in all the 212 communes; but there are still 38 guilds or corporations with special rights over certain fiefs, &c.

The Thurgau originally took in all the country, roughly speaking, between the Reuss, the Lake of Lucerne, the Rhine and the Lake of Constance; but many smaller districts (Zürichgau, Toggenburg, Appenzell, St Gall) were gradually carved out of it, and the county was reduced to about the size of the present canton when in 1764 it passed by the gift of the last count of Kyburg to his nephew Rudolph of Habsburg, chosen emperor in 1723. In 1415 the count, Duke Frederick of Austria (a Habsburg), was put under the ban of the empire by the emperor Sigismund for having aided Pope John XXIII, to escape from Constance, and the county was overrun, Sigismund in 1417 mortgaging to the city of Constance the appellate jurisdiction in all civil and criminal matters ("Landgericht" and "Bluttarn") arising within the county, which he had declared to be forfeited in consequence of Frederick's conduct. In 1460 some of the Confederates, now becoming very eager for conquests, overran and seized the county. Winterthur was saved, but in 1461 Frederick's son, Duke Sigismund, had perforce to cede the county to the Confederates. Henceforth it was ruled as a "subject district" by seven members of the League—Bern occupied in the west, not being admitted to a share in the government till 1712, after one of the wars of religion. It was only in 1499 that the Confederation (then consisting of ten members) obtained from the emperor (the claims of Constance being passed over in silence) the supreme jurisdiction, through the mediation of the duke of Milan, but there were still 105 minor jurisdictions belonging to various lords spiritual (particularly the bishop of Constance) or secular (the abbots of Reichenau) and temporal, which went on till 1798 and greatly limited the power of the Confederates. Thurgau had hoped, but in vain, to be admitted in 1499 a full member of the Confederation.

At the time of the Reformation many of the inhabitants became Protestants, and bitter quarrels ensued between the Protestant and Catholic (the latter having a large majority) members of the Confederation who had rights over Thurgau, with regard to the toleration of the new doctrines in the "subject districts," such as Thurgau. By the first peace of Kappel (1529), the majorit in each "commune" was to settle the religion of the "subject commune"; but by the second (1531, after Zwingli's death) both religions were to be allowed side by side in each "commune." Thurgau thus became a "canton of parity," as it is to this day. Its rulers, however, continued to watch other each very closely, and Killian Kesslerling, one of the chief military commanders in Thurgau, was in 1633, on suspicion of having connived at the advance of the Swedes through Thurgau on Constance, seized by the Catholic cantons and severely punished. In 1798 Thurgau became free, and was one of the nineteen cantons of the Helvetic republic, being formally received as the other, "subject of St. Gall" (and the abbey of Reichenau) and temporal, which went on till 1798 and greatly limited the power of the Confederates. Thurgau had hoped, but in vain, to be admitted in 1499 a full member of the Confederation.

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portable vessel in which burning incense (g.s.) can be carried.

The censer, to use the more general term, is a vessel which contains burning charcoal on which the aromatic substances to be burned are sprinkled.

The early Jewish portable censer would seem to have been a bowl with a handle, resembling a ladle. A similar form was used by the ancient Egyptians long prior to the Jewish use. There are various representations on the monuments; in some the censer appears as a small cup or bowl held by a human hand to which a long handle is attached on which is a small box to hold the incense. The Greek and Roman censers (θυραιρός and ταφύραμα or taphuríboum) are of different shape. They are small portable braziers (foculis) of bronze or sometimes of silver and of highly ornate design. One type took the form of a candelabrum with a small flat brazier on the top. They were carried in processions and were lifted by cords. Terra cotta censers have also been found of a similar shape. The censers or thuribles in Christian usage have been specially adapted to be swung, though there are in existence many early specimens of heavy weight and made of gold or silver which were obviously not meant to be used in this way and have handles and not chains. The thurible, the procession; peace was made with Cretona, and also, after a period of war, with Tarentum, and Thurii rose rapidly in power and drew settlers from all parts of Greece, especially from Peloponnesus, so that the tie to Athens was not always acknowledged. The oracle of Delphi determined that the city had no founder but Apollo, and in the Athenian War in Sicily Thurii was at first neutral, though it finally helped the Athenians. Thurii had a democratic constitution and good laws, and, though we hear little of its history till in 390 it received a severe defeat from the rising power of the Lucanians, many beautiful coins testify to the wealth and splendour of its days of prosperity. In the 4th century it continued to decline, and at length called in the help of the Romans against the Lucanians, and then in 282 against Tarentum. Thenceforward its position was dependent, and in the Second Punic War, after several vicissitudes, it was Populated and plundered by Hannibal (204). In 194 a Roman colony was founded, with Latin rights, known for a time as Copiae, but afterwards by the old name of Thurii. It continued to be a place of some importance, the situation being favourable and the region fertile, and does not seem to have been wholly abandoned till the middle ages. The site of the original Greek city is not accurately known, though that of the Roman town, which probably though not certainly occupied the same site, is fixed by insinuative ruins as being 4 m. to the east of Terranova di Sibari, and as occupying an area some 4 m. in circuit. The tombs found in 1879-1880 (see Sybaris) lie a little to the east of the site.

The Thurii-Thuringia is strictly designated only that district in upper Saxony that is bounded by the Werra, the Harz Mountains, the Saale and the Thuringian Forest; in common parlance, however, it is frequently used as equivalent to the Thuringian states, i.e. the group of small duchies and principalities lying between Prussia, Hesse-Nassau, Bavaria and the kingdom of Saxony. Such Thuringian states are Saxe-Weimar-Eisenach, Saxe-Coburg-Gotha, Saxe-Meiningen, Saxe-Altenburg, Schwarzburg-Rudolstadt, Schwarzburg-Sondershausen, and the two principalities of Reuss, all of which are separately described. Besides these, the term Thuringia also, of course, includes the various "ex-Prussian" Saxony, Bavaria and Bohemia which lie embedded among them.

The Thuringian are first mentioned by Vegetius Renatus about A.D. 420 when they occupied the district between the Harz Mountains and the Thuringian Forest. They were probably descended from the Hermunduri, a Suevic people referred to by Tacitus as living in this region during the 1st century. They were tributary to Attila the Hun, under whom they served at the battle of Châlons in 497. They were governed by kings, whose realm in the early 6th century touched both the Danube and the lower Elbe. At this time King Basin divided Thuringia among three sons: first, Heraklaz, who obtained sole possession by the help of Theuderich I., king of Austrasia, but having refused to pay the price he had promised for this assistance, was defeated by Theuderich in a series of battles and murdered by him in 531. The northern portion of the kingdom was given to the Saxons who had joined him against Hermannfried; the southern part was added to Austrasia; and the name of Thuringia was confined to the district bounded by the Harz Mountains, the Werra, the Thuringian Forest and the Saale. It remained under the direct rule of the Frankish kings until 954, when Radulf was appointed duke of the Thuringians by King Dagobert I. Radulf made himself practically independent of the Franks, in spite of an attack made on him by Sigebert III., king of Austrasia. About this time the conversion of the Thuringians to Christianity was begun by British missionaries and continued by St Boniface, who founded a bishopric at Erfurt. They were again reduced to dependence on the Franks by Charles Martel, who abolished the office of dukedom and divided the country among Frankish counts. About 804 Charlemagne, in order to defend the line of the Saale against the Slavs, founded the Thuringian mark, while the monastery was practically coextensive with the former duchy. In 849 King Louis the German recognized Thukulf as duke (dux Sorabitë limitis), and some of his successors bore the title of margrave until the death of Burkhard in 908, when the country was seized by Otto the Illustrious, duke of Saxony. Thuringia was retained by Otto's son and successor, Henry I. the Fowler, in spite of the opposition of the German king, Conrad I., and ceased for a time to enjoy a separate political existence. It appears to have been united with Meissen for some time, and this was certainly the case from 1046 to 1067, when both countries were ruled by William and Otto, counts of Weimar. During the 11th century the Thuringians refused to pay tithes to Siegfried, archbishop of Mainz, and this was probably one reason why they joined the rising of the Saxons against the emperor Henry IV. in 1073.

About this time a new dominion was founded by Louis the Bearded, who by purchase, gift or marriage obtained several counties in Thuringia. These passed on his death in 1056 to his son Louis the Springer (d. 1123), who took part in the Saxon risings against the emperors Henry IV. and Henry V., built the castle of the Wartburg near Eisenach, which was the residence of his family for nearly 200 years, and remained in close alliance with the emperors. Louis the Springer paid tribute to the emperors of Reinhardsbrunn, where as a monk he passed his last days. His son Louis was appointed landgrave of Thuringia in 1130 by the emperor Lothair II.; by his marriage with Hedwig of Gudensberg in 1137 he obtained a large part of Hesse. He was succeeded in 1140 by his son Louis II. the Hard, who married Judith, a sister of the emperor Frederick I., and on his behalf took a leading part in the opposition to his powerful neighbour Henry the Lion, duke of Saxony. In 1172 he was succeeded

See F. Lenormant, La Grande-Grece i, 317 (Paris, 1881). (T. As.)
by his son Louis III, the Pious. He acquired the Saxon palatinate in 1179, on the death of Adalbert, count of Sommerschenburg, went to Italy to assist Frederick I. in 1157, joined in the war against Henry the Lion in 1180, and distinguished himself at the siege of Acre in the Third Crusade, on the return from which he died at Cyprus in 1180. He was succeeded by his brother Hermann I., during whose reign Thuringia suffered greatly from the ravages of the adherents of Philip, duke of Swabia, and also from those of his rival Otto of Brunswick. The next landsgrave (1217-1257) was his son Louis IV. the Saint, who succeeded his father Hermann, and entered into hostile relations with Hungary, and acted as guardian for his kinsman Henry III. the Illustrious, margrave of Meissen. This Louis, who is celebrated in story, destroyed many robber-castles in Thuringia and died at Otranto while accompanying the emperor Frederick II. on crusade. The next ruler was Henry Raspe, who made himself regent on behalf of his nephew Hermann II. from 1227 to 1238 and in 1241 succeeded his former ward as landsgrave. Henry was appointed regent for King Conrad IV., but he soon transferred his allegiance from the emperor to Pope Innocent IV., and the latter in 1246 was chosen as the new king of Thuringia. The son of the latter, Henry VII., was in turn landsgrave of Thuringia, and was married to his son Albert the Degenerate, who sold it in 1293 to the German king Adolph of Nassau for 12,000 marks of silver. Albert's sons Frederick the Undaunted and Dietrich contested this transaction, and the attempts of Adolph and his successor Albert I. to enforce it led to the infliction of great hardships upon the Thuringians. Frederick defeated Albert decisively and in 1314 was formally invested with Thuringia by the emperor Henry VII. His son Frederick II. the Grave (1333-1349) consolidated the power of his dynasty against rebellious vassals and the neighbouring counts of Weimar and Schweizburg. His son Frederick III. the Strong (1349-1381) and his grandson Balthasar (1381-1406) further extended their dominion by marriage and conquest, and the latter of these founded the university at Erfurt (1392). Balthasar's son, Frederick the Peaceful, became landsgrave in 1406 but left the government largely to his father-in-law Günther, count of Schwarzburg. He died childless in 1440, and Thuringia then passed to the electoral dynasty of Saxony. After a joint rule by Frederick II. and his brother William, the latter in 1445 became sole landsgrave as William III. and died without sons in 1452. In 1455 his nephews and heirs Albert and Ernest made a division of their lands, and Thuringia was given to the Ernestine branch of the family of Wettin, with which its subsequent history is identified (see SAXONY).

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THURINGIAN FOREST—THURLOE, a range of hills in Germany, extending in an irregular line from the neighbourhood of Eisenach in the N.W. to the Lobenstein Kulm on the Bavarian frontier on the S.E. On the S.E. it is continued directly by the Frankenwald mountain to the Fichtelgebirge, while on the N.E. it approaches the Harz Mountains, and thus takes its place in the great Sudetic chain of central Germany. The length of the Thuringian chain is 70 m., and its breadth varies from 6 to 22 m. It nowhere rises into peaks, and only a few of its rounded summits reach 3000 ft.; the successive hills form a continuous comb; the north-west slopes are precipitous and seamed with winding gorges. This range encloses many charming valleys and glens; the most prominent feature of its scenery is formed by the forests, chiefly of pines and firs. The north-west part of the system is the loftier and the more densely wooded as well as the more beautiful; the highest summits are the Grosser Beerberg (3225 ft.), Schneekopf (3200 ft.) and the Waldstein (3257 ft.). The crest of the Thuringian Forest, from the Werra to the Saale, is traversed by the Rennsteig or Rainsteig, a broad path of unknown antiquity, perhaps referred to in a letter of Pope Gregory III. dated 738. The name means probably "frontier-path"; and the path marks in fact the boundary between Thuringia and Franconia. It may be also regarded as part of the boundary line between north and south Germany, for dialect, customs, local names and costume are different on the two sides. The rocks are largely volcanic, the stratification being complex. The mineral resources have been nearly exhausted, but the district is an important centre of small industries (glassware, earthenware, meerschaum-ware, iron castings and toys being among its principal products) and a favourite resort for tourists.

See Regel, Thüringen, ein landeskundlicher Grundriss (Jena, 1897); Trinius, Thüringer Wanderbuch (8 vols., Minden, 1896-1902); Frischoldt, „Der Thüringer Wald und seine nächste Umgebung.“ in Forschungen zur deutschen Landeskunde (Breslau, 1890); Walther, Geologische Heimatkunde von Thüringen (Jena, 1906); and Meyer's Reisebuch, „Thüringen“ (18th ed., Leipzig, 1806).

THURLES, a market town of Co. Tipperary, Ireland, pleasantly situated on the Suir, and on the main line of the Great Southern & Western railway, 87 m. S.W. of Dublin. Pop. (1901), 4411. Thurles is the seat of the Roman Catholic archdiocese of Cashel; and the cathedral of St Patrick is a beautiful building. The town is the seat of other important Catholic establishments, including an Ursuline convent; a Presbyterian convent; St. Patrick's Catholic College (1859) for ecclesiastical students, where was held in 1850 the synod of Thurles; and an establishment of Christian Brothers, who devote themselves to the instruction of boys on the Lancastrian method. The town has a considerable agricultural and retail trade, and there is a monthly horse fair largely attended by English and continental buyers. Thurles is governed by an urban district council.

Originally the town was called Duras O'Fogarty. In the 10th century it was the scene of a defeat of the Irish by the Danes. A preceptory was founded here by the Knights Templars, who possessed themselves of a castle, of which there are remains, erected early in the 13th century. A castle was subsequently erected by James Butler, first lord patrician of Tipperary, of which the keep collapsed in 1868. There were several other strongholds in the vicinity. South-west of the town, at a distance of 33 m., stands the Cistercian abbey of Holy Cross, one of the finest ruins in Ireland. It was founded by Donnell O'Brien, king of Thomond (1176-1194); and owes its foundation and name to the presentation to his family of a portion of the true Cross, which attracted numerous pilgrims. The shrine of this relic is in the Ursuline convent at Blackrock, Co. Cork. The ruins, beautifully placed on the bank of the river, embody a cruciform church, transitional Norman in style, and exhibiting the carving of the period in its highest development. There is a fine Perpendicular tomb in the choir. A large portion remains of the adjoining buildings, including chapter-house, sacristy, cloisters and dormitory.
of Oliver Thurlow, John, through whose interest he was appointed a
secretary to the parliamentary commissioners at Uxbridge in
January 1645. He was admitted to Lincoln’s Inn in 1647; and
in March 1648 he received the appointment of receiver of the
custor’s fines, worth £350 a year. He took no part in the
subsequent historical events or in the king’s death. In March
1651 he attended St John and Sir Walter Strickland as secretary
in the Court of Carousal and in the same year he was appointed
secretary to the council of state, being apparently
also elected a member thereof about the same time. His duties
included the control of the intelligence department and of
the posts, and his perfect system of collecting information and
success in discovering the plans of the enemies of the administration
astonished his contemporaries. By his means, it was said,
“Cromwell carried the secrets of all the princes of Europe at
his girdle.” On the 10th of February 1654 he was made a
bencher of Lincoln’s In.
In the parliaments of 1654 and of 1656 he represented Ely; he was appointed a member of Clarendon’s
second council in 1657; and in 1658 was raised to the
peerage on the Charterhouse in the same year; and in 1658 became chancellor of
Glasgow University. Thurlow was elected to Cromwell as a
man and admired him as a ruler, and Cromwell probably placed
more confidence in the secretary than in any one of those
who surrounded him. Thurlow, however, by no means directed
Cromwell’s policy. He was in favour of the protector’s assump-
tion of the royal title, and was opposed to the military party
who obtained the ascendancy. After Oliver’s death he sup-
ported Richard Cromwell’s succession and took a prominent part
in the protectorate, by his advice and direction all international
transactions, and by his exhortations and courtesies to
foreigners. His relations with the Senate in Rome, and his
renunciation of power in 1659, as member for Cambridge University.
Attacked by the republicans on the ground of arbitrary imprisonments and
transportations during the Protectorate, he succeeded in vindicat-
ing his conduct; but the breach between the army and the
parliament, and the ascendancy obtained by the former, caused
his own as well as Richard’s downfall. Nevertheless, being
indispensable, he was reappointed secretary of state on the
27th of February 1660. He appears to have steadily resisted
the Restoration, and his promises of support to Hyde in April
inspired little confidence. On the 15th of May 1660 he was
arrested on the charge of high treason, but was released on the
20th of June, subject to the obligation of attending the secretary of
state “for the service of the state whenever they should
require.” He subsequently wrote several papers on the subject
of foreign affairs for Clarendon’s information. He died on the
21st of February 1668 at his chambers in Lincoln’s Inn, and is
buried under the chapel there. Thurlow twice married, and by his second wife Anne, daughter of Sir John Lyttoce of
East Moulsey in Surrey, he had four sons and two daughters.

His extensive correspondence, the originals of which are in the
Bodleian Library at Oxford and the British Museum (Add. MSS.
4156, 4157, 4158), is one of the chief sources of information for the
period. A portion was published with a memoir by T. Birch
in 1742, and other correspondence is printed in R. Vaughan’s
lectione of Oliver Cromwell (1836). See also Die Politik des Pro-
tекторates Oliver Cromwell in der Auffassung und Thätigkeit . . . des
Staatssekretärs John Thurlow, by Sigismund, Freiherr von Bährillos-
hausen (1899); Eng. Hist. Rev., xiii, 527 (Thurlow and the post
office); Notes and Queries, 11th series, vol. viii. p. 83 (account of his
death); A Letter to a Friend . . . on the Publication of Thurlow’s
State Papers (1742); Clarendon’s History of the Rebellion; Gardiner’s
History of the Commonwealth.

THURLOW, EDWARD THURLOW, 1ST BARON (1731–1806),
English lord chancellor, was born at Bream Ash, in the county of
Norfolk, on the 6th of December 1731. He was the eldest
son of the Rev. Thomas Thurlow. He was educated at a private
school and at the grammar school of Canterbury, where he was
considered a bold, refractory, clever boy. In 1743 Thurlow
entered Caius College, Cambridge, but an act of insubordination
necessitated his leaving Cambridge without a degree (1751).
He was for some time articled to a solicitor in Lincoln’s Inn
along with the poet Cowper, but in 1754 was called to the bar
at the Inner Temple, and subsequently went on the western
Robinson v. The Earl of Winchelsea (1758) Thurlow came into
collision with Sir Fletcher Norton, afterwards 1st Baron Grantley
(1716–1780), then the terror of solicitors and the tyrant of the
bar, and put down his arrogance with dignity and success. From
this time his practice increased rapidly. In 1761 he was made
a king’s counsel, through the influence of the duchess of Queens-
berry. In 1762 he was elected a bencher of the Inner Temple. 
Thurlow now with some hesitation entered himself into the
ranks of the Tory party. In 1766 he became member for Tam-
worth. In 1769 the Douglas peerage case came on before the
House of Lords, and Thurlow, who had drawn the plead-
ings some years before (Notes and Queries, 3rd series, vol. iii.
p. 122), led for the appellant in a speech of great analytic power.
In 1770, as a recognition of his defence in the previous January
of the expulsion of Wilkes, Thurlow was made solicitor-general
on the resignation of Dunning, and in the following year, after
he had enhanced his reputation with the government by attack-
ing the rights of juries in cases of libel (Rex v. Miller, 20 St.
Tr. 370–806) and the liberty of the press (16 Partly. Hist.
174). Thurlow, acting as the king’s adviser, and in accordance with
his public life as factious as his youth had been daring. His
hatred of the American colonists, and his impudent assertion
that as attorney-general he might set aside by scire facias as
forfeited every charter in America (debate on the American
Prohibitory Bill, 18 P.H. 999); his speech in aggravation of
punishment in the case of Horne Tooke (20 St. Tr. 777–783),
when he alleged that the prisoner ought to be pilloried, because
imprisonment was no penalty to a man of sedentary habits
and a fine would be paid by seditious subscription; and his
opposition to the measures of the ministry in the Jacobites.
In 1778 Thurlow became lord chancellor and Baron
Thurlow of Ashfield, and took his seat in the House of Lords,
where he soon acquired an almost dictatorial power. He
opposed the economical and constitutional reforms proposed
by Burke and Dunning. Under Rockingham he clung to the
chancellorship, while conducting himself like a leader of
the opposition. To the short-lived ministry of Shelburne he gave
consistent support. Under the coalition of Fox and North (April
to December 1783) the great seal was placed in commission,
and Lord Loughborough was made first commissioner. But
Thurlow, acting as the king’s adviser, and in accordance with
his wishes, harassed the new ministry, and ultimately rejected
the rejection of Fox’s India Bill (24 P.H. 226). The coalition
was at once dissolved. Pitt accepted office, and Thurlow again
became lord chancellor (Dec. 23, 1783). At first he supported
the government, but soon his overbearing temper asserted itself.
Imprudently relying on the friendship of the king, and actuated
by scarcely disguised enmity to Pitt, Thurlow passed rapidly
from occasional acts of hostility to secret disaffection, and finally
to open revolt. He delivered himself strongly against a bill,
introduced without his privy, for the restoration to the heirs
of attainted owners of estates forfeited in the Jacobite rebellion
of 1745. Partly to please the king and queen, partly from dislike
to Burke, and partly perhaps from a real belief in the ground-
lessness of the accusation, he supported Warren Hastings on
every occasion “with indecorous violence.” His negotiations
with the Whigs during the discussion of the Regency Bill
(1788–Feb. 19, 1789) were designed to secure his seat on the
woolsock in the event of Fox being called to power. The climax
was reached in 1792, when he attacked Pitt’s Bill “to establish
a sinking fund for the redemption of the national debt,” not on
account of the economic objections to which it was liable, but
on the trivial ground that it was an unconstitutional attempt
to bind further parliaments. The bill was carried, but only by
a narrow majority, and Pitt, feeling that co-operation with such
a colleague was impossible, insisted successfully on his
dismissal (June 15, 1792). The ex-chancellor, who had a few days
before been created Baron Thurlow of Thurlow, with remainder to
his brothers and their male descendants, now retired into private
life, and, with the exception of a futile intrigue, under the auspices
of the prince of Wales, for the formation of a ministry from
which Pitt and Fox should be excluded, and in which the earl of
Motra should be premier and Thurlow chancellor (1797), finally
abandoned hope of office. In 1795 he opposed the Tennis and Sedition bills without success. In 1801 he spoke on behalf of Horne Tooke—now his friend—when a bill was introduced to render a priest in orders ineligible for a seat in the House of Commons. He died at the age of thirty-five in the House of Commons, and was burried at the nearby church.

Sir Thomas was never married, but left three natural daughters, for whom he made a handsome provision. The title descended to his nephew, son of the bishop of Durham.

Lord Thurlow was a master of a coarse caustic wit, which habitually expressed itself with the force and vividness of the public press. He was also gifted in his profession, and the great legal merits of Eldon Thurlow's personal appearance were striking. His dark complexion, harsh but regular features, severe and dignified demeanour, and bushy eyebrows, doubtless contributed to his professional and political eminence and provoked the sarcasm of Fox that he looked wiser than any man ever saw. Yet he was far from being an impartial judge of his own profession through his bias, and he possessed all the qualities which command success. His speeches in the trial of the duke of Kingston for bigamy (20 St. Tr. 375-455) are vigorous and statesmanlike. His charge to the Grand Jury at Dublin in 1782, and his argument for the Crown in Campbell v. Hall (30 St. Tr. 312-316) show that he might have rendered high service to the judicial literature of his country had he relied more upon his own industry and less upon the learning of Hargrave and Kenyon.


THURMAN, ALLEN GRANBERY (1813-1895), American jurist and statesman, was born at Lynchburg, Virginia, on the 13th of November 1813. In 1819 he removed with his parents to Chillicothe, Ohio, where he attended the local academy for two years, studied law in the office of his uncle, William Allen, and in 1835 was admitted to the bar, becoming his uncle's law partner. He began to take an active part in politics in 1842, and in 1843-44 was a delegate to the Democratic convention in Cincinnati, where he advocated the Wilmot Proviso. From 1851 to February 1856 he was an associate justice of the state supreme court, and from December 1854 was chief justice. He was Democratic candidate for governor of Ohio in 1857, and was defeated by Rutherford B. Hayes by a majority of less than 3000 votes; but the Democrats gained a majority in both branches of the state legislature, and Thurlow was elected to the United States Senate, where he served from 1861 until 1865 during the 46th Congress (1879-1881) as president, pro tem. Here he became the recognized Democratic leader in Congress, and was chairman of the judiciary committee. He contested the constitutionality of the Civil Rights Bill, opposed the resumption of specie payments, advocated the payment of the public debt in silver and supported the Bland-Allison Act. He introduced the Thurlow Bill, for which he was chiefly responsible, which became law in May 1878, and readjusted the government's relations with the bond-aided Pacific railways. Thurlow was a member of the Electoral Commission of 1871, and was one of the American delegates to the international monetary conference at Paris in 1881. In 1876, 1880 and 1884 he was a candidate for the presidency, and in 1888 he was nominated for vice-president on the ticket with Grover Cleveland, but was defeated in the election. He died at Columbus, Ohio, on the 12th of December 1895.

THURSDAY ISLAND, one of the smallest of the Prince of Wales group, N. of Cape York, in the Torres Strait, attached to Somerset county, Queensland, Australia. (Pop. (1901), 1534. It has an excellent harbour, Port Kennedy, and is a port of call for mail steamers and the centre of the bêche-de-mer and pearl fisheries of the Torres Strait. It is a fortified coaling station for the British navy. The neighbouring Friday Island is the quarantine and leper station for Queensland.

THURSO, a municipal and police burgh, and seaport of Caithness, Scotland. (Pop. (1901), 3723. It is situated at the mouth of the Thurso, on Thurso Bay, 21 m. N.W. of Wick, and 319 m. N. of Edinburgh by the North British and Highland railways, the most northerly town in Scotland. Coaches run daily to Mey and Wick and every day a mail-car goes to Tongue, in Sutherlandshire, about 40 m. west.

In Mac donnal Square, laid out with ornamental walls, there is a statue of Sir John Kinross. A promenade along the sands was opened in 1882. The town-hall contains a public library and museum, which possesses the geological and botanical specimens of Robert Dick (1811-1866), the "Thurso baker," as well as a large collection of northern birds. In the neighbourhood are quarries for Caithness flags, which are cut and dressed in the town. They constitute the leading export, but the trade of the port is hindered by the inconvenience of the harbour. There is, however, communication daily from Scrabster pier, 2 m. north-west, with Scapa and Stromness in Orkney (Orkneys). The train to Inverness passes through Thurso, and goes on to Inverness and Leith; and occasionally in summer with Liverpool. To the east is Thurso Castle, the residence of the Ulster branch of the Sinclairs, and near it is Harold's Tower, built over the grave of Earl Harold, once owner of half of Caithness, and half of the Orkneys and Shetlands, who fell in battle with Earl Harold the Wicked in 1090. About three-quarters of a mile west stand the ruins of the bishop's palace, which was destroyed by fire in 1222. Thurso was the centre of the Norse power on the mainland when at its height under Thorfinn (1014), and afterwards till the battle of Largs (1265). Count Thorfinn appointed his brother-in-law Orm I> for a time at Thurso and despoiled it till he was surprised and slain by Thorfinn in 1046. In the time of Malcolm II. Earl Edgar resided in the town. In 1633 it was created a burgh of barony, and was the seat of the sheriff courts of the county till they were removed to Wick in 1828.

THURSTAN, or TURSTIN (d. 1140), archbishop of York, was the son of a certain Anger, or Auger, prebendary of St. Paul's, London, and a brother of Audoen (d. 1130), bishop of Ely. He himself was a prebendary of St. Paul's, and was also a clerk (the voice of) at Winchester; once a week at York; and finally at Dunfermline, where he was once archbishop. He was installed archbishop of York in 1130, but was also murdered by the people of York. His murder was an event in the history of the archbishopric, and his death was an event in the history of York. He was a man of great learning, and a great patron of learning, and was one of the most famous archbishops of the Middle Ages. He was a man of great learning, and a great patron of learning, and was one of the most famous archbishops of the Middle Ages.

He was a man of great learning, and a great patron of learning, and was one of the most famous archbishops of the Middle Ages.
in August 1138. Early in 1140 he entered the order of the Cluniacs at Pontefract and here he died on the 6th of February 1140. Thurstan was generous to the churches of his diocese and was the founder of several religious houses.

See his life in the Fasti eboracenses, edited by J. Raine (1863).

**THYLACINE** *(Thylacinus cynocephalus).* The only known living species of this genus, though smaller than a common wolf, is the largest predaceous marsupial existing. It is confined to the island of Tasmania, although fragments of bones and teeth found in caves afford evidence that a closely allied species on the mainland of Australia already existed. The general colour of the thylacine is grey-brown, but it has a series of transverse black bands on the hinder part of the back and loins, whence the name of “tiger” frequently applied to it by the colonists. It is also called “wolf,” and sometimes, though less appropriately, “hyena.” Owing to the havoc it commits among the sheep-folds, it has been nearly exterminated in all the more settled parts of Tasmania, but still finds shelter in the more mountainous regions of the island. The female produces four young at a time. (See MARSUPIALS.)

**THYROSTRACA.** The genus *Thyrostraca* (nat. ord. Labiatae) comprises a number of fragrant aromatic undershubs, with very small leaves and whorls of small purple honey-bearing flowers in the axes of the leaves or at the ends of the branches. The common garden thyme, a native of the Mediterranean region, is *Thymus vulgaris*; the wild thyme of English banks is *T. serpyllum*. Marjoram (*Origanum*) is also closely allied. All these plants are remarkable for their essential oil, to which their fragrance is due. From this oil is produced by distillation the substance known as thymol.

**THYMOIL,** C₆H₅OH or C₆H₅(OH) (CH₃) (C₆H₅) \[ 1:3:6 \], a methylisopropylphenol isomerically with carvacrol (q.e.), is an aromatic substance found with the hydrocarbons cymene, C₆H₄(1), and thymene, C₆H₄(1) in oil of thyme (*Thymus vulgaris*) and in other essential oils, e.g. *Carum coticum*, from which it may be extracted by shaking with potassium hydroxide, filtering and precipitating the phenol with hydrochloric acid. It can be prepared from dibrom-menthol (obtained by brominating menthol in chloroform solution) by eliminating two molecules of hydrobromic acid. Thymol crystallizes in large colourless plates, which melt at 44°C and boil at 230°C. On distillation it loses its volatile constituents. Mere isolation has a strong odour of thyme and a pungent taste, and is freely soluble in alcohol, ether, chloroform or olive oil, but almost insoluble in cold water. It is a more powerful antiseptic than carbolic acid and is used in the Malacetic acid as being used for the same purposes. A saturated solution (1 in 1000 of warm water), thymol gauze and an ointment are used. Externally it is anti-parasitic, and is used in certain stages of eczema and psoriasis, and the alcoholic solution has been used in ringworm; internally it has been employed as an internal antiseptic in typhoid fever. Its chief use is as an anthelmintic to destroy the *Ankylostoma duodenale*. Thymol may colour the urine green. Thymol iodide, official in the United States, is a compound of iodine and thymol; it is also known as aristol or anidril. It was introduced as a substitute for iodine and is stated to be less toxic. *Glycyphymin* is a proprietary preparation, used in the treatment of catarrhal conditions of mucous membranes, while a mixture of naphthalene, camphor and thymol is sold under the name of thymolpin.

**THYROID** *(Gr. θυροεδής, shield-shaped, from θύρα, a door, δέσμη, and ἔσσω, form),* in anatomy, a term applied (1) to the largest of the cartilages of the larynx (see RESPIRATORY SYSTEM), (2) to one of two arteries which lie near the thyroid cartilage and gland (see ARTERIES), and (3) to the vascular ductless gland, which rests on the larynx and upper part of the trachea (see DUCTLESS GLANDS). The thyroid gland is used in medicine in two forms. *Thyroidium siccatum* is a light dull brown powder, prepared by drying the thyroid gland of a sheep. Its chief constituent is a protein known as thyroglobulin, the active principle of which contains 9-3% of iodine and 0-5% of phosphorus, and is known as idothyrin or thyroidin. The dried gland easily becomes damp and deteriorates. *Liquor thyroidei* is a pink turbid liquid made by macerating the fresh gland of a sheep with glycerin and phenol.

Thyroid gland administered to man increases the pulse rate, causes increased and unfeebled cardiac beat and leads to increased metabolism, consequently to hunger, and to a feeling of restlessness and loss of weight; it therefore reduces the body weight. Glocosuria develops from the inability of the body to ingest glucose. Overdoses of thyroid cause rapid pulse, headache and vomiting, diarrhea, and dizziness, with inanition and weakness. These symptoms are known as *thyroidism*.

Thyroid gland was introduced for the treatment of patients suffering from goitre, myxoedema and cretinism, in which effusions and degenerations of the tissues are dependent on the use of thyroid; it therefore reduces the body weight. Glocosuria develops from the inability of the body to ingest glucose. Overdoses of thyroid cause rapid pulse, headache and vomiting, diarrhea, and dizziness, with inanition and weakness. These symptoms are known as *thyroidism*.

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THYROSTRACA

("Challenger" Reports, "Cirripedia," 1883, viii, 8-11.), gives a brief geological summary down to 1882. In that year J. M. Clarke (Am. Jour. Sci. and Arts, 1884) described a new species of Plumbulites (Barrande, 1872), remarking that the species in question, P. devonis, is interesting in being the first representative of fossil barnacles, and that it appears to have a new relation to the Plumbulites and Anatifopsis, as well as the Turritopsis of Woodward, being from the Upper and Lower Silurian, and Plumbulites janes (Hall and Whitt., Pal. Ohio, vol. ii.) from the Hudson River group. Since Plumbulites was a synonym of Terrulipes (not Turritopsis), the species Turritipes wrighti (Woodward, 1862), from the Upper Silurian of Dudley, did not long enjoy an isolated eminence as the oldest known cirripede. As pointed out by Dr. Bathr. (Geo. Mag. 1890, p. 149), who translated his Pygoma con- taceum, 1865, to a new genus Brachypteras (fig. 1), and a new family from the Devonian, intermediate between the Rhaetic Pollicipes and the modern Balanus. Among other fossil genera of recent instiga- tor of the Alcanides, Lepas, Rhizop. Squama, Stemnum can only be mentioned as incentives to research. Long living forms, added by Wettner to the Catalina. It may be noticed Kolelepas willei, from the Loyalty Islands (Stebbing, in Willey's Zool. Results (1900) pt. v., p. 577. This was found in a Turbo shell, occupied also by Pagonurid, and coated with Actinians. The cirripede, which has an elastic peduncle, a crested capitulum, but no valves, and the first cirri longer than the rest, are strikingly similar in external form, the name given by Wettner in place of the preoccupied Gymnolepas (Aurivillius). In the new genus Scalpellum, S. giganteum, Grun. (Trans. Zool. Soc.) is compared with S. stearnsii (fig. 2), Pilsbury, 1890, which shall be accounted the greater. The latter is found in open sea, and the former in the Baltic. Aus den Tiefen des Weltmeeres, 1900, p. 502.

The horizontal distribution of barnacles over all seas is fully explained by Darwin. The bathymetric range of sessile as well as pedunculate forms down to such depths as twelve or eighteen thousand feet—Verruca quadrangularis, Hook. 1900 fathoms; Scalpellum regium, Wyville Thomson, 2850 fathoms—is a more recent discovery. Grivel (Recherches sur l'ant. 1886) found that the species frequenting sea sur- face or shallow water, notwithstanding their feeble powers of vision, cannot live long on land. Saccocoma, which some small species, especially in the genus Discelisopus, occupy the very jaws of large crustaceans. It is generally supposed that cirripedes are confined to salt water, and, generally speaking, that in the Baltic. Peduncules larger than the base of the foot. Balanus amphitrite (Darwin?) from roots and stems of mangroves in the Congo, where, says, "it follows the mangroves as far as their vegetation extends along the stream, to six seas-miles from the mouth." Darwin notes B. improvisus as quite tolerant of water not saline. Why the Thyrostraca, so hardy, so widely dispersed and from one area to another, show such a large number of species, have made so extended and more independent incursions into fresh water remains a problem. Though the Orthiolepas australis (Taylor of Bass Strait) is certainly the only the cirripedia of a cirripede, it still shows one of the many facilities for dispersion which these creatures enjoy. A striking instance of their abundance is cited by Aurivillius (1864) from the coast of Issas, and another by Eekelaar (Dutch East Indies) observed great masses of Lepas fuscicostata forming broad belts in the North Sea. Aurivillius himself examined a humpback whale which had as many as fifty specimens of Coronula diadema on its belly, something of an oddity, for whales do not frequent this part of the sea; it is sometimes seen not only in the North Sea, but in the North Sea, and off the coast of the Yellow Sea, and the Shantung, a most unusual sight. The author has seen some species of the cirripede, especially those of the small genus Lepas, in the Baltic, where they are sometimes seen to be in great numbers, though not in large masses.

Fig. 1. Brachypteras cretaceus (Woodward), from Margate chalk.

Fig. 2. Scalpellum stearnsii. (Two-thirds nat. size.)

when entirely debarred from water, it is of no great moment that abysmal forms have gradually acquired such toleration of darkness as makes their health independent of the sun. Among other singularities of the deep sea, which some small species, especially in the genus Discelisopus, occupy the very jaws of large crustaceans. It is generally supposed that cirripedes are confined to salt water, and, generally speaking, that in the Baltic. Peduncules larger than the base of the foot. Balanus amphitrite (Darwin?) from roots and stems of mangroves in the Congo, where, says, "it follows the mangroves as far as their vegetation extends along the stream, to six seas-miles from the mouth." Darwin notes B. improvisus as quite tolerant of water not saline. Why the Thyrostraca, so hardy, so widely dispersed and from one area to another, show such a large number of species, have made so extended and more independent incursions into fresh water remains a problem. Though the Orthiolepas australis (Taylor of Bass Strait) is certainly the only the cirripedia of a cirripede, it still shows one of the many facilities for dispersion which these creatures enjoy. A striking instance of their abundance is cited by Aurivillius (1864) from the coast of Issas, and another by Eekelaar (Dutch East Indies) observed great masses of Lepas fuscicostata forming broad belts in the North Sea. Aurivillius himself examined a humpback whale which had as many as fifty specimens of Coronula diadema on its belly, something of an oddity, for whales do not frequent this part of the sea; it is sometimes seen not only in the North Sea, but in the North Sea, and off the coast of the Yellow Sea, and the Shantung, a most unusual sight. The author has seen some species of the cirripede, especially those of the small genus Lepas, in the Baltic, where they are sometimes seen to be in great numbers, though not in large masses.

Fig. 1. Brachypteras cretaceus (Woodward), from Margate chalk.

Fig. 2. Scalpellum stearnsii. (Two-thirds nat. size.)
geradise (Lacaze-Duthiers, 1885), sends such rootlets into its host as would justify the term Rhizothoracida. The small sinuose segmented body is enclosed, except for one small opening, in an enormous sac-like carapace, between the lamellae of which are protruded from the body the ovary and "liver," both large, bifurcate and ramified. It is this sac-like and not valvular carapace, therefore, that justifies the term Ascothoracida. But Synagoga mira, Norman, 1888 (Brit. Assoc. Report for 1887), has the body covered by two nearly circular valves instead of a sac. Petaraca bakhchidzis, G. H. Fowler (Quart. Journ. Mic. Sci., 1889, vol. xxx. pt. ii. p. 115), has a bilobed carapace, ventrally open; Denenageraster asterica, Knipovich (Bidopptica Centralblat, 1891, x. 207), is a multibulibar, with apparently indistinct segmentation of the body proper on the dorsal side. For this highly problematic group the original authorities should by all means be consulted. The student may then be asked to compare the account of Synagoga mira both with the figure of the cypris-stage of Denenageraster asterica and with the figure of the "indeterminate animal found on Gerardia," about which Lacaze-Duthiers asks, "Is it the cypris-stage of Laura?" (Mém. Acad. Sci., 1883, xlii. 160, pl. i, fig. 102). S. mira was found, like Laura geradise (fig. 3), in the Mediterranean, and found like it attached to an antipatharian. Its six pairs of limbs are not like the bare and simple feet of the Laura, but two-branched and setose as in the ordinary cypris-stage of the cirripede. The conclusion, therefore, from these facts and from the suggested comparisons, seems at least extremely probable that the question asked by H. Lacaze-Duthiers should be answered in the affirmative, and that S. mira is either the cypris-stage of Laura geradise or of some congeneric species. In Lacaze-Duthiers's highly-elaborated memoir it should be noticed that he uses the term "cirrhes" rather misleadingly, not for cirriform heaps, but as the equivalent of setae. Also he gives two different reckonings of the segmentation, counting first eleven body segments without the caudal furca (p. 40), and then the caudal furca as itself the eleventh segment (p. 41). Of Petaraca the development is not yet known. The points of agreement and difference between it and Laura are carefully drawn out in the essay by Dr. G. H. Fowler, who inclines to favor a close relationship between the Thyrostraca and Ostracoda. To the extreme development of the carapace in Laura, as compared with the segmented body, it would be difficult to find among crustaceans any analogy more striking than that of the great ovaial expansions in Nicopee estaci, the little copepod parasite of the common lobster. The compactness of the class Cladocera is generally admitted; of the precise affinities of its subdivisions there is still much uncertainty.

THYRSUS (the latinized form of Gr. δήφως, a stem or stalk) the wand or staff of Dionysus (Bacchus), the Bacchants and Maenads and the votaries taking part in his orgiastic rites. As commonly represented on the monuments it was a straight staff terminating in a pine cone, a ribbon or fillet being attached to the head below it. Another form terminated in a bunch of grapes and vine leaves, or ivy-berries and leaves. The pinecone or bunch of leaves was sometimes supposed to cover the head of a spear, and the thyrsus was termed θυρόφσακες (see Diovoeuses and Mystax).

THYSANOPTERA (θῦσαν, a fringe, and πτερόν, a wing), a term used in zoological classification for a small order of the class Hexapoda (q.v.). The minute insects included in it, which haunt blossoms and leaves, are fairly well known to gardeners by the name Thrips, a generic term used by Linnaeus for the four species of the group which he had examined and relegated to the order Hemiptera. The term Thysanoptera was first used by the Irish entomologist A. H. Haliday (1836), who made a careful study of the British species and recognized that their structural peculiarities required ordinal separation. H. Burmeister in 1838 also considered that these insects should form a distinct order, for which he proposed the name Physopoda, with reference to the bladder-like outgrowths (fig. 3) on the feet. Since then various authors have incorporated the Thysanoptera with one of the larger orders, some, following Linnaeus, regarding them as Hemiptera, others grouping with them the Orthoptera or "Pseudoneuroptera." But all recent students agree with Haliday and Burmeister in allowing the Thysanoptera to rank as a distinct order, ranking affinities on the one hand with the Corroentia (beetles and biting lice) and on the other with the Hemiptera (crickets, bugs, &c.).

Characters.—The Thysanoptera, small insects with firmly chitinized cuticle, are recognized by the combination of imperfectly suctorial jaws—the mandibles acting as pickers and maxillae retaining their palps (see fig. 2)—with the presence of two pairs of excessively narrow wings (fig. 1), which are partly or completely surrounded by elongate delicate bristles forming a fringe. Other important structural features are mentioned below. In their life-history the Thysanoptera belong to the Exopterygote division of the Hexapoda (q.v.). Thenewly hatched insect closely resembles the parent, and the wing-rudiments appear originally on the second and third thoracic segments; but before the final moult the nymph remains quiescent, taking no food. Its condition thus recalls the pupal instar of the higher (Endopterygote) Hexapoda; and the Thysanoptera, though few in number, are seen to be of great interest to the student, exhibiting at once a transition between the biting and the suctorial mouth, and the passage from "incomplete" to "complete" metamorphosis.

Structure.—The head is usually quadrangular in form with small but prominent compound eyes (fig. 2), whose facets are relatively large and convex; three ocelli may also be present on the vertex. The feelers are inserted close together (fig. 2). The extreme front of the head; they exceed the head in length, but they are composed of only six to nine segments, which are beset with prominent spines, some of the latter appearing to be organs of special sense. The mouth, with its jaws, forms a conical outgrowth which projects backwards, so that its apex lies beneath the prothorax. The labrum (fig. 2 e), which encloses the cone in front, is irregularly triangular in shape. Behind the mouth the two maxillae of the second pair are intimately

![Fig. 3.—A, Laura geradise; B, Carapace ait open to show the body proper.](image-url)
THYSANOPTERA

associated to form the labium (fig. 2 b), whose appendicular nature is shown only by a median furrow and by short, cylindrical palps (fig. 2 i) with two or four segments. The maxillae of the first pair (fig. 2 j) enclose the mouth at either side. They are broad at the base, but narrower toward the tip (fig. 2 i) and divided into three segments. Within the mouth lie a pair of slender piercers (fig. 2 d), while a single piercer (fig. 2 e) is situated asymmetrically on the left side. The nature of these structures has been much disputed. H. Uzel, with the major authority, believes that the mandibles of the left mandible, the right mandible being absent. C. Börner, however, has shown that the unpaired piercer is attached directly to the base of the left maxilla. He therefore regards it as the inner lobe (locusia) of that maxilla, comparing it with the piercing organs of Lepidoptera, the book-lice (see Copeognatha in article NEUROPTERA). The pair of piercers, connected by muscles with the base of the maxillae, but attached directly to the head skeleton, into which they can be withdrawn, are regarded by former authors as mandibles.

Turning to the thorax we find that the first segment (prothorax) is distinct and free, with a wide dorsal sclerite. The mesothorax and metathorax are rather intimately fused together. Most remarkable in this order is the structure of the feet; there are never more than two dorsal segments, and the claws, usually so conspicuous in insect feet, are reduced (fig. 3 a) or absent, and the legs carry: pelligerous spines, and the terminal dorsal segment is cup-shaped at the end; from this hollow a delicate bladder (fig. 3 b) can be protruded, which at the same time has a direct communication with the blood-pressure, and by means of this bladder—acting as a sucker—the insect obtains nutrition from any surface that the foot touches. The narrow, delicate, fringed wings have already been described; each wing may be surrounded by a transparent "wing-bladder," or by a transparent film, the longitudinal nervurs, or the nervuration may be altogether degenerated. A fair number of species are wingless (fig. 3 d), and in both winged and wingless the occurrence of winged females with wingless males is noteworthy.

Ten segments are recognizable in the abdomen, which is elongated in some cases, and in many families the females of Thysanoptera have a conspicuous ovipositor (fig. 4) with serrate processes, projecting from the ventral surface of the abdomen. The number of spiracles is greatly reduced; in the adult a pair is present on the mesothorax, sometimes also on the metathorax, and there is always a pair on the first and another pair on the eighth abdominal segment. These processes belong to the remarkable honeycomb-like structures, and perforations to the tracheal tubes have not been demonstrated. The internal structure of the abdomen has been studied by K. Jordan. They possess a long, tubular gullet and a highly concentrated nervous system; in addition to the subesophageal ganglion, there are two thoracic ganglia and a single abdominal nerve-mass which is situated far forward. In this condensation of the nervous system several authors have been led astray by the presence of four Malpighian (excretory) tubes the Thysanoptera resemble the Hemiptera.

Development and Habitats. Many species of Thysanoptera are known to be habitually parthenogenetic. The eggs are laid on the food-plant, those females possessed of an ovipositor cutting through the epidermis and placing their eggs singly within the plant-tissues; a single female may take possession of the entire plant. The young insect resembles its parent in most points, but the head is disproportionately large; the anterior abdominal spiracles are on the second segment instead of on the first, and the foot has only a single segment. At first the eyes consist of a few distinct facets on either side of the head; they increase in number as growth proceeds, and become aggregated to form the curious compound eye of the adult. From two to four mouth parts—tentacles, maxillae, and proboscis—are formed. The "imaginal stage" is reached, which in the insect is moderately active and possesses wing-rudiments reaching to the second abdominal segment. After another moult the insect passes into the passive nymphal form "pupal tube" and remains in this condition in some safe hiding-place, such as the soil at the base of its food-plant or the hollow of a leaf-stalk. During this stage the cuticle draws in for the imaginal article which is forming beneath, ultimately becoming separated as a thin transparent pellicle through which the form of the adult can be seen.

Thysanoptera are found on the leaves and in the blossoms of plants. According to Hinds they feed chiefly on the green tissues, but they can also be procured by piercing mouth-parts and the sap withdrawn by suction. The traces are almost always irregular streaks of dry, whitened cells. It has been stated that when present in blossoms they feed on nectar, but it is more probable that the stems of the flowers and the fruits of many trees and others periodically migrate to roots. While the majority of the Thysanoptera are thus vegetarian in their diet, and are frequently associated with the blossoms, some species, when occurring in large numbers in the soil, adopt a predacious habit, killing aphids and small mites (so-called "red-spiders") and sucking their juices. There are even records of an Anaphothrips, when cut off from its normal vegetable food, of the becoming cannibalistic and feeding on its own species. The usual variations in habit that characterize plant-feeding insects are exhibited by the Thysanoptera some species being found only on one particular food-plant, while others thrive indifferently on a large assortment. Some members of this order spend the winter in the adult state, others in the "larval" or "pupal" condition. They shelter in crevices of the bark of trees, in the dried stems of grasses, in the dry leaves of bulbs, and fallen leaves on the ground.

Hinds states that the hibernating individuals live for more than six months. During summer there may be eight or nine successive generations when conditions are favorable and food abundant.

Distribution and History. The Thysanoptera are probably world-wide in their range, but they have hardly been studied outside Europe and North America. Fossil insects referable to the order have been found in amber, the White River Oligocene of North America, and the Baltic amber, but nothing is known as to the previous history of the group.

Classification.—Only about 150 species of Thysanoptera are known, and but a few of these have a more or less restricted distribution. They are described by Uzel, the North American by Hinds. These writers both follow the classification of Haliday, who divided the order into two groups or sub-orders.

1. Terebrantia: In this division (fig. 1, 4) the abdomen is cylindrical, the female is provided with a ventral ovipositor and has the terminal abdominal segment conical; the corresponding segment of the male is usually flattened. The forewings have at least a single longitudinal nervure—often one reaching from base to tip of the wing. The maxillary palps have usually three, the labial either two or four segments. There are two families of Terebrantia: (a) the Aedoeothrieidae, whose females have nine segments; whose wings, relatively broad and rounded at the tip, have a few cross nerves, and whose ovipositor is curved backwards; and (b) the Thripidae, whose females have from six to eight segments, the maxillary and labial palps, and the narrow acuminate wings have no cross nerves, and whose ovipositor is curved forwards. The latter family contains the great majority of the order.

2. Tubulifera: This division comprises a single large family, the Phloeothripidae; the species are not numerous, but some of them are of large size for Thysanoptera, as much as 8 mm. (one-third inch) in length. These insects have the abdomen flattened, with its terminal segment narrow and cylindrical. The palps, both maxillary and labial, have two segments. There is no ovipositor, and the wings are either without nervature, or a single degraded longitudinal nervure does not reach to the tip. While the Terebrantia are often winged and are hibernating in the ground (fig. 5), Megalothrips lati- tubuliferus are slow and deliberate. ventris, female, Europe. (According to Hinds, "they never 16")

RUNNING SPRING!

BIBLIOGRAPHY.—The number of important writings on the Thysanoptera is not large. A. Haliday's papers in Entom. Mag., 1836-1837, vols. iii. and iv., are still valuable and contain nearly all the information on this group, and after them have been studied (Zeits. wiss. Zool., 1888, vol. xxvii.) are valuable and the descriptions of the jaws by H. Garman (Amer. Nat., 1896, vol. xxxiv.), and C. Börner (Zeits. f. Zool., 1904, etc.), and the descriptions of the others are H. Uzel's Monographie der Ordnung Thysanoptera (Koniggratz, 1853; in the Czech language, but with a German summary), and W. E. Hinds's Monograph of the North American species (Proc. U. S. Nat. Mus., 1899, vol. xxvii.).

(G. H. C.)
THYSANURA, the name applied by P. A. Latreille to the primitive wingless insects known as springtails and bristletails. Sir J. Lubbock (Lord Avebury) separated the springtails as a distinct order, the Collembola, and by many students this separation has been maintained. It is better, on the whole, to regard the Thysanura and Collembola as sub-orders of a single order, the Aptera (q.v.). The Thysanura are recognizable by their elongate feelers and tail-processes ( cerci). Campodea (q.v.) Mecistus and Lepisia—to which belongs the "silver-fish"—are the best known genera. (See also HEXAPODA and Aptera.)

THYSAGETAE, an ancient tribe described by Herodotus (iv. 22, 123) as occupying a district to the north-east of Scythia separated from the Budini by a desert seven days' journey broad—perhaps the Voguls. From their land four rivers flowed into the Maeotis, but as one of them, the Oaurus, is almost certainly the Volga, there must be some mistake about this. They seem to have held the southern end of the Uralis about Ufis and Orenburg. (E. H. M.)

TIAN-SHAN, or CELESTIAL MOUNTAINS, one of the most extensive mountain systems of Asia. In the western prolongation, the system extends from the E. edge (in about 65° E.) of the Aral-Caspian depression in the W. to the great bend of the Hwang-ho (about 103° E.) in the E. The Chinese geographers, however, appear to have confined the term to that part of the system which falls between the conspicuous mountain-knot of Khan-tengri (8° 11' E. and 42° 15' N.) and the Otun-koza or Barkul depression in 92°-93° E., where the northern ranges of the system abut upon the Ektagh Alatai; and this conception and limitation of the term are more or less accepted by some European geographers, e.g. Dr Max Friedrichsen and G. E. Grum-Grahimalo. On the other hand P. P. Semenov (or Semyonov), one of the earliest scientific explorers of the system, applies the name to the ranges which lie immediately west of Khan-tengri, including Khan-tengri itself. The Tertiary Mountains and their north-western continuation, the Chinghiz-tau, are sometimes considered to belong orographically to the Alatian system; but there are good reasons for regarding them as an independent range. Excluding these mountains, the northernmost member of the Tien-shan system is the Dzungarian Alatau in 45°-46° 30' N. The southernmost range is the Trans-Alai, or eastern W.S.W. prolongation, Peter the Great's accretion in Karsteghin (Bokhara), though some geographers (e.g. Max Friedrichsen) assign both the Alai and Trans-Alai Mountains to the Pamirs.

General Orographical Description.—The Tien-shan consists almost everywhere of "sheaves" of parallel ranges, having their strike preponderantly east and west, while the Terek-tau, that is the main west of Khan-tengri and to the E.S.E. east of 92° E., thus describing as it were a wide flattened arc open to the south. The principal constituent ranges are accompanied by another set of ranges which break away from the main axes in a southerly direction giving rise to saps, and bounding them run from five to seven ridges as broad as the basin and rising by gentle slopes to 13,000-16,000 ft. The ridges run for long distances parallel to each other, and on many miles the sky-line is an almost straight crest, from which the rounded slopes of pure white snow-fields descend towards the basin. The crest line is notched by high passes only 1000-2000 ft. below the top of the crest. Often the summits of the ridge are broken into individual mountains, broadly flat-topped and of nearly equal elevation. . . . (Since late Tertiary times erosion has had but little effect in altering the country from the state to which it was brought by the great Tertiary "depressions." The result of these geological changes is that, although the internal structure of the Tien-shan region is highly mountainous, its external appearance is of a peneplain.) The valleys of the Tien-shan are often deeply incised between the ranges, and on the west side of the mountains the valleys are carried down into a narrow flat plain or intermontane basin, which often fills up to the elevation of 10,000 ft., and is consequently called a "matttormer." The loftiest range is that to the north, which exceeds 16,000 ft., and the altitude increases generally from west to east as far as the Bedel pass in 78° 30' E., where the route crosses from Ak-su and Uch-Turfan to the valley of the Naryn and Ferghana. At its south-western extremity the Kokshal-tau merges in the Kokya Mountains (16,000-18,000 ft.), which at their other end are merged in the Trans-Alai and Eastern and Northern Tien-shan.—The mutual relations and exact orographical connexions of several of the ranges east and north of the Khan-tengri group are not yet elucidated. The region east of the Bokhara Alatau was explored during the second quarter of the 19th century, by P. K. Kozlov, V. A. Obручев, the brothers G. E. and M. E. Grishmalo, V. I. Rebrovov and Sven Hedin. The system is known there locally as the Barkul Mountains and the valley of Ferghana against the Aralo-Caspian desert. The other arm of the bifurcation, situated farther south, and beginning at the Terek-tau, is double; it consists of the Alai and Trans-Alai transverse mountain ranges, divided by the low Bashkirs and Turkistan ranges, though orographically the Trans-Alai ought probably to be described as the border-ridge of the Pamir plateau. Thus the Tien-shan is as a whole narrowest in the east and spreads out again in the west.

Khan-tengri and the Central Tien-shan.—The peak of Khan-tengri, which according to Max Friedrichsen's observations is not so high as had generally been supposed, being 22,800 ft. instead of 24,000 ft., stands at the back of the Tien-shan range, as the crest of the watershed of the south-west. Its lofty summit on the actual watershed, according to G. Merz-Beck, seems to rise to 22,000 ft. (about 20,670 ft.); its altitude he puts at 20,670 ft. But the general altitude of the crest of the watershed he estimates at about 16,500 ft., and it is overtopped by peaks (e.g. Dr von Almasy's peak Edward Vil.) rising to 20,670 ft. and 21,720 ft.

Closely connected with the Khan-tengri knot are the Khalyk-tau on the east, and on the west three diverging lines of elevation, namely the Terskei Alatau, the Kirghiz Alatau, and between them the high Naryn rise, which is really in the Trans-Alai and the westernmost of the three. Thus the main mountain barrier seems to be divided into three sections, the eastern or Karatau, the middle or Naryn, and the western or Pamir.
TIAN-SHAN

Karylyk-tagh, which stretches from W.N.W. to E.S.E. Its middle parts are snow-clad, the snow lying down to 12,000 ft. on the north side, while the peaks reach altitudes of 14,000-15,000 ft., but the range is divided by a steppe and desert land lying between the east, where there are passes at 9600 ft. and 10,600 ft. (Belu-daban). Towards the east, the Karlyk-tagh radiates outwards, at the same time decreasing in altitude, though it rises again in the rocky Emir tagh, a line of peaks stretching from near the town of Chui to Karlyk Lake. The range belongs to the Chol-tagh. The Chol-tagh marks the northern escarpment, as the Kuruk-tagh, farther south, marks the southern escarpment, of the great massif. From the Chol-tagh to the south lies the Murz Sems (southern range, described under Gont) are apparently eastern prolongations, the former of the Khaidyk-tagh or Khaidu-tagh, and the latter, of the Kok-teke Mountains, which enclose on north and south respectively the Terek and the Lake of Baskunchak. These ranges terminate at the Kok-teke, on to the Khalyk-tau of the Khen tengri group. The Khaidyk-tau, which are crossed by the passes of Tash-againsn (770 ft.) and Ketyl (9900 ft.), are not improbably connected by the right hand continuation of the Ala-tau, as the two parallel range, the Khungie Ala-tau, in the west, in that they are an eastern prolongation of the latter. The Narat-tau appear to form a diagonal (E.W. to W.S.W.) link between the Khaitzhi tau and the Khalyk-tau and are crossed by passes which V. I. Roborovski estimates at 10,800 ft. (Sary-tyur) and 11,800 ft. (Mukhdurul). The Jambé pass in this same range lies at an altitude of 11,000 ft. and the Cholkhe pass 11,710 ft.

At the west end of the Barkul range is the gap of Otunkoza (2390 ft.), by which the Hami-Barkul caravan road crosses into the valley of Dzungaria, and at Urumqai (87° 30' E.), over 200 m. farther west, the east and west branches of the range converge and create the oasis of Turfan and Dzungaria. Between these two gaps stretches the snow-clad range of the Bogdo-olai, which runs at an average altitude of 17,000-18,000 ft. in the conspicuous double peak of Turpanat-tagh or Topotar-aule, a mountain which the Mongols regard with religious veneration. On the north side of this range the snow-line runs at an altitude of 2000 ft., and the steeps, which according to the Chinese are known as the "stony slopes of the Karlyk-tau," reach at 8000 ft. the snow-capped peaks of the Alatau, which lie at an altitude of 14,900 ft. In the south the Bogdo-olai is flanked by the nearly parallel range of the Jargab, a range which, in contrast to most of the common ranges, carries no perpetual snow. But its altitude does not exceed 10,100 ft., and its steep rocky slopes meet in a sharp, denticulated crest. West of the Urumqai gap, the Bogdo-olai is continued in the dangling range of the Karlyk-tau, which, rising both north and south, make a curious curve to the north-west and finally, under the name of the Talki Mountains, merge into the Boro-khor range. The Iren-khabirga, like the Bogdo-olai and the Terskei Ala-tau, are capped with perpetual snow. They culminate in the peak of Ala-megen-or at an altitude of 20,000 ft. The more southerly of the twin ranges, the Avral-tau, in which is the Arystan-daban pass at an altitude of 10,800 ft., terminates in 82° E. over against the confines of the Kizhik and 12,740 ft. The Boro-khor Mountains, with an average elevation of at least 11,900 ft., have all the characteristics of a border-range. This range, the slopes of which are alternately rounded and steep, is divided into two branches by the 89° 60' meridian. The south branch of the range, rising at 9000 ft., separates the valley of Kula (II) on the south from the depressions of Zairam-nor (6820 ft.) and Ehi-nor (670 ft.) in the valley of the Borotala on the north, the said valley opening out into the Karalai-Karakul basin. The valley of the Borotala, which is flanked by the Boro-khor lie at an altitude of 9000 ft., and the Terskei Ala-tau, which is parallel to another one and also to the lake and to the Terskei Ala-tau. The two chains are connected by the lofty transverse ridge of Amurad, Almata or Almatinka. The mountain chain of the Karakul-Ala-tau, which is joined to the Terskei Ala-tau, swings away to the north-west, and is continued in the elevated ranges of Kandyk-tau, Kulja-bashi, Khan-tau and the Chu-lii Mountains, the general altitudes of which lie between 4000 and 5000 ft. In the middle of the Trans-ili Ala-tau rises the Pamir or Pamir massif. This is a dome-shaped massif of the Pamir massif, which rises abruptly from the desert and lifts its snow peaks to an altitude of 15,000-16,000 ft., separating the river Syr-darya from the river Pamir. The Trans-ili becomes it Mel Taigar at an altitude of 4990 ft. The Trans-ili is a river of the Pamir massif. The Trans-ili rises near 8900 ft. above the Issyk-kul and lifts its summits higher than 13,000 ft. The passes across the twin

1 It may however eventually turn out that these ranges, together with the Mechin-ola, farther to the north-east and intimately connected with the Karlyk-tau, belong to the Altai system.
Indeed, the evidences, so far as they have been examined, appear to warrant the conclusion that the region of the Western Tian-shan, from Lake Issyk-kul southwards, was in great part the scene of probably five successive glacial periods, each being less severe than the preceding. It is probable that the glacial stream, at the head of the lake, or five large glaciers stream down the shoulders and embed themselves in the hollow flanks of Khan-tengri—the Semenov at altitudes of 12,410-12,800 ft., the Mushtekhet at 11,910-11,920 ft., the Inylchik glacier, and the Barson. The Inylchik glacier is composed of a length of about 45 m. glaciers. Occur also on Baiman mount to the south of the town of Auz, a by no means uncommon region there and other places. Formerly, the Fedchenko and Shishky's glaciers south of peak Kham. Generally speaking, the snow-line runs at 11,500-12,800 ft. above sea-level, and all ranges the peaks of which shoot up above 12,000 ft. are covered with a considerable amount of snow. Towards the plateau, the altitudes are 10,500 ft. A feature generally characteristic of the Tian-shan as a whole is that the absolute elevation of the ranges increases gradually from north to south, and from the centre decreases towards both the east and the west. At the same time the relative altitudes, or the heights of the mountain ranges above the valleys which flank them, decrease from north to south. For instance, in the Dzungarian Alai-tau, the valleys going south lie successively... in altitudes of 4300 ft. in the Borteilin, at 5600 ft. in the Urtasaryk and at 6820 beside the Zairam-nor. Again, while the III (Kulja) valley lies at 1300 ft. the Issyk-kul has an altitude of 5300 ft., the lower reaches of the Shishkys tend to the Chinghiz at 1500 ft. 6070 ft. the Son-kul valley 9430 ft. the Ak-sai valley, farther east, 10,000 to 11,150 ft., and the Charyk-kul on the north side of the Terek Mountains 11,200 ft. In the elevated regions of this part of the mountainous region, the snow-line rises above 12,000 ft. and the snow-line runs at a higher level than is usual elsewhere, namely at 12,900 ft. and even at 13,000-13,800 ft. on the Kokkii Mountains. "It is the middle of June," says one authority, "when the first snow is seen in the range."

The snow-line in the middle of July is 5000 ft. in most of the higher ranges is both milder and moister than on the south and east, and accordingly the precipitation in the former is relatively heavier, namely 10 to 20 in. annually. It used to be supposed that the snow-line in the central part of the range would be much lower in 20th century, and approximately the present snow-line would be 10,000 ft. The vegetation becomes luxuriant. According to P. P. Semenov, the following vegetable zones may be distinguished on the northern slopes of the Tian-shan: 1) at about 1575-3400 ft. are the zone of cultivation, 4300-8100 ft. the zone of coniferous trees, 8100-9500 ft. alpine pastures, 9500-11,900 ft., the higher alpine regions, and above the last limit is the region of perpetual snows. The range has a very abrupt gradient and desolate below the 10,000 ft. limit and above that it is dotted with scanty patches of grass and bush vegetation. Its general aspect is that of rugged slopes of bare rock, seeded with the beds of dry torrents choked with gravel (sees farther Turkestan, West)."
that of Benedict XII. (d. 1342), of which the head is preserved in the museum at Avignon, while an effigy of the same pope in the crypt of St Peter's at Rome has a tiara with only two crowns. Since Benedict XII. the triple-crowned tiara has appeared regularly on the monuments of the popes. The tiaras are essentially uniform, though the ornament varies (leaves or spikes).

Outside Rome it was still a considerable time before the triple-crowned tiara appeared in representations of the popes, and as late as the 15th century they are sometimes pictured with the single-crowned tiara. The reason for the addition of the third crown is unknown. The symbolism now attached to the triple crown (authority over heaven, earth and hell, or the temporal power and the power of binding and loosing) is certainly not the original explanation.

Several baseless hypotheses have been advanced as to the origin of the papal tiara. In all probability the camesacuum, the oldest form of the tiara, came into use under the Greek and Syrian popes of the 7th, or the beginning of the 8th century, perhaps even under Pope Constantine himself. The prototype of the camesacuum must undoubtedly be sought at Constantinople in the head-ornament forming part of the Byzantine court costume.

TIARET (Toherit), a town of Algeria, in the Tell Atlas, department of Oran, 122 m. S.E. of Mostaganem by rail. It occupies a fine open plateau 800 ft. above the sea at an elevation of 1552 ft. Pop. (1906), 5778, of whom 3433 were Europeans. The Wadi Tiaret flows through the town in a series of cascades. The upper town, the residential quarter, is on the right bank of this stream. The citadel occupies a separate hill on the other side of the wadi. The chief business centre is the lower town where are also the principal public buildings. On another hill opposite the citadel is the native town.

The citadel occupies the site of a Roman station believed to be that of Thurturia. Tiaret (Berber for "station") was a town of note at the time of the Arab invasion of North Africa in the 7th century and is stated by Ibn Khaldun to have offered a stubborn resistance to Sidi-Okba. In 767 it was taken by Abdurrahman ibn Rostem, the founder of the dynasty of the Beni Rustam (Rostem). Their empire, which during the reign of Abdurrahman (761-784) and his son Abdul Wahab (784-823) extended over the greater part of the modern Algeria, was known as the Ibadite Empire from Abdullah ibn Ibad, the founder of the heretical sect to which Abdurrahman belonged. The Ibadites represented the moderate section of the Kharjites (q.v.), and under the rule of the Beni Rustam the empire was a well-governed community. The dynasty was overthrown by the Fatimite general al Shiil in 829. Two years later Tiaret was captured by Massali ibn Habip of the Miknas dynasty of Morocco, and after his death in 924 two other princes of the same house maintained their independence, but in 933 the Fatimites again gained the mastery. The Ibadites, after being expelled from the Tell, took refuge in Wargla. They were driven thence in the 11th century and migrated to Mzaab, where their descendants still profess the Ibadite doctrines (see Mzabites). After its second capture by the Fatimites, Tiaret ceased to be the capital of a separate state. For a long period it was included in the sultanate of Tiemcen, and in the 16th century fell to the Turks. It was one of the chief towns of Abd el Kader, but was occupied by the French in 1843. At Takedempt, 6 m. west of Tiaret, Abd el Kader had his principal arsenal. About a mile from Takedempt are ruins of a town supposed to be the remains of the Ibadite capital. Eighteen miles S.S.W. of Tiaret are the sepulchral monuments known as the Jedars (see Algeria: § Archaeology).

TIBBU, or TIBBU (" Man of Tu", "i.e." of the rocks"), a nomadic tribe of the western Sahara, their tribe is very constant westward with that of the Tuareg Berbers. Roughly, their domain is some 200,000 sq. m. Their westernmost settlements are the oasis of Agram, Kawar and Jebabo, their northernmost the district of Gatron (Qatrun) within the Fezzan frontier, while south and south-east they merge gradually in the negroid populations of Kanem, Bornu (Chad basin), Wadai and north-west Darfur. But the bulk of the nation is concentrated in the region of Tibesti or Tu, hence their name. There are two main divisions—the northern Teda, or lessnegroid, Tiaret, and the southern Daza, or more negroid, Tiabb. Some what more distinctly connected with the same family are the Baelie of the eastern and south-eastern oases and the Zoghawa (Zaghwa) of Darfur. The Tiabb are variously estimated as numbering from 60,000 to 100,000, but their districts are so little known that these figures are not to be relied on.

The Tiabb are usually identified with the Garamantes of Herodotus (iv. 183), whose capital was Garama (Idrisi’s Germa) in Phazzania (Fezzan). The Hellenic name of what are now the Beni N'agatesians (Negroes ?) : ‘Οντας ἐν καὶ κατὰ τὸν ἤλιον Λαμπάς (i. 8). But Leo Africanus transfers them to the Berber connexion, whose fifth great division he deals with under the names of Gumeri (Garama, Germa), the Allied Bardacan, and the Zaghawa tribes, or negroes of the Tibesti. Lastly Heinrich Barth on linguistic grounds grouped them with the Kanaari of Bornu, who are undoubtedly negroes; and since his time (1854-1853) they have been regarded by most ethnologists as a negro people. Gustav Nachtigal, who studied them carefully (1870-1875), although his own inferences are somewhat vague, supplies sufficient evidence for a solution of the question. And more recently, as Kadum (1907), or negroes, or, in the time of the, the Teda, or true Tiabb, probably identical with the Tedamansil, a branch of the Garamantes, placed by Ploemey south of the Samamisci in Tripolitana,4 physically resemble their western Tuareg neighbours. Their language with general terms, without doubt, has undergone no perceptible change in their rocky homes, and are still distinguished by the regular features, long black ringlety hair, naughty bearing and fierce expression common to so many of the negro people, and, while they are finely proportioned, except the somewhat small hands and feet, with lighter complexion than that of the southern Daza, and no trace of beard, a little more robust, or, in the case of women, the third language characteristics of the true negro. “ Their women are charming while still in the bloom of youth " (Keane’s Reclus, xxii. 429). But there has been a general displacement of the race southwards; and, while a few Tiabb are still found in the Wadi Al Tana in the Nohla, the numbers have since medieval times penetrated into the Kanem, Bornu, Wadai and Darfur regions of central Sudan. Here they have everywhere merged in the natives, so that in the Daza, Kanembo, Kordofan and Darfur their people and language are mingled with all the shades of transition between the true negro and the true Berber. The same transitional stages are observed in the Tiabb forms of speech, which constitute a wide-spread linguistic family, whose most archaic and purest branch is the Tedaga of Tibesti (Nachtigal). Through the southern Dazaga the Tedaga merges in the more highly developed, and more recent Kanem, Bornu (Kanuri), Ennedi (Fadila) and Darfur (Zoghawa) dialects, which, owing to the absence of grammatical gender and some other structural features, are usually classed as negro languages. But a negro tongue could not have attained its present isolation without the care of a people who have carefully preserved it and explained the expression of this linguistic difficulty is obviously the same as that of the physical puzzle. The negro affinities of the southern Tedaga and the negro linguistic features of the original and now partly displaced negro idioms of central Sudan. There remains the final difficulty that Tedaga itself has nothing in common with the Berber or any Hamitic tongue. If, therefore, it is not Hamitic, how is it a negro group?. Its negro characteristics have been largely assimilated to the Sudanese negro dialects.

Lying on the tract of the great caravan route between Fezzan and Lake Chad, the Tiabb have always been a predatory race, levying blackmail on the caravans passing through their country, maintaining inter-tribal feuds and carrying on constant

1 See Vater, Mithräen, ii. p. 45 of Berlin ed. 1812, and Nachtigal, Stützpunkte im Sudan, ii. p. 17.
2 "Ursprünglich ein Negervolk," Lepsius, Nubische Grammatik (Einleitung), Berlin, 1880.
3 The original inhabitants of the Kufara (Kufra) oases were Teda, who were pushed south of the Duka by the Semnian conquerors of the end of the 18th century. Since the beginning of the 18th century they have been replaced elsewhere in Kufra by the Zlwa Arabs from the Leshkerre oases.
warfare with the surrounding Berber and Sudanese populations. The tribal organization embraces dardai or headmen, maina or nobles, and the common folk, while the unwritten law of custom rules supreme over classes. Their customs are partly negroid, partly Arab. They scent their faces like the negroes and wear the veil like the Tuareg.

See G. F. Lyon, Narrative of Travels in Northern Africa (London, 1821); Gustav Nachtigal, Sahara and Sudan (Berlin and Leipzig, 1879-1889); Gerhard Rohtls, Quer durch Afrika (1874-1875).

**TIBER** (anc. *Tiberis*; Ital. *Tevere*), a river of central Italy. It traverses the Tuscan Apennines—in which it rises at a point some 12 m. N. of Fieve San Stefano, 4160 ft. above sea-level—in a series of picturesque ravines, skirts the west foot of the Sabine Mountains in a broad shallow valley, then crosses the Roman Campagna, cutting its way through Rome, and finally enters the Tyrrhenian (Mediterranean) Sea by two arms at Ostia and Fiumicino, the latter artificial. Its principal tributaries are the Paglia, the Nera and the Anio or Teverone, and it is generally navigable by boats up to the confluence of the Nera, a distance of 104 m., though, owing to the rapidity of the current, there is very little navigation above Rome. The total length of the river is 240 m., of which 21 m. lie between Rome and the sea. This latter portion of the river's course is tortuous, but in spite of this, and although the depth varies from only 7 to 20 ft., and in places at low water does not exceed 3 ft., it is navigable by vessels up to 180 tons burden and proposals have been made to extend its navigable channel so as to increase this depth to 8 ft. at least, or to build a ship canal up to Rome. The area of the Tiber basin is 6845 sq. m. The stream is heavily charged with sediment, and from that circumstance got its ancient epithet of *fluvius* (tawny). It does not, however, form a delta proportionate to the volume of its water, owing to a strong sea current flowing northwards close to the shore, to the sudden sinking of the sea to a great depth immediately off the mouth of the river, and possibly also to the far more southward current of the Italian coast from the Tiber mouth southwards to Terracina. Still it has advanced at each mouth about 2 m. since Roman times, while the effect of the sediment it brings down is seen on the north-west coast as far as Palo (anc. *Alismum*), and on the south-east beyond Tor Paterno (see LAURENTINA Via) in the gradual advance of the coast. The rate of advance at Fiumicino is estimated at 13 ft. per annum. From Rome to the sea the fall is only 6-5: 1000. The arm which reaches the sea at Fiumicino is a canal dug by Claudius and improved by Trajan (see PORTUS), which partially silted up in the middle ages, and was reopened for navigation by Paul V. in 1612, 28 m. long, 50-130 ft. wide, and with a minimum depth of 5 ft. The lower course of the Tiber has been in part taken from the earliest ages subject to frequent and severe inundations; of more recent ones, those of 1598, 1879 and 1904 have been especially destructive, but since the year 1876 the municipality of Rome, assisted by the Italian Government, has taken steps to check, and possibly to prevent these calamities within the city by constructing embankments of stone, resting on caissons, for a total distance (counting in both sides of the river) of 6 miles. The flood of 1900 carried away about 1 m. of the new embankments, but it is the arm opposite the island owing to the faulty planning of the course of the river at that point, which threw the whole of the water into the right arm, and except in flood time, left the left arm dry—a fault which has since been corrected.

In the prehistoric period the mouth of the Tiber must have been situated at the point where the hills which follow it on each side cease, a Point 12 m. below Rome. On the right bank they are of Pleistocene gravel, on the left of tufa; and on the latter, a cliff rising above the river (the ancient *Pulita saxa*) stood Ficana (marked by the farmhouse of Dragoncello), which is said to have owed its origin to Ancus Marcius. Beyond these hills the low coast belt formed by the solid matter brought down by the river begins; and on each side of the mouth in the flat ground were salt marshes (see Ostia). The flood of 1900, when the river both above and below Rome flowed over the length of its valley, from hill to hill, and over most of the low ground at its mouth, gave an idea of the conditions which must have existed in prehistoric days.

**TIBERIAS** a town on the western shore of the sea of Galilee (to which it gives its modern Arabic name, *Ba’ar Tubariya*, i.e. Sea of Tiberias). It has a population of about 4000, more than half of whom are Jews (principally Polish immigrants). It stands in a fertile but fever-stricken strip of plain between the Galilean mountains and the Lake of Tiberias. For many centuries it was the seat of a kainmakam or sub-governor, subordinate to the governor of 'Akka. There are Latin and Greek hospices here, as well as an important mission, with hospital and schools, under the United Free Church of Scotland. The pre-Herodian history of the city is not certain. There is a rabbinical tradition that it stands on the site of a city called Rakka, but this is wholly imaginary. Josephus (Ant. xviii. 2, 3) describes the building of Tiberias by Herod Antipas near a village called Emmaus, where are hot springs. This is probably the Hammath of Jos. xix. 35. The probability is that Herod built an entirely new city; in fact, the circumstance that it was necessary to disturb an ancient graveyard proves that there were here no buildings previously. The graveyard was probably the cemetery of Hammath. Owing to this necessity Herod had a difficulty in peopling his city, and, indeed, was compelled to use force (Jos. Ant., loc. cit.) to cause any but the dregs of the populace to incur defilement by living in a place thus unclean. On this account Tiberias was long regarded with aversion by Jews, but after the fall of Jerusalem it was settled by them and rose to be the chief centre of rabbinic learning.

The building of the city falls between A.D. 16 and A.D. 22. It was named in honour of the emperor Tiberius, and rapidly increased in luxury and art, on entirely Greek models. Probably because it was so completely exotic in character it is passed over in almost total silence in the Gospels—the city (as opposed to the lake) is mentioned but once, as the place from which came boats with sight-seers to the scene of the feeding the five thousand, John vi. 23. There is no reason to suppose that Christ ever visited it. The city surrendered to Vespasian, and was given by him to Agrippa, a famous rabbinic school. Here lived Rabbi Judah ha-Kadosh, where he edited the Jerusalem Talmud, and here are the tombs of Rabbi Aqiba and Maimonides. Christianity never succeeded in establishing itself here in the Byzantine period, though there was a bishopric of Tiberias, and a church built by Constantine. In 637 the Arabs captured the town. The crusaders under Tancred retook it, but lost it to Saladin in 1187. In the 16th century the city was rebuilt by Joseph ben Arud, subvented by Doña Gracia and Sultan Suleiman. An attempt was made to introduce the silk industry. In the 18th century it was fortified and occupied by the famous independent sheikh Dhahir el-Amir.

Tiberias is notoriously dirty and proverbial for its fleas, whose king is said by the Arabs to hold his court here. Most of the town was ruined by the earthquake of 1837. The most interesting buildings are the ruins of a fortress, perhaps Herodian, south of the town, and an ancient synagogue on the sea-coast. The hot springs mentioned by Josephus (and also by Pliny) are about half an hour's journey to the south. (R. A. S. M.)

**TIBERIUS [TIBERIUS CAIUSIAZIT NOER]** (42 B.C.—A.D. 37), Roman emperor, was born near the town of Betar (Qabri), the son of the father, who bore the same name, who was an officer of Julius Caesar, who afterwards proposed to confer honours on the assassins, then joined Mark Antony's brother in his mad attack on Octavian, took refuge with Mark Antony, and returned to Rome when the general amnesty was proclaimed in 39 B.C. Livia, the mother of Tiberius, was also of the Claudian family, out of which her father had passed by adoption into that of the Livii Drusi. Early in 38 Livia was amicably ceded to Octavian (the future Augustus), and three months after her new marriage Drusus, brother to Tiberius, was born. Livia had no children by Augustus, and therefore devoted all her remarkable gifts to the advancement of her sons. Tiberius passed through the list of state offices in the usual princely fashion, beginning with the quaeestorship at the age of eighteen, and attaining the consulate for the first time at twenty-nine. From the great capacity for civil affairs
which he displayed as emperor it may be inferred that he applied himself with determination to learn the business of government.

But from 22 to 6 B.C. and again from A.D. 4 to 10 by far the greater part of Tiberius’s time was spent in the camp. His first service was as legionario tribune in one of the desperate and arduous wars which led to peace in the Spanish peninsula through the decimation, or rather the extermination, of the rebellious tribes. In 20 B.C. Augustus sent Tiberius with an army to seat Tigranes of Armenia on the throne as a Roman vassal. When Tiberius approached the frontier of Armenia, he found its throne vacant through the assassination of the king, and Tigranes stepped into his place without a blow being struck. Tiberius crowned Tigranes king with his own hand. Then the Partian monarch was laden with spoils beyond the standards of three Roman armies.\footnote{Horace, Odes, iv. 14.}

The senate offered a thanksgiving such as was usually celebrated in honour of a great victory. The following year was passed by Tiberius as governor of Transalpine Gaul. In the next year (13) he was despatched to aid his brother Drusus in subjugating the Retai and Vindelic, peoples dwelling in the mountainous region whence the Rhine, Rhone and Danube take their rise.\footnote{Drusus attacked from the eastern side, while Tiberius operated from the upper waters of the Rhine, and by stern measures the mountain dwellers were reduced to a state of quietude, and could no longer cut communications between northern Italy and Gaul, nor procreate their raids in both countries.} In 12 B.C. Agrippina, the great general of Augustus, died at the age of fifty-one, leaving Julia, the emperor’s only child, a widow. Agrippina, daughter of Agrippa by an earlier marriage, was wife of Tiberius, and had borne him a son, Drusus, afterwards father of Germanicus. Livis, with great difficulty, prevailed upon Augustus to replace Agrippa by Tiberius, who was compelled to exchange Agrippina for Julia, to his bitter grief. During the year of mourning for Agrippa, which delayed his new marriage, Tiberius was occupied with a protracted campaign against the Pannonians, followed by successful expeditions in the three succeeding summers.\footnote{His victories in the Danube regions, the emperor conferred on him the distinctions which flowed from a military triumph in republican times (now first separated from the actual triumph), and he enjoyed the “ovation” or lesser form of triumphal entry into the capital.} On the death of Drusus in the autumn of 9 B.C. Tiberius, whose reputation had hitherto been eclipsed by that of his brother, stepped into the position of the first soldier of the empire. The army, if it did not warmly admire Tiberius, entertain[ed a loyalty confidence in a leader who, as Velleius (the historian who served under him) tells us, always made the safety of his soldiers his first care. In the campaign of the Rhine, Drusus’s death Tiberius traversed all Germany between the Rhine and the Elbe, and met with slight opposition. But it would be too much to believe the statement of Velleius that he “reduced Germany almost to the position of a tributary province.” He was rewarded with the full triumph, the military title of “imperator,” and his second consulship, though the opposition of the powerful Sugambri had been only broken by an act of treachery, the guilt of which should perhaps be laid at the door of Augustus. In 7 B.C. there was another but insignificant campaign in the province of Cisalpine Gaul. In 6 B.C. Augustus bestowed on his stepson the tribunician authority for five years. Tiberius was thus in the most formal manner associated with the emperor in the conduct of the government on the civil side; but Tacitus (Ann. iii. 56) goes too far when he says that this promotion marked him out as the heir to the throne.

Tiberius now suddenly begged permission to retire to Rhodes and devote himself to study. He seems to have declined absolutely at the time to state his reasons for this course, but he obstinately adhered to it, in spite of the tears of Livia and the lamentations of Augustus to the senate that his son had betrayed him. The departure from Italy was as secret as it could be made. Years afterwards, when Tiberius broke silence about his motives, he declared that he had retired in order to allow the young princes, Gaius and Lucius, sons of Agrippa and Julia, a free course. There was perhaps a portion of the truth wrapped up in this declaration. Like Agrippa, who retired to Mytilene to avoid the young Marcellus, Tiberius had clearly no taste to become the servant of the two children whom Augustus had adopted in their infancy and evidently destined to be joint emperors after his death. But it may well be believed that Tiberius, unlike Agrippa, had no burning ambition to see himself in the place destined for his stepsons; and it may have been in his eyes one of the attractions of exile that it released him from the obligation to aid in carrying out the far-reaching designs which Livia cherished for his sake. But the contemporaries of Tiberius were no doubt right in believing that the scandal of Julia’s life did more than all else to render his position at Rome intolerable. His conduct to her from first to last gives a strong impression of his dignity and self-respect. When at length the emperor’s eyes were opened, and he inflicted severe punishment upon his daughter, her husband, now divorced by the emperor’s act, made earnest intercession for her, and did what he could to alleviate her suffering. At Rhodes Tiberius lived simply, passing his time mainly in the company of Greek professors, with whom he associated on pretty equal terms. He acquired considerable proficiency in the studies of the day, among which was astrology. But his attempts at composition, whether in prose or verse, were laboured and obscure. After five years’ absence from Rome, he begged for leave to return; but the boon was anxiously refused, and Livia with difficulty got her son made nominally a legate of Augustus, so as in some degree to veil his disgrace. The next two years were spent in solicitude and gloom. Then, on the intercession of Gaius, Augustus allowed Tiberius to come back to Rome, but on the express understanding that he was to hold aloof from all public functions—an understanding which he thoroughly carried out.

He had scarcely returned before death removed (A.D. 2) Lucius, the younger of the two princes, and a year and a half later Gaius also died. The emperor was thus left with only one son to succeed him, his only child, Julia, and still a boy. Four months after Gaius’s death Augustus adopted Agrippa and at the same time Tiberius. The emperor now indicated clearly his expectation that Tiberius would be his principal successor. The two essential ingredients in the imperial authority—the \textit{proconsulare imperium} and the \textit{tribunicia potestas}—were conferred on Tiberius, and not on Agrippa, who was too young to receive them. Tiberius’ career as a general now began anew. In two or three safe rather than brilliant campaigns he strengthened the Roman hold on Germany, and established the winter camps of the legions in the interior, away from the Rhine.

In A.D. 5 it became necessary to attack the formidable confederacy built up by Marobodius, with its centre in Bohemia. At the most critical moment, when Pannonia and Dalmatia broke out into insurrection, and an unparalleled disaster seemed to be impending, Marobodius accepted an honourable peace. The four serious campaigns which the war cost displayed Tiberius at his best as a general. When he was about to celebrate his well-won triumphs, the terrible catastrophe to Varus and his legions (A.D. 9) turned the rejoicing into lasting sorrow, and produced a profound change in the Roman policy towards Germany. Although Tiberius with his nephew and adopted son Germanicus made in A.D. 9 and 10 two more marches into the interior of Germany, the Romans never again attempted to bound their domain by the Elbe, but clung to the neighbourhood of the Rhine. Tiberius was thus robbed in great part of the fruit of his campaigns; but nothing can deprive him of the credit of being a chief founder of the imperial system in the lands of Europe. From the beginning of 11, when he celebrated a magnificent triumph, to the time of the emperor’s death in 14 Tiberius remained almost entirely in Italy, and held rather the position of a joint emperor than of that of expectant heir. Agrippa Postumus had died, and his place was beyond his reach; he had been banished to a desolate island. In all probability Tiberius was not present when Augustus died, although Livia
spread reports (eagerly amplified by Velleius) of an affectionate interview and a lingering farewell.

Tiberius ascended the throne at the age of fifty-six. What struck his contemporaries most was his absolute impenetrability. All his feelings, desires, passions and ambitions were locked behind an impassable barrier, and had to be interpreted by the very uncertain light of his external acts. It is recorded of him that only once did he as commander take counsel with his officers concerning military operations, and that was when the destruction of Varus’s legions had made it imperatively necessary not lightly to risk the loss of a single soldier. The penalty of his incurtnability was widespread dislike and suspicion. But behind his defences there lay an intellect of high power, cold, clear, and tenacious, in which every department of the state more by virtue of instinct and application than by genius. His mind moved so slowly and he was accustomed to deliberate so long that men sometimes made the mistake of deeming him a wavering. He was in reality one of the most tenacious of men. When he had once formed an aim he could wait patiently for years till the favourable moment enabled him to achieve it, and if compelled to yield ground he never failed to recover it in the end. The key to much of his character lies in the observation that he had in early life set before himself a certain ideal of what a Roman in high position ought to be, and to this ideal he rigorously adhered. Agrippa Postumus, sternness, silence, simplicity of life and frugality as he deemed that they had been practised by the Fabrici, the Curii and the Fabii. That Tiberius’s character was stained by Vice before he became emperor, no one who fairly weighs the records can believe. The persuasion entertained by many at the end of his life that he had been always a monster of wickedness, but had succeeded in concealing the fact till he became emperor, has slightly discoloured the narratives we possess of his earlier years.

The change which came over him in the last years of his life seems to have been due to an inward conviction of the spiritual powers that had made him the elder Pliny call him “the gloomiest of mankind,” and disposed him to brood over mysteries and superstitions. As this gloom deepened his will grew weaker, his power tended to fall into the hands of unworthy instruments, terrors closed in around his mind, and his naturally clear vision was perturbed.

The change of masters had been anticipated by the Roman world with apprehension, but it was smoothly accomplished, Tiberius was already invested with the necessary powers, and it may even be that the senate was not permitted the satisfaction of giving a formal sanction to his accession. Agrippa Postumus was put to death, but Livia may be reasonably regarded as the instigator of this crime. Livia indeed expected to share the imperial authority with her son. At first Tiberius allowed some recognition to the claim; but he soon shook himself free, and later became estranged from his mother and held no communication with her for years before her death. The history of Tiberius’s relations with other members of his family is hardly less miserable. Perhaps with any other commander than Germanicus the dangerous mutiny of the troops on the Rhine which broke out soon after Tiberius’s accession would have ended in a massacre of the discontented legions upon the capital. The perilous episode of Arminius caused the recall of Germanicus and his despatch to the East on an honourable but comparatively inactive mission. The pride and passion of Agrippina, the grand-daughter of Augustus and wife of Germanicus, tended to open a breach between the husband and the emperor. In his Eastern command Germanicus found himself perpetually watched and even violently opposed by Piso, the governor of Syria, who was expected to have received secret orders from Tiberius. When Germanicus died at Antioch in A.D. 19, the popular wish combined with Agrippina in demanding vengeance upon Piso; and the emperor was forced to disown him. The insinuation, conveyed by Tacitus, that Piso poisoned Germanicus on orders from Tiberius, will not stand criticism. The death of Germanicus was followed four years later by that of the emperor’s son Drusus. These two princes had been firm friends, and Livilla, the wife of Drusus, was sister to Germanicus. Years afterwards it was found that Drusus had fallen a victim to the treachery of his wife Livilla, who had joined him to that of the emperor’s executor the state Sejanus. When Drusus died, Tiberius nominated two of Agrippina’s sons as his heirs. But Sejanus had grown strong by nursing the emperor’s suspicions and dislike for the household of Germanicus, and the mother and the princes were imprisoned on a charge of crime. In his memoirs of his own life Tiberius declared that he killed Sejanus because he had discovered that he entertained a mad rage against the sons of Germanicus. But the destruction of Sejanus did not save Agrippina and her two children. The third son Gaius Caesar (Caligula), lived to become emperor when Tiberius died in 37.

Throughout his reign Tiberius strove earnestly to do his duty to the empire at large. But he lived through the last century of exceptional upheaval and with an almost superstitious reverence the constitutional forms which had been constructed by Augustus. Only two changes of moment were introduced. The imperial guard, hitherto only seen near the city in small detachments, was by the advice of Sejanus encamped permanently in full force close to the walls. By this measure the turbulence of the populace was kept in check. The officer in command of the guard became at once the most important of the emperor’s lieutenants. The other change was the practically complete abolition of the old comitia. But the state was treated with an almost hypocritical deference, and a pedantic observance of forms as the essential principles of ancient Roman forms was observed towards the senatorial magistrates. The care expended by Tiberius on the provinces was unremitting. His favourite maxim was that a good shepherd should shear the flock and not slay it. When he died he left the subject peoples of the empire in a condition of prosperity such as they had never known before and never knew again. Soldiers, governors and officials of all kinds were kept in wholesome dread of vengeance if they oppressed those beneath them or encouraged irregularity of any kind. Strict economy permitted light taxation and the state was permitted almost without any reluctance the use of noble families and the revenue of the publicans. Public security both in Italy and abroad was maintained by a strong hand, and commerce was stimulated by the improvement of communications. Jurisdiction both within and without the capital was on the whole exercised with steadiness and equity, and the laws of the empire were at many points improved. The social and moral reforms of Augustus were upheld and carried further. Such risings against the emperor’s authority as occurred within the Roman domain were put down with no great difficulty. The foreign or rather the frontier policy was a policy of peace, and it was pursued with consider-
shrouded himself in mystery, and such stories are probably the result of unfriendly attempts to penetrate the darkness. If history ventures to doubt the blackness of Theodora, that of Tiberius grows continually lighter under the investigations of criticism. Suetonius makes the emperor’s condition to have been one of mania, issuing frequently in the abandonment of all moral restraint. But in that case the authority of Tiberius, which was as firmly upheld during the years spent at Capreae as it had been earlier, must have fallen to pieces and come to an end. With respect to Sejanus, it is impossible to acquit Tiberius of blame. If he was deceived in his favourite he must have been willing to be deceived. He conferred on Sejanus a position as great as had been held by Agrippa during the reign of Augustus, and the minister was actually, and all but formally, joint emperor. Of the administrative ability of Sejanus there can be no question; but the charm and secret of his power lay in the use he made of those apprehensions of personal danger which seem never to have been absent from his master’s mind. The growth of “delation,” the darkest shadow that lies on the reign, was mainly a consequence of the supremacy and the arts of Sejanus. Historians of Rome in ancient times remembered Tiberius chiefly as the sovereign under whose rule prosecutions for treason on slight pretexts first became rife, and the hateful rule of informers was first allowed to fatten on the gains of judicial murder. Augustus had allowed considerable licence of speech and writing against himself, and had made no attempt to set up a doctrine of constructive treason. But the history of the state trials of Tiberius’s reign shows conclusively that the straining of the law proceeded in the first instance from the eager flattery of the senate, was in the earlier days checked and controlled to a great extent by the emperor, and was by him acquiesced in at the end of his reign, with a sort of contemptuous indifference, till he developed, under the influence of his fears, a readiness to shed blood.

The principal authorities for the reign of Tiberius are Tacitus and Suetonius. The Annales of Tacitus were not published till nearly eighty years after the death of Tiberius. He rarely quotes an authority by name. In all probability he drew most largely from other historians who had preceded him; to some extent he availed himself of oral tradition; and of archives and original records he made some, but comparatively little, use. In his history of Tiberius two influences were at work, in almost equal strength: on the one hand he strived continually after fairness; on the other the bias of a man steeped in senatorial traditions forbids him to attain it. No historian more frequently refutes himself. Suetonius was a biographer rather than an historian, and the ancient biographer was even less given to exhaustive inquiry than the ancient historian; moreover Suetonius was not gifted with great critical faculty, though he told the truth so far as he could see it. His Lives of the Twelve Caesars was written nearly at the time when Tacitus was composing the Annales, but was published a little later. Velleius Paterculus is by far the oldest authority for any part of Tiberius’s life. He had been an officer under Tiberius, and he eulogizes his old general enthusiastically—feeling it necessary, however, to do less than justice to the achievements of Germanicus. To Velleius all defenders of Tiberius have eagerly appealed. In truth it is his silence alone which affords any external aid in repelling the charges of Tacitus and Suetonius, and the fact that Velleius published his work in the lifetime of his master deprives that silence of its value. The eulogy of Sejanus which is linked with that of Tiberius must needs shake faith in the scrupulousness of the author. It is still doubtful whether Dio Cassius (whose History ended with the year 239) in his narrative of the reign of Tiberius is to any great extent independent of Tacitus. In recent times a considerable mass of inscriptions has added to our knowledge of the administration of this emperor. The chief account of Tiberius in English is that contained in Dean Merivale’s History of the Roman Empire. Professor E. S. Beesly has written an interesting defence of him in his Catoine, Cleodius and Tiberius (1878). The best recent history of this period is Hermann Schiller’s Geschichte der römischen Kaiserzeit (Gotha, 1883). Much historical information is given in the editions of the Annales of Tacitus, of which the best in English is that of Furneaux (Oxford, 1884); Freytag, Tacitus and Tactius (Berlin, 1870) (following Stahli, Tiberius, Berlin, 1863), exposes the inconsistencies of Tacitus’ account. Many monographs have since appeared, written on similar lines, among which may be mentioned Jhne, Zur Erekreitung des Kaisers Tiberius (Strassburg, 1902); Gentile, L’Intrepide Tiberio secondo la moderna critica storica (1887); J. C. Varner, Tiberius the Tyrant (1902). The principles of the imperial administration of the provinces by Tiberius have been treated by Mommsen in the fifth volume of his History of Rome, translated into English by W. P. Dickson (1888).

**TIBESTI—TIBET**

TIBESTI, a mountainous and little known region of the central Sahara, inhabited by the Tibbu (q.v.). The country was partly explored in 1876 by Gustav Nachtigal; it had not been again visited by Europeans up to 1910, though French officers had reached Borku on its southern borders. By the Anglo-French declaration of the 21st of March 1899 Tiberist was included in the French sphere of influence in North Africa.

TIBET, or THIBET, a country of central Asia. It is the highest country in the world, comprising table-lands averaging over 16,500 ft. above the sea, the valleys being at 12,000 to 17,400 ft., the peaks at 20,000 to 24,600 ft., and the passes at 10,000 to 15,000 ft. It is bounded on the N. by Turkestan, on the E. by China, on the W. by Kasmir and Laos, and on the S. by India, Nepal and Bhutan. It has an area of over 1,000,000 sq. m., and an estimated population of about 3,000,000, being very sparsely inhabited.

**Origin of Name.**—The Tibetans call their country Bod, which
word in colloquial pronunciation is aspirated into Bhôd or Bhôt, and in the modern Lhasa dialect is curtailed into Bhô. Hence the country is known to Indians as Bhôti, and the inhabitants as Bhôt-îas.

This territory came to be known as Europeans as "Tibet" evidently because the great plateau with its uplands bordering the frontiers of China, Mongolia and Kashmir, through which travellers communicated with this country, is called by the natives Zhô-bhôt (written stod-bod) or "High Bod," or "Tibet," which designation in the loose orthography of travellers assumed a variety of forms. Thus in Chinese annals are found Tu-bol (5th century, a.d.), Tu-po-le, Tu-bul, Tu-bo-le (1018 and 1050 A.D.), etc. Bushell shows, being the same Chinese character which had formerly the sound of po); in Mongolian, Tôbô, Tobôt; in Arabic, Tôbet; in Jetib; J. de Plano Carpini (1247), Thôbet; Rubruquis (1253), Marco Polo (1298), Tébet; Ibn Batuta (1340), Thûtâb; Ibn Haukul (1376), Al Biruni (1020), Ovodic of Purdone (c. 1328), Orazio della Penna (1370), Tébet, which is the form now generally adopted. The inhabitants of Tibet call themselves Bod-po (pronounced usually Bhôd-po), or people of Bod. Owing to the rarefied air the men are somewhat taller than the flowery native writers are. "The Icy Land" (Gangs-Can) and the "Country of the Red Faces" (Gong-mar-gyi-yul). The Chinese name for central Tibet is Wei-T'sang, which is a transcription of the Tibetan designation of the two provinces U and Tsang (spelt dows-gisang) that constitute central Tibet. Among the Mongols, Tibetans are called "Tangutu" and the country Baromitala or the "right side," in contradistinction to Deonitala or the left side, which was their own name for Mongolia itself.

Geography of Tibet. A large part of Tibet is divided into three parts, the lake region in the west and north-west, and the river region, which spreads out on three sides of the former on the east, south, and west. The lake region extends from the Pangong t'so (t'so-lake) in Ladak, near the source of the Indus to the sources of the Salween, the Mekong and the Yangtse. This region is called the Chang-tang (Byang-lang) or "Northern Plateau" by the people of Tibet. It is extensive, elevated, and of the most barren appearance. From its great distance from the ocean it is extremely arid, and possesses no river outlet. The mountain ranges are spread out, rounded, disconnected, separated by flat valleys relatively of little depth. The country is dotted over with large and small lakes, generally salt or alkaline, and intersected by streams, and the soil is boggy and covered with tufts of grass, thus resembling the Siberian tundra and the Pamirs. Its average altitude is over 10,000 feet above sea-level, and it is highly diversified, and fresh-water lakes are intermingled. The lakes are generally without outlet, or have only a small effluent. The deposits consist of soda, potash, bcrax and common salt. This last is frequently found in large quantities. The mines of gold, silver, and copper are mentioned, but probably the result of the action of wind and intense cold. The loftiest lake so far as observed is Hosga t'so, near the Lingshi pass, at an elevation of 17,500 feet, and 27 miles in circumference. The lake region is noted for a vast number of hot springs, which are widely distributed between the Himalayas and 34° N., but are most numerous to the west of Tengri Nor (north-west of Lhasa). So intense is the cold in Tibet that these springs are sometimes represented by columns of ice, the nearly boiling water having frozen in the act of ejection. The southern portion, from Lake Pangong to Tengri Nor, is inhabited by pastoral tribes of Tibetans, and possesses a few hamlets, such as Ombo, Rukud and Senja. The river region comprises the upper courses of the Brahmaputra (Yaru Tsangpo), the Salween (Gyama nyul chu), the Yangtse (Dre chu), the Mekong (Nanga chu), and the Salween (Ma chu). Amidst the mountains there are numerous narrow valleys and ravines, from an altitude of 12,000 ft. downwards, with here and there fine forests covering the mountain sides. Villages of high stone-built houses, are numerous, yet enough to afford a little space for agriculture. The northern portion of Tibet is an arid and wind-swept desert; but in the southern portion the valleys of Lhasa, Shigatse, Gyansitse and the Brahmaputra extend over a good soil and groves of trees, well irrigated and richly cultivated.

The valley of the Brahmaputra (q.v.), or Yaru Tsangpo or simply Tsang-po, is the river as various local names—is the great waterway of central Tibet. On its north bank rises the Indus, by the Himalayas, on the north by a mountain system still more vast. This mountain-system was only vaguely known, in fact its existence was doubted by the little knowledge. During his journeys in 1900-1908, crossed it at several points. He found the system to form the chief physiographical feature of southern Tibet, and stated it to be "on the whole the most massive range on the crust of the earth, its average height above the sea-level being greater than that of the Himalayas. Its peaks are 4000 to 5000 feet lower than Mount Everest, but its passes average 3000 feet higher than the Himalayan passes." Its extreme breadth is almost as great as that of the great basin of the central area, by the chain of lakes running N.W. and S.E. between 30° and 33° N., beyond which the mountains of central Tibet are much lower. The system at no point narrows to a single range; generally there are three great chains, and the valleys are everywhere broad. As across its breadth on the north and south is a great range of mountains, the watershed between rivers flowing to the Indian Ocean—the Indus and its tributaries, Brahmaputra and its tributaries, and Salween—on which different systems flowing to the Indian Ocean are separated. The principal ranges in the system are the Nien-chên-tang-la, called Kanchen-gangri in the west, the Targo-Gangri-Laphching range, the very lofty Humpo-Gangri range, the Dingla range, &c. The Targo-Gangri system is the one that had been studied always by Hedin's discoveries, and named Gangri; Hedin proposed for it the name of Trans-Himalaya.

Geology and Mineral Wealth.—Little is known of the geological structure of the central regions of Tibet. The observations of Strachey, Godwin-Austen and of Griesbach and other members of the Geological Survey of India only extend to the southern edge or rim of the great plateau, where vast alluvial deposits in horizontal strata have been farmed out. These mines are used by Russian explorers but have superficially examined the mountain regions of the north and north-east, and the British mission to Lhasa in 1904 only observed the country lying along the trade-route to that city. The general structure of the Trans-Himalaya and the western mountain system indicate that the main axis of upheaval of the whole vast mass of the Tibetan highlands is to be found on two approximately parallel ridges, which are separated by the Kukim-Yong-tso (10200) lake which is more or less coincident with the watershed between Indus and the central lake region, extending from Lake Pangong to Tengri Nor, the plateau enclosed between the two being wrinkled into parallels of ranges, of which there are two large sets of higher and lower, averaging from 1000 to 1500 ft. The strike of these folds is usually east and west and roughly parallel to the axes of elevation of the mountains. A most remarkable and noteworthy economic feature is the almost universal distribution of gold throughout Tibet. The gold-digging is referred to in some way mythical terms by Herodotus. Every river which rises in Tibet washes down sand impregnated with gold; this sand is not sought, but the miners, from the nature of the intervening strata, but must have existed previously in the crystalline rocks of the main axes of upheaval. In western Tibet the gold mines of Jahang have been worked since 1885. They have been visited by a number of the members of the Indian Survey, who report that much gold was produced and remitted twice a year under a Chinese guard to Peking. The Tibetans diggers collected together at the mines chiefly during the winter, when the frost assisted to bind the loose alluvial sand and render excavation easy. These mines are within 200 m. of the Ladak frontier, near the sources of the Indus, at an elevation which cannot be less than 15,000 ft. above sea-level. These aboriginal gold-digging villages of the Ladak frontier have been abandoned owing to the exorbitant levies levied on gold production by Chinese and Tibetan officials. Between the Ladak frontier and Lhasa the plateau region teems with evidences of abandoned mines, where the Indians have worked over large areas which had been abandoned by the exorbitant levies of past centuries. The gold-diggers are Chinese and Tibetan officials. Between the Ladak frontier and Lhasa the plateau region teems with evidences of abandoned mines, where the Indians have worked over large areas which had been abandoned by the exorbitant levies of past centuries. The gold-diggers are Chinese
desolation is unsolved by the existence of trees or vegetation of any size, and where the wind sweeps unchecked across vast expanses of arid plain. All the western region is but slightly affected by the monsoon. The central plateau is also characterized by extreme dryness in autumn, winter and spring, with an abundant rain in summer, whilst the eastern mountain region, extending to China south of the Dang la (which, with an altitude of 5,000 ft., or 1,525 m., is the highest point on the road to Lhasa), is subject to intense heat in summer and intense cold in winter. In March snow still lies deep in the Tsaidam passes, whilst Welby found the heat oppressive in June on a journey of observation on the plateau south of the He Kun, and a temperate climate prevailing about the sources of the Dré chu (Yangtze) in August.

All travellers testify to the perpetual wind currents from the west, which, in the case of the Tsaidam (9,000 ft.) and through the higher valleys of eastern Tibet, is a prevailing feature throughout Tibet at certain seasons of the year, as it is in the Pamirs, in Turkestan, in western Afghanistan and in Persia. The climate of southern Tibet, however, subject to considerable modifications from that of the northern and central regions, owing doubtless to its geographical connexion with northern India. Here, at an elevation of 13,000 ft., about the great Lango Dung, we hear of crops being richly cultivated; the class of barley is fully represented, and the more prominent kinds are Chusum and Kham-ling. Western and southern Tibetan flora were partially explored previously to the advent of these travellers. Professor Maximowicz concludes from an analysis of the Pjeyval's collection that the flora of Tibet is peculiarly rich in the number of species, and that it is chiefly composed of immigrants from the Himalaya and Mongolia. There is also a large percentage of endemic species. Chinese and European plants follow in the process of immigration. Those species which are distinctive of the eastern border ridges are found to reach the plateau, but do not spread westwards, so that a botanical separation or distinction is found to exist between the true plateau of Tibet and the adjacent tracts of the Pamirs. These farther to the east than the flora of Tibet on the whole as belonging to the Arctic-Alpine section of the great northern division, but containing a purely endemic element. Two typical species are Lysichiton spathularis, which occurs in the Pamirs, and the smaller form, L. pallasianus, an endemic fern specimen obtained by Lüttledale (Polypodium hastatum) is indicative of eastern China. Of the fifty or sixty genera obtained by Dr. Waddell from a single plant are, as a rule, perhaps indicating many of the most characteristic mountain forms. In the higher regions of northern and western Tibet the conditions under which vegetation exists are extreme. Here there are no trees, no shrubs, nor any plants above a foot high. Welby says he saw nothing higher than an onion. The peculiar form of tussocky grass which prevails in the Pamirs is the characteristic feature of the Tibetan Chang-tang of the Tsaidam plains and of the bogs north-east of Lhasa. Of grasses indeed there are many forms, some peculiar to Tibet, but no trees or shrubs at any elevation higher than 15,000 ft., except in the Kharo Pass of central Tibet, where Waddell has recorded the height of 16,300 ft. A flowering plant (Sussurra iridactyla) was discovered by Bower at an elevation of 19,000 ft. In south-eastern Tibet, where Himalayan conditions of climate prevail, we have a completely different flora. Of the list of plants in Rockhill's 'Tibet' the 'hot lands' (Tsari) in southern and south-eastern Tibet, extending even to Batang, peaches, apricots, apples, plums, grapes, water-melons, &c., and even pomegranates, are raised; most of Tibet on the other hand is a land of rice, wheat, barley, or such as parsnips, beans, cabbages, onions, &c. The principal cereals raised are barley and buckwheat, wheat in small quantities, and a little oats. A few localities in the extreme southern portions of the country, and the Lahul Valley, produce tea, a plant much esteemed on the mountainous ridges of the north. A variety of mountain bamboo is found in southern and parts of eastern Tibet, and is much used for basket work. Tibet produces a large number of valuable plants obtainable in China and Mongolia, among others the Cordyceps sinensis, the Coptis teeta, Wall., and Pickorrhiza kurroa, Royle, &c. Rubarb is also found in great quantities in eastern Tibet and Amdo; it is largely exported for European use, but does not appear to be used medicinally in the country. The trees most commonly found are the plane, poplar, maple, walnut, oak, the Cupressus funebris, the Pinus nepalensis, the Ephedra tamariscina, and the Salix smithii. Some of the most valuable plants are obtained in the mountains of southern and south-western Tibet, yielding the excellent yellow and red colours used to dye the native cloths. Waddell gives a list of 164 species of plants collected during his journey between Lhasa and Tashkashim.

Fauna.—The fauna of Tibet has been by no means exhaustively investigated, especially the rodents and smaller species of animals. Among domesticated animals to be found the horse, mule, ass, goat, sheep, yak, oxcart, camel, donkey, and the increased use of the cow is noticeable. Ovis aries and Equus caballus are the commonest species of the domesticated race of the Angora goat, and of the horse, in Tibet, whilst the others are found only as birds of passage. In eastern Tibet, on the Chinese border, varieties of the pheasant tribe abound, some of which are rare. Among them are the white pheasant, the Cerinthus temminckii, two kinds of eared pheasants, and the beautiful Lophura rubriventris. Moreover, the snowcock, the splitird (Tetraogallus tibetanus) are occasionally met with in the uplands, while the ordinary pheasants (Perdix hodgsoni) is common in the region, but there are no partridges.

People.—The Tibetan race, which probably belongs to the Turko-Mongol stock, is divided between the nomadic tent-dwelling Tibetans of the lake region and transition zone between it and the river region, and the settled sedentary population of the valleys. The tent-dwelling Tibetans, called Dokpa or Drupa (spelt kbro-ga), or 'steppe-dwellers,' are generally of a more Mongolized type than the people of the lowlands. The males measure about 5 ft. 5 in., except in eastern Tibet, where 5 ft. 9 in. is a common stature; the females are appreciably less. The head is mesaticephalic, verging on brachycephalic in the case of many of the Dokpa; the hair is black and somewhat curly; the eyes are usually of a clear brown, in some cases even hazel; the cheek-bones are high, but not so high as with the Mongols; the nose is thick, sometimes depressed at the root, in other cases prominent, even aquiline, though the nostrils are broad. The teeth are strong but irregular; the ears, with tolerably large lobes, stand out from the head, but to a less degree than with the Mongols. The mouth is broad, the lips not full, and, among the people of the lower altitudes, decidedly thin. The beard is sparse, and, with the exception of the moustache, which is sometimes worn, especially in central Tibet, it is plucked out with tweezers. The shoulders are broad, the arms round; the legs are not well developed, the calf is especially small. The foot is somewhat small but broad, the hand coarse. The women are usually stouter than the men. The colour of the skin of the Tibetans is a light brown, sometimes so light as to show ruddy cheeks in children; where exposed to the weather it becomes a dark brown. Their voices are full, deep and powerful. They can endure exposure without much apparent inconvenience; and though the nature of the food they use is such that they cannot stand absolute privation for any considerable length of time, they can exist for long periods on starvation rations, if eked out with weak soup or buttered tea, which is drunk at frequent intervals. The sedentary population of Tibet is of the same general type, except in less degree; the same physical traits as the Dokpa, but as one approaches China, India or the border lands generally, one observes that the admixture of foreign blood has considerably modified the primitive type. Among the customs of the Tibetans, perhaps the most peculiar is polyandry, the brothers in a family having one wife in common. Monogamy, however, seems to be the rule among the pastoral tribes, and polygamy is not unknown in Tibet, especially in the eastern parts of the country.

Their religion is described under Lamaism.

(L. A. W; T. H. H.)
TIBET

Language.—The language of Tibet bears no special name, it is merely known as "The Speech of Bod or Tibet," namely, Bod-skud (popularly known as "The language of the Tibetans and transplanted in the P. T. genus"), in contradistinction to the rje-sa or "polite respectful speech," of the educated classes, and the chos-skud or "the style in which the scriptures and other classical works are written.

It is not a uniform speech, but comprises several dialects which have been classed by Jaeschke into three groups, namely, (1) the central or Lhasa dialect, which is the language of the Tibetan peninsula, Tsang (including Spiti) which is the lingua franca of the whole country, (2) the western dialects of Ladak, Lahul, Baltiistan, and Purig, and (3) the eastern dialects of the provinces of Khams. In addition to these, there are many other dialects of Tibetans, which are spoken in the frontier Himalayan districts and states outside Tibet, namely, in Kunawar and Bashahr, Garwhal, Kumaon, Nepal, including Sikkim and Bhutan, and the Bhotanta dialect of Nepal. For the most part, these are not considered as dialects of Tibetan, but are spoken by the Nepalese or Sikkimese, who are not considered as such, and therefore not as a separate people. The language is spoken in the central and the Sifan dialects of a group of dialects on the Chinese frontier, which includes the Minyak, Sungpan, Lianfo, and Tochu dialects. On the north bordering on Turkestan the dialect of the nomadic Hor-pa tribes is much mixed with Turkic ingredients. The number of speakers of Tibetan dialects is probably not far short of eight millions.

Linguistically, Tibetan is allied to the Burman languages, and forms with them a group of languages known as Tungus-Burman-Tibet, and sometimes called "Tibeto-Burman" (q.v.), the unity of which family was first recognized by William Hodgson in 1828, and indeed several of the dialects of Tibetan are still only known through the Burman and Chinese sources mentioned above. The former, of which a knowledge was known of the Tibetan language before Hodgson's time was mainly derived from the writings of the Romish friars who resided in Lhasa in the 17th century, and who are called "the authors of the 18th century." The first serious European student of Tibetan was Csoma de Koros (1784-1842), an indefatigable Hungarian, who devoted his life to the study of this language and the ancient Buddhist literature in it. His name is still remembered today; for he was not known by his full name: Cora, which was a kind of cap he wore, a kind of fur cap which is still common in the Himalayas. The Tibetan characters were drawn by Della Penna and engraved by Ant. Fontanita in 1738. In 1820 Abel Remusat published his Recerches sur les langues tartares, a chapter of which was devoted to Tibetan.

1 The Capuchin friars who were settled in Lhasa for a quarter of a century from 1719 studied the language; two of them, Francesco Orsi and Giovanni Battista Lampugnani, were known as "the two European Capuchins of the Antarctic," and spoke Tibetan, and Cassian di Macerata sent home materials which were utilized by the Augustinian friar Aug. Ant. Geografi of Romana (1711-1797) in his Alphabetai tibetum (Rome, 1762, 4to), a ponderous and rather unemotional work in which some words, especially verbs, were transcribed with great caution. The Tibetan characters were drawn by Della Penna and engraved by Ant. Fontanita in 1738. In 1820 Abel Remusat published his Recerches sur les langues tartares, a chapter of which was devoted to Tibetan.

2 The first Tibetan dictionary for Europeans was a Dictionary of the Bhutana or Bhotan Language, published at Serampur near Calcutta in 1828. It was, however, crude and unedited and contained many serious mistakes, having been taken from the MS. notes of an unknown Italian priest (now believed to be Father Juvalal of Agra, who had been stationed near the frontier of Bhutan), whose MS. was translated into English by Fr. G. Schroeter and published without supervision by any Tibetan scholar; and Csoma was unaware of its existence when compiling his dictionary. As an example of the defective Vol. 1, pp. 247-249. He employed the Tibetan-Deutsche Wörterbuch in 1841, and these corrections of these works which he transcribed in a new, simplified language, and of the general form of the language which has been made by Dr. G. A. Bells in 1841. Meanwhile, the dictionary published by his student Walter, the collection Dictionary of Western Tibet. In 1902 was brought out at Calcutta a Tibetan English Dictionary with Sanskrit synonymes, introduced in 1839 and published by E. S. D. Schier in 1841, and the P. T. deutsches-deutsches Wörterbuch in 1841, and these corrections were made by a number of Chinese, Tibetans, and Missionaries of the English Bible Society. In 1858 a Grammata tibetana, a comprehensive grammar, was prepared by Meilhat, and published by the Press of the Missionary Society of Edinburgh, and edited by Graham Sandberg and the Moravian missionary A. H. Heydey. The Tibetan Manual by W. A. V. Donaldson (1935) is a useful work, and so is the Manual of Tibetan Grammar by C. A. Bell (Cambridge, 1919), which has full English-Tibetan vocabularies, and I. S. B. Survey of India (1908). As regards native philology, the most ancient work extant is a grammar of the Tibetan tongue preserved in a manuscript in the library of the P. T. in St. Petersburg. There are other works of the same kind, dictionaries by later writers, translations of many Sanskrit works on grammar, vocabulary, &c., and bilingual dictionaries, Sanskrit and Tibetan. As separate publications there are several dictionaries in Chinese and Tibetan: Chinese, Manchu, Mongol, Oelot, Tibetan and Turkish; Tibetan, Sanskrit, Manchu, Mongol and Chinese.

The language was first reduced to writing with the assistance of Indian Buddhist monks in the middle of the 7th century A.D. by a Chinese named Sabin, and was first used in the printed form of the Indian Sanskrit charact}
The verb, which is properly a kind of noun or participle, has no element analogous to the English verb "to be." In this respect, Tibetan is like the Anglo-Saxon. In both languages the sentence "I am," /*are/*/*is*, is expressed as an external and internal inflection, or the addition of auxiliary verbs and suffixes when the stem is not susceptible of inflexion, so that instead of saying "I go," "a Tibetan says" /*my go*/. The conditions which cause the prefix to be used are not easily and clearly stated, and imperative are marked either by aspiration of the initial or by one of the five prefix consonants according to the rules of euphony, and the whole looks like a former system thrown into confusion and misapplication of some accidental word order so that the prefix a or e in the present tends to become a in the imperative, the e changing to a in the past and future; and u are less liable to change. Which case then it is difficult to indicate certainly which of the number of verbs are capable of four changes; some cannot assume more than three, some two, and many only one. This deficiency is made up by the addition of auxiliaries or suffixes. There are no new words formed by assonance and consonantial changes, and languages of eastern Asia, though words expressive of a collective or integer are often used after the tens, sometimes after a smaller number. A good deal of new research on the grammar is to be found in Grisewood's "Linguistic Survey of India," part III., 1908. In scientific and astrological works, the numerals, as in Sanskrit, are expressed by symbolic words. In the order of the sentence the substantive precedes the adjective and the verb last; the object and the adverb precede the verb, and the genitive precedes the noun on which it depends; this contrasts with the order in the isolating Chinese, where the order is subject, verb, object. An accent has been assigned to the nouns in the nominative case, which goes only before a neuter or intransitive verb. The chief differences between the classical language of the Tibetan translators of the 9th century and the vernacular, as well as the language of the present day, are vocabulary, grammar and grammatical structure, and arose from the influence of the translated texts.

The Tibetan language, presenting such marked differences between its written and spoken forms, has a great interest for philologists, *Philology*. On account of its bearing on the history of the monosyllabic languages of eastern Asia, with their so-called "Isolation," or "Foreign," or "Intransitive," or "Nominal," or "Consonantal," or "Consonatical" forms. Is the Tibetan a monosyllabic language passing to agglutinative, or the reverse? The question has turned mainly upon the elucidation of the phenomenon of the silent letters, generally prefixed, which differentiate the meaning of words, without their pronunciation, in the central dialect or current speech of Lhasa. Rémusat rather dubiously suggested, while Schmidt and Schlegel, in the "Voyage en Chine," have been led to the view that the Tadji is a monosyllabic language of two parts, or in the order of the language, "Isolation," with the superimposition of "Consonantal," or "Consonatical," forms. Is the language monosyllabic, or "Isolated," or "Nominal," or "Foreign," or "Intransitive," or "Consonantal," or "Consonatical," as the case may be? The question of whether the pronunciation is that of a written, or the written that of a spoken, language is a problem of great interest.

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account just given stands good whatever solution the question of prefixes may receive in future.

**Literature.**—The religious literature, which is very considerable, is the source of almost all our information about the legends and folk-tales and superstitions of the Tibetans. A number of Tibetan religious treatises, with a few monastic and other works, have been translated into English, and a few of the more popular and classical Buddhist works have been published in the vernacular (Tibetan). Most of the Buddhist literature of Tibet is divided, probably owing to the printing being in the hands of the priests. One of the most popular and widely circulated books is called *The Hundred Thousand Songs of the Vajra Song* (Dzongs i lha). This name is usually ascribed to Mila, although this book (ascribed to his disciple), often called Mila, was a Buddhist ascetic of the 11th century, who, during the intervals of meditation travelled through the upper part of the country, and thus became acquainted with the people by their improvisations in poetry and song, proselytizing, refuting and converting heretics, and working manifold miracles. His legends are not without wit and poetical merit. An equally popular and instructive work is *Sgrungs rgyags* (At the Feet of the Dissipated Young Dalai Lama who was deposed in 1701 (see LILASA). There are a number of poems written in an elevated style, also dramatic works chiefly alluding to characters of mystic lore and the history of the Tibetan race. The Tserig Epic, which has been translated by A. H. Francke under the title of the *Kesar Saga*, is a widely known tale of a heroic warrior king of northern Asia named Kesar (believed by some to be a transcription of "Czar") but it is not found as a printed book. Several collections of folk-songs have also been published by A. Francke from Ladak. A long story book, called the *Dijiang yi* (*Sjugro ba giungs*), and regarded as the national epic in Khiam, has been partly seen by Dreogol and Baber. It is in prose; but the dialogue, interspersed with songs, is metrical, and is much more extensive than the prose framework. Religious literature includes instructions alternative with comic episodes. It includes three divisions—the *Dijiang ling*, which describes the invasion of part of Tibet by the Dijiang or Moso; the *Hor ling*, which recounts the conquests of the Hor (Turk tribe) from that country; and the *Dijiang ling* (Chinese division), which narrates a contest of unknown date between the Tibetans and the Chinese. This work has apparently never been published, and even the titles of the three divisions cannot, says Baber, be obtained in a complete form. But every Tibetan, or at least every native of Khiam, who possesses any education, is able to recite or to chant passages of the work. Another Tibetan story, Khaur, the *Gyjaldrug*, praises Dzigolme, a famous warrior who subdued the savage men of Khiam. Dramatic works exist, as also a version of the *Ramayana* in the first volume of the *Bsdilogs* of the Peking University.

**Writing.**—Writing was not introduced until the 7th century. Notched sticks (shing-chram) and knotted cords were in current use, but the latter contrivance is only faintly alluded to in the Tibetan records, whilst of the other there are numerous examples. No mention is anywhere made of a hieroglyphical writing, but on the eastern frontier the medicine-men or *lomba* of the Moso have a peculiar pictorial writing, which is known in Europe from two published MSS. (In Journ. Roy. Asiatic Soc., 1855, xvi.), though apparently now confined solely to purposes of witchcraft, it perhaps contains survivals of a former extensive system superseded by the Tibetan letters. According to Baber, writing, as it now exists, is a development or confused mixture of the old Sanskrit and modified Sanskrit "writing in thirty characters" (already detailed under Language and six of which do not exist in Sanskrit) in two styles, the thick letter and the thin letter, the latter being the more common, and is used in printed books, and the half-cursive "cornered letters," so called from their less regular heads. The former are traditionally said to have been derived from the Landza character. The Landza of Nepal, however, is certainly not the origin of the Tibetan letter, but rather an ornamental development of the parent letter. The close resemblance of the Tibetan characters "with heads" to the Gupta inscriptions of Allahabad shows them to be of the same parentage, and the monumental writing of the four main divisions of the Dravidian family, and various arguments appear to show that the other Tibetan letters came from the same Indian character in the style in which it was used in common India. The "half-cursive" or "headless" (a-med) characters, of which there are several styles. The ancient manuscripts discovered by Dr. M. Aurel Stein in Khotan seem to include very early, if not the oldest, forms derived from the script. (A. W. & C. L., Tibet.)

**Political Divisions.**—Tibetans divide their country into five provinces: (1) Amo, which comprises that part of the Chinese province of Kanshu which is inhabited by Tibetans, and Koko Nor region, extending southwards to the Yellow river and westwards as far as the Tasaidam. Amo is inhabited in its eastern part by Tibetans, called Rongga or "razheng-folk," who are agriculturists, and in the western by pastoral tribes, collectively called Panaka or the Three Panakas. (2) Khams or Khamde, which includes all eastern Tibet between the Chinese provinces of Szechuan and Yunnan, and the district of Lhong, which forms the eastern border of the Lhasa-governed territory. This province is divided into the five Horba tribes, the eighteen Nyarong states in the valley of the upper Yalu, and the districts of Litang, Batang, Derge, Gartok Chiamdo and Draya. In Khamdo, but subject to the direct rule of Lhasa, are several small districts, the principal are Nyarong, Tsarang, and Mar Khams or "Lower Khamdo." Most of these districts are governed by *daba* or chiefs, while a few have kings or *gyalpo*, the most powerful of the latter being the king of the Litang district, who is the head of Chagla, or, as it is better known, Tachenlu, as it is called by the Chinese or the Dartsenmo of the Tibetans, the headquarters of the ten trade with China. Khamdo is under the direct rule of the Chinese provincial authorities of Szechuan. Some of its rulers send also tribute missions to Peking. For convenience of classification we may include in Khamdo a long strip of country extending along the northern border of the Lhasa territory of Lhong-jong and Larego as far as Tengri Nor, and bounded to the north by the Tang-la mountains, which is designated by Tibetans as *Gyuda* or "the Chinese province." This strip of country has its own native chiefs, but is under the control of a high Manchu officer stationed at Lhasa, known colloquially as the "superintendent of savage tribes." (3) The third political division is *U* (written Dhus), meaning "Central." It includes Lhasa and a large number of outlying districts in south-eastern Tibet, such as Po, Pemakothen, Zayul. The pastoral or Dokpa tribes, north and north-east of Tengri Nor, are also under its rule. (4) The fourth division of Tibet, called *Tsung*, includes all south-west Tibet from the Lhasa or Central frontier to the Indus. (5) The fifth division, called *Nari* (Mngah-ri) by the Tibetans or *Hande* by the Indians, who call the inhabitants Haniyias, comprises the whole country around the sources and along the upper course of the Indus and the Sutlej, and also all north-western Tibet generally, as far as Ladak and the border of Kashmir. Tsang and Nari are under the rule of Lhasa, all the high civil and military authorities in these provinces holding their offices from these. These provinces, however, do not include the elevated steppes of Tsaidam (extending between the Kuen-lun and the Altyn Tagh), inhabited by a mixed race of marauding people, Tunguts and Mongols. Yet Tsaidam is geographically a northern extension of the great Tibetan plateau, and in most of its essential physical features it is more closely allied to the Chang-tang of the south than to the sandy depressions of Chinese Turkestan or Mongolia on the north.

**Government.**—Though the whole of Tibet is under the suzerainty of China, the government of the country is divided into two distinct administrations, the one under the rule of the Dalai Lama of Lhasa, the other under local kings or chiefs, and comprising a number of fields or fiefs immediately controlled by the high Chinese officials residing at Lhasa, Sining Fu, and the capital of the Chinese province of Szechuan. North-eastern Tibet or Amo, and also a portion of Khamdo, are under the supervision of a high official (Manchu) residing at Sining Fu in Kanshu, whose title is Imperial Controller-General of Koko Nor. The native chiefs of the Panaka and other Tibetan tribes of this region are styled *phesa* ("official") or "headman") by both the natives and the Chinese. The region under the supervision of the imperial controller includes all the countries north of the upper course of the Dere-chu (Yar-khol). They pay to China a tax of some 3d. to any other impost; they also pay a small tax in kind, sheep, butter, &c., to their chiefs. The province of Khamdo, including all eastern Tibet, is governed by local chiefs, styled *gyalpo*, "king," and *daba*, "chief," succession to the chieftainship being usually assured to the eldest son not a lama. Each chief appoints a certain number of civil and military officers to assist in the government of the country, and each village has its headman or *besa*, also an hereditary office. None of these officials receive salaries; they are only exempt from taxation, and some have grants of land made to them. The only tax paid to China is a so-called "horse-tax" of about 3d. for each family. Once in every five
years the chiefs send a tribute mission to the capital of Szechuen, and once every ten years to Peking, but the tribute sent is purely nominal. The Chinese maintain a few small military posts with from six or eight to twenty men stationed in them; they are under the orders of a colonel residing at Tachienlu. There are also a few lama chiefs.

The part of Tibet under the rule of Lhasa, by far the largest and wealthiest, includes the central province of Ī, Tsang, Nari, and a number of large outlying districts in southern and eastern Tibet. The central government at Lhasa, all of the province is at Lhasa; the nominal head is the Dalai lama or grand lama. The Tashi lama or head of the monastery of Tashihunpo near Shigatse is inferior to the Dalai lama in secular authority, of which, indeed, he has little—much less than formerly—but he is considered by some of his worshippers actually superior to him in religious rank. The person next in consideration to the two great lamas is the regent, who is an ecclesiastic appointed during the minority of each Dalai lama. Under him are four ministers of state (sha-po or kalön), who divide among themselves, under the immediate control of the chief minister, the management of all secular affairs of the country. There is also a Tsong-du or National Assembly, divided into a greater assembly, including all government officials, and called together only to decide on matters of supreme importance, and a lesser assembly, consisting of certain high officials of Lhasa, noblemen, and delegates from the monasteries of Debung, Sera, and Galdan, and fairly constantly in session. The Tsong-du discusses all matters of importance, especially relating to foreign policy, and its decisions are final. The army is under the command of the senior Chinese amban, a Tibetan generalissimo or mag-pön, and six Tibetan generals (dak-pön or de-pön). The military duties of the generals are slight, but their political status is high. Under the dak-pön are six rü-pön or colonels, and a number of subordinate officers. The regular army consists (in theory) of 6,000 men, on active service for three years, and at home on half-pay for three years. After the six years they pass into the reserve or militia (yul-mag). The taxes paid to the Lhasa government are mostly in kind, sheep, ponies, meal, butter, wool, native cloth, &c., and the coin paid is said to be about 30,000 ounces of silver a year. Chandra Das states that the crown revenues of Lhasa amount to about 3,000,000 rupees annually.

All high Tibetan officials, whether ecclesiastics or laymen, are appointed subject to confirmation by the Chinese government. The administrative subdivisions of the Lhasa country, of which there are fifty-four, are called jong, or "prefecture," each of which is under the rule of two jong-pön, the one a lama, the other a layman. They collect all taxes, are responsible for the levy of troops, the courier service, corvées, &c., and exercise judicial functions, corresponding directly with Lhasa. There are 123 sub-prefectures under jong-nyer. Under them are village headmen or tsö-pön, headmen or mi-pön, and elders or gya-po. All are appointed for indefinite periods by the prefects.

Industries and Trade.—The industries are confined to the manufacture of woolen cloth of various degrees of fineness and colour. and called iruk, irma, and lams, to that of small rugs, pottery of an inferior quality, utensils of copper and iron, some of which show considerable artistic design, and to such other small trades as are essentially the banks of the province. The best artisans are Nepalese and Chinese, the former being the best workers in metal and dyers.

The great trade routes are, first, that which, starting from Cheng-tu, the capital of the Chinese province of Szechuen, passes by way of Tachenlur or Dartsedo, Litang, Batang, Chiamdo, Larego, Lhasa, Gyantse, Shigatse, reaches the Nepalese border at Nielam and goes thence to Katmandu. This route is called Gya-lam, "the China road" (or "high road"); the great bulk of Tibetan travel goes over it. Minor roads go from Sinping Fu in the Chinese province of Kansu via Tsialdam and the Tachenlur to the Tsangpo valley at Nielam or "northern road," which was much used by traders till the middle of the 19th century, when the Mahommadedan rebellions in northwestern China practically closed it. Another road starts from Szechuen and follows the river Szechuen, by way of the Yarrow River, joins the Gya-lam at Chiamdo; it is little used, as it passes through the country of the wild marauding Golok. Still another route starts from Tachenlur, and by the valley of the Yalung and the Dzo chu runs to Yekundo, and thence to Chiamdo. From this point it leads to Kirocho, and then through Gyade or Chinese province, thence to Lhasa and Lhasa. An important trade route from Sikhim Fu in Yarkandese region (Guiedad of the French missionaries) joins the Gyamal at Batang.

The most direct route from India to Lhasa, and that most frequented by the traders of Lhasa, is by the Chumbi Valley, and was opened by Sir Robert Brown in 1851. It runs from the British station of the Tang Pass (15,200 ft.), and thence proceeds via Gyantse (13,200 ft.) and the Khargo Pass (16,500 ft.), Yamdok Lake (15,000 ft.) to the Tsang-po (12,100 ft.), and crossing the river which runs up along the Kyi Chu, on the general level of the Chumbi, down to the Wei, 250 miles from Lhasa. The road from Simla goes 200 miles about midway between Lhasa and Lake Mansarowar. Further west Tibet may be reached from Kumaon by one of a group of passes (of which the best known is the Milam) leading to Lake Mansarowar. The lake becomes a sort of obligatory post on all routes to Tibet which lie between Ladak and Nepal. The Shipki road from Simla, which strikes the Sutlej at Totling (where there is a bridge), leads up to Manasarowar, coinciding with the high road (Changlow) after passing Totling. The remarkable area of gold-mining industry which lies to the north-east of Gartok is reached by another route from Leh, which, crossing the Chang-la close to Leh, passes by Rudok and goes to Katmandu. One of the most important lands of Tibet is the Chinese brick-tea, which even passes as currency. The tea imported from Szechuen is for the most part of inferior quality, estimated at 35% tea-leaves and 65% twigs and other material. It is compressed into large bricks, and costs two-thirds of a penny per pound. Efforts have been made by the planters of the Duars to prepare Indian brick-tea for the Tibetan market, which it is essential to counteract the European invasion of the market.

Money.—It is curious that Tibet, though using coined money, seems never, strictly speaking, to have had a coinage of its own. Till nearly the end of the 18th century the coinage had for a long time been derived from Nepal. That valley prior to the Gurkhas' domination (1766) was divided into four states (Kathmandu, Patan, and Katmandu), and these struck silver mohurs, as they were called, of the nominal value of half a rupee. The coins were sometimes struck with silver and copper, strung together in necklaces. These latter bore (obverse) a Nepalese emblem surrounded by eight fleurons containing the eight sacred Buddhist jewels, and (reverse) an eight-petalled flower surrounded by eight fleurons containing the names of the eight jewels in Tibetan characters. Portions of Chinese silver were sent from Lhasa with a small proportion of gold dust, and an equal weight in mohurs was returned, leaving to the Nepal rajahs, between gold dust and alloy, a good profit. The trade in these coins (which we may perhaps consider as almost the last to deteriorate) is said to have been a small addition to wealth. But the Gurkhas were mistrusted and their coin refused. A coinage was then issued which appeared only once in Tibet for domestic circulation, and was known as "kang-kow, i.e. miskangyung ("cash") are cut into aliquot parts, and in commerce are known as "la-poch," or "la-choo," the Chinese silver, stamped with the imperial seal, are also used. But of late years there has been an enormous influx of Anglo-Indian rupees, so that these have become practically the currency of the
country, even to the frontier of China, and are now counted, instead of being valued as bullion. They are called Piting tanka, (foreign coins), from the Hindi tanka, a rupee.

**Weights and Measures.**—The weights and measures in use are practically those of China. Desideri remained in the west till employed at the court of Lhasa, and the jealousies of the people are, the bre or bo of about four pints and the chush of twenty bo; the capacity of the bo varies according to localities. The most commonly used measures of length are the span (mto), the cubit (brau), and the arm’s-length or fathom (doppa).

**Exploration.**—Tibet was a terra incognita to Europeans. It is difficult of access on all sides, and everywhere difficult to traverse. Its great elevation causes the climate to be rather arctic than tropical, so that there is no gradual blending of the climates and physical conditions of India and Tibet, such as would tend to promote intercourse between the inhabitants of these countries. On the contrary, there are sharp lines of demarcation, in only a few points, and in the social aspects and conditions of life on either side. No great armies have ever crossed Tibet to invade India; even those of Genghis Khan took the circuitous route via Bokhara and Afghanistan, not the direct route from Mongolia across Tibet. Added to this was the religious exclusiveness of the Tibetans themselves. Thus it was no easy matter for the early European travellers to find their way into and explore Tibet. Frater Odoric of Pordenone is supposed to have reached Lhasa via the Tangrung, Cathay; but this visit is doubtful. On the strength of certain statements in his narrative, and of other accounts, Mendes Pinto, some authorities hold that he may have visited Lhasa in the course of his journeys in the middle of the 14th century. The Jesuit Antonio Andrade, a native of Portugal (1586-1634), travelling from India, appears to have entered Tibet on the west, in the Manasarowar Lake region, and made his way across to Tangut and north-western China; in 1661 the Jesuit fathers Johann Guebier (an Austrian) and Albert D’Orville (a Belgian) travelled from Peking via Tangut to Lhasa, and thence through Nepal to India. The extracts from Guebier’s narrative, given by Gabet, in his Kitab-i-burj (1667), are accompanied by a good drawing of Potala. During the first half of the 18th century various Capuchin friars appear to have passed freely between Calcutta and Lhasa (1708) by way of Nepal. They even founded a mission in Lhasa, which, after failing at first, was more firmly established in 1715 and lasted till 1733.

In 1716 two Jesuits, P. Ipolito Desideri, of Pistoia, and P. Freyre, a Portuguese, reached Lhasa by way of Kashmire, Ladakh, and the enormous journey from Ladakh by the holy lakes and the valley of the Tsangpo. The Jesuit at Lhasa till April 1721, witnessing the capture of Lhasa successively by Dzungar and Chinese. Of the moderation of the latter, and their abstinence from all outrage or plunder, he speaks highly. His departure was due to controversies between the Jesuits and Capuchins at Rome, which caused an order to be issued for his retirement from Tibet. An interesting letter from him, dated the 10th of April, 1716, is printed in the Lettres édifiantes, rec. xv., and he left a large MS. volume of his observations. The next European visitor was Samuel Van de Putte, of Flushing, an LL.D. of Leiden, whose thirst for travel carried him through India to Lhasa (1731), where he is said to have resided a long time, to have acquired the language, and to have become intimate with some of the lamas. After travelling from Lhasa to Peking with a Lama mission he returned, again by Lhasa, to India, and was an eyewitness of the sack of Delhi by Nadir Shah in 1737. Unhappily he ordered papers to be burnt after his death, and the knowledge that such a traveller must have accumulated died with him. In 1745 the Capuchin mission finally collapsed after a revival had been attempted in 1741 by a party under Orazio della Penna, of which Cassiano Bellettagi was chronicler. We possess some of the results collected by this mission in an excellent short treatise on Tibet by P. Orazio himself, as well as in the Alphabeta Tibetana of the Augustine monk A. Georgi (Rome, 1762). Some fifty volumes, the relics of the mission library, were in 1847 recovered from Lhasa by Brian Hodgson, through the courtesy of the Dalai Lama himself, and were transmitted as an offering to Pope Pius IX. The first Englishman to enter Tibet was George Bogle, a writer of the East India Company, in 1774, on an embassy from Warren Hastings to the Tashi lama of Shigatse. In 1783 Lieut. Samuel Turner was despatched on a mission similar to that of Bogle, and reached Shigatse, 1811-1812 the first English visit to Lhasa occurred. The travelled was Thomas Manning, a Cambridge man of Calius College, who had been long devoted to Chinese studies, the “friend M.” of Charles Lamb, from whom “Elia” professes to have got that translation of a Chinese MS. which furnished the dissertation on roast pig. After residing some years at Canton, Manning went to Calcutta, bent on reaching the interior of China through Tibet, since from the seaboard it was sealed. He actually did reach Lhasa, stayed about five months, and had several interviews with the Dalai Lama but was not destined to go further. He never published anything regarding his journey, and its occurrence was unknown to few, when his narrative was printed, through the zeal of Mr (afterwards Sir) C. Markham, in 1876. The account, though containing some passages of great interest, is disappointing. Manning was the only Englishman known to have reached the sacred city without the aid of an army. But the Abbé Huc states that William Moorcroft, an Englishman who made a journey into Tibet in the neighbourhood of Lake Manasarowar in 1812, and who afterwards went to Kashgar in 1824, lived in Lhasa for twelve years disguised as a Mussulman, and then went to the Afghan frontier in 1825 on his second journey; but if Huc’s statement is true he reached Lhasa in 1826, and did not leave it till 1838, being assassinated on his homeward journey, when maps and drawings were found on him, and his identity was for the first time suspected by the Tibetans. During the 19th century Europeans were systematically prevented from entering the country or speedily expelled if found in it. In 1844-1846 the French missionaries, Évariste Régis Huc and Joseph Gabet, made their way to Lhasa from China. They travelled from China the route followed by Guebier and Van de Putte, and reached Lhasa on the 29th of January 1846. On the 15th of March they were sent off under escort by the rugged road to Szzechueh. Huc’s book, Souvenirs d’un voyage, &c, is one of the most delightful books of travel. Huc was, indeed, not only without science, perhaps without accurate knowledge of any kind, but also without that geographical sense which sometimes enables a traveller to bring back valuable contributions to geographical knowledge though unable to make instrumental observations. He was, however, amazingly clever as a narrator and sketcher of character. It was Ke-sien, a well known Chinese statesman, who was dispatched for the purpose of keeping peace with the English at Canton in 1841, and was then on a special deputation to Lhasa, who ostensibly expelled them. The Tibetan regent, with his enlightened and kindly spirit, is painted by Huc in most attractive colours, and Markham expressed the opinion that the native authorities were then willing to receive strangers, while the jealousy that excluded them was Chinese only. The brothers Henry and Richard Strachey visited Manasarowar Lake in 1846 and 1848 respectively. In 1866 the Abbé Desgodins travelled through portions of eastern Tibet and reached Chiamdo (in Khâm), but was prevented from approaching any closer to Lhasa.

Beginning in 1863 a number of native Indian explorers were sent by the government of India into Tibet, for the purpose of surveying the country and collecting information about its inhabitants. These men were specially trained at Dehra Dun in the work of surveying, and entered Tibet with a strong wooden box with a specially concealed secret drawer for holding observing instruments, a prayer wheel with rolls of blank paper instead of prayers in the barrel on which observations might be noted, and lamaze rosaries by the beads of which each hundred passes might be counted. As may be imagined, they carried their lives in their hands in case of discovery. The best known of these men were Pundit Nain Singh, Pundit Krishna, originally known as A.-K. (from the first and last letters of his name transposed) and Uyen Gyaoto, or U.-G. Nain Singh reached Lhasa in the course of two remarkable journeys. In the first, after an ineffectual attempt by Nepal, he
travelled by the Manasarowar Lake, and the road thence eastward, parallel to the course of the Tsango, reaching Lhasa on the 10th of January 1866, and leaving it on the 21st of April 1867. On the second journey (1874) he started from Ladak, crossing the vast and elevated plateau by the Tengri Nor and other large lakes, and again reaching Lhasa on the 18th of November. Nain Singh gave an account of his journeys, and of his residence there, which, though brief, is full of intelligence and interest. This enterprising and deserving man, on the completion of his journey in 1875, was rewarded by the Indian government with a pension of information and land, and afterwards received the silver medal of the Royal Geographical Society and the Companionship of the Star of India. He died early in 1882.

In 1878 A.-K also revisited Lhasa, stayed a year, and afterwards continued into Tsaidam, not returning to India till 1882. Lama Ugyen Gyatsa, a semi-Tibetan, who was originally a teacher of Tibetan in a Darjeeling school, was trained by the Indian Survey Department as a surveyor, and being deputed to take tribute from his monastery to Tashilhunpo, he secured permission in 1879 from the Tashilhunpo authorities for Sarat Chandra Das, Bengal schoolmaster at Darjeeling, to visit that monastery, where his name stood as a vacancy. It was the opportunity for a series of valuable exploratory journeys through the Tibetan provinces adjoining the Indian and Nepalese frontiers, which added greatly to our stock of information about Lhasa and the districts surrounding that city. In their first journey the travellers set out from Jogni in Sikkim, and traversing the north-east corner of Nepal, crossed into Tibet by the Chatang la, and travelled northwards to Shigatse and Tashilhunpo. They returned by much the same way to near Khamba jong, and re-entered Sikkim by the Donkya pass. The journey was fruitful of information and of land, for mapping. Ugyen Gyatsa undertook another journey in 1883 to complete and extend his former surveys. Travelling by way of Khamba jong directly to Gyantsé and Shigatse, he turned eastwards at the latter town, finished the survey of the Yamdok tso, and crossed the Himalaya into the valley of the Lobratsangpo or Upper Manas river. At Shakhang jong he was arrested, and his true character discovered. He managed, nevertheless, to extricate himself, and turning north-eastwards he passed through Chetang, and reached Lhasa by way of Samye monastery. From this city he started for Darjeeling, which he reached on December 15th, 1882, into Central Tibet made a second journey in 1881, with the intention of reaching Lhasa. He travelled by way of Tashilhunpo, lay dangerously ill for some time at Samding monastery, duly reached Lhasa, where he visited the Dalai Lama, but owing to small-pox in the city could remain there only a fortnight, though he made full use of this time. During a journey home occupying nearly half a year he collected much further valuable information. Sarat Chandra Das's reports of his two journeys were published by the Indian government, but for political reasons were until 1890 kept strictly confidential. In 1899 they were edited by the Royal Geographical Society and in 1902 published. They contain valuable information on the superstitions, ethnology and religion of Tibet. Chandra Das also brought back from his journeys a large number of interesting books in Tibetan and Sanskrit, the most valuable of which have been edited and published by him, some with the assistance of Ugyen Gyatsa and other lamas.

The Russian explorer Prjevalsky, although he was not, strictly speaking, an explorer of Tibet, did much industrially towards determining the conformation of its north-eastern and eastern mountain systems. His third journey, into Central Asian wilds, which lasted from March 1879 to October 1880, included the sources of the Hwang Ho, or Yellow river, till then unmapped and unknown. His fourth journey, between November 1883 and October 1885, covered much of northern Tibet, and established the true character of Tsaidam. It was when setting out in 1888 to make an attempt to reach Lhasa that he died.

After Prjevalsky's death, V. I. Roborovski, with several companions, explored the western ranges of the Kuen-lun, and crossed southwards into Tibet, tracing the course of the Kiria river to the north-western plains of the central plateau. The distinguishing feature of these explorations, led by Russian officers, is their high scientific value and the contributions they have offered to the botany, natural history, geology and meteorology of the regions under investigation in addition to the actual geographical data attained. The Kuen-lun is known in their writings as the Russian Range.

In 1888 Mr W. W. Rockhill, an American possessing the unique qualifications for Tibetan exploration of a profound knowledge of the language and history of the country, coupled with the instincts and training of a scientific explorer, with the lamasery of Kumbum in north-western Tibet, took with three Chinese servants and a small caravan, proceeded round the north shore of Koko Nor, crossed eastern Tsaidam, and explored some of the rivers and lakes directly south of that region. Leaving Barong Tsaidam, he travelled south by way of the sources of the Yellow river, till he reached the Dre chu (upper Yangtsze-kiang), which he crossed to the north of the important trading centre of Yekundo. From this point he followed the valley of the Dre chu till about lat. 30° 31', where he passed into the basin of the Yelung river, traversed the Hornu basin, and finally reached Tachienlu by the Gi la and the valley of the Darchu.

In 1891 Mr Rockhill, starting again from Kumbum with three Chinese, passed south of Koko Nor through the country of the pastoral Panaka Tibetans, and by a very difficult pass (Vahon jamkar la) entered again the basin of the Tsaidam. He then turned west, followed the base of the south Tsaidam range as far as the Naichi Gol, where he entered the southern mountainous region forming the northern borderland of Tibet. From this point the traveller followed a general south-westerly direction around the heads of all the feeders of the upper Dre chu, and thence into the lake region of northern central Tibet, crossing Bonvalot's route south of the Chi-chang tso and that of Bower a few days farther south. Here, just north of the Namur tso his farther progress south was arrested and he was compelled to take an easterly course. After making a long détour north, often crossing the roads previously travelled by Bonvalot and Bower, and passing by Riwoche, he came to Chimdo and Tachienlu. The results of Mr Rockhill's two journeys were important and valuable.

Messrs A. D. Carey and A. Dalgleish in 1885–1887 made a protracted journey from Ladak, in the course of which they crossed the Aksai Chin, reached Khotan, entered the Tarim basin, and subsequently made their way eastwards and then southwards across the Alyn Tagh and the Tarim Khotian, and other ranges to the Tsaidam region. Finally a second journey was made into the north-west, through the Humboldt range, and by Hami, Urumchii, and Yarkand to Ladak again.

Bonvalot, accompanied by Father Dedeken of the Belgian Catholic Mission and Prince Henri d'Orléans, left Charkhil, south-west of the Lob Nor, in November 1889, and taking a very nearly due southerly course, reached on the 13th of February 1890 the eastern end of the Tengri Nor. Then pushing southwards, he crossed the Nienchen-tang-la and entered the Dam district near the Lhasa-Sining high road. Here the party was stopped by Tibetan authorities and forced to take the tea route through Chinese Tibet (Gyade) by way of Batasumdo, Chebotenchin, Riwoche, Chiamdo to Changka, near the upper Yangtsze-kiang, whence they proceeded to Tachienlu by Batang and Litang. Bonvalot noted some extinct volcanoes in the northern Tibet desert.

Accompanied by Dr W. G. Thorold, of the Indian Medical Service, and a native sub-surveyor, Captain Hamilton Bower, I.S.C., set out from Leh on the 1st of June 1891, and crossed the Lanak la and the Ladak frontier on the 3rd of July. From this point the party took a general easterly direction past the Mangtza tso, Horpa tso, Charol tso, and around the northern end of the Aru tso, all important lakes, at an average altitude of about 16,500 ft. From the Aru tso the travellers took a south-easterly direction...
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across the great northern plateau or Changtang till they reached the south-eastern side of the Garing t'so, in about 31° 30' N. and 89° 10' E. At this point Bower was stopped by some of the headmen of the Tibetan pastoral tribes (here under the rule of Lhasa), and obliged to make a long circuit to the north west well out of Lhasa territory, and then eastward—till he struck the road to Chiamdo through Gyade or Chinese Tibet. Crossing the Sining-Lhasa road a little south of the Dang la range, and about two days' journey north of Nagchuka, Captain Bower crossed the Su chu, and following a course parallel to the Giama-nu chu, he made his way to Rwoche and thence to Chiamdo, from which town he followed the Lhasa-Tachienlu high road to the latter town, which he reached on the 18th October. The results of Captain Bower's journey were all of first-class importance.

Miss Annie R. Taylor, an Englishwoman of the China Inland Mission, started from Tao-chow (Kansuh) in September 1892, accompanied only by five Asiatics. Passing by the famous lamasery of Labrang, south of the yellow river, she crossed the river and traversed the southern part of the country inhabited by the predatory Tibetan tribes called Golok. Thence, after crossing the upper Yalung, which flows by the town of Kanze, she pursued the junction of the upper and lower roads of the Vangpo-shiang (Dre) crossing that river somewhere near where A.-K. had crossed it in 1881 and Rockhill in 1889, and then came to the town of Gye-Yekundo. From this point she seems to have followed the Chiamdo road to near that town, when she turned westwards and continued in that direction till she came on the high road from Lhasa to Sining Fu somewhere north of Nagchuka. Here, like all other European travellers who have tried to reach Lhasa from the north, she was stopped by the Lhasan authorities. She appears to have followed about the same route on her way back to China, for she again went to Yekundo and thence by the high road followed previously by A.-K. and Rockhill, to Tachienlu in Sze-ch'uen, where she arrived on the 12th of April 1893.

In 1893 MMJ L. Dutreuil de Rhins and Fernand Grenard, both Frenchmen, left Chercen, with Lhasa as their objective. After crossing the Kara muren davan in the Arkha Tagh, they entered the lake region of north Tibet and followed a general southerly direction across low ranges of hills and plateaus, and by numerous small lakes till they arrived in 31° 30' N., where they changed direction to east-south-east, passing to the north of the Chargut and Ziling lakes. The travellers were able to push on as far as the north-eastern bank of the great Tengri Nor, which they reached on the 30th of November 1893. Here they were finally stopped by the Tibetans, and after a delay of six weeks passed in vain attempts to obtain permission to go to Lhasa, they were only allowed to proceed to Nagchuka on the Sining-Lhasa road, and to continue by the Gyade route to Yekundo, near the upper Dre chu, and thence to Sining in Kansuh. From Nagchuka the travellers followed a heretofore unexplored road through the Gyade country, crossing Rockhill's route in the Pse-Sangyl districts near Tashiilin (their Tachi gompa). The road followed by them to Yekundo is called by Tibetans the upper road (gong lam), and had apparently been followed previously by Miss Taylor. Reaching Yekundo (or Gergundo) on the 21st of May 1894, the travellers started for the Koko Nor and Sining on the 1st of June; but the party was attacked near Tungbhumdo (Tumbumbo of previous travellers), and Dutreuil de Rhins was killed on the 5th of June. M. Grenard after a few days resumed his march, passed east of the Noring t'so, the eastern extremity of Tousu Nor, and thence by the south-eastern corner of Koko Nor to the town of Sining Fu in Kansuh. The results of this exploration were a large number of maps and a report of great scientific importance. Mr Littledale, an Englishman, accompanied by his wife, left Khotan in the early part of 1895, and travelling thence to St George R. C. Cherchen, he turned southwards, and following up Littledale, 1895.

the course of the Cherchen darya to a point near its source, he continued in that direction between 87° and 89° E. across the northern plateau of Tibet till he reached the Zilling (or Garing) t'so. Pursuing, amid great difficulties, his southerly course, he finally reached the western bank of Tengri Nor. Pushing rapidly on in the direction of Lhasa, when not over 50 m. away from the city (camp, 35° 12' 13' N.) he was finally stopped by the Lhasan authorities and obliged, in great part on account of the severe illness of Mrs Littledale, to give up the attempt to reach Sikkim, and to take a direct trail to Ladak. In the latter part of this remarkable journey Littledale's route lay parallel but to the south of the routes followed previously by Nain Sing, and more recently by Bower. Passing by Rudok, the party re-entered Ladak at the village of Shushal on the 27th of October 1895, and left on the 2nd of November. Mr Littledale returned to Europe by a journey between Khotan and Shushal, and brought back a valuable collection of plants, which, added to those collected by other travellers in this part of Tibet, enabled botanists considerably to extend their scanty knowledge of this region.

Accompanied by Lieut. N. Malcolm of the 53rd Highlanders, Captain Welby, of the British army, left Lhasa on the 4th of May 1896. The travellers were compelled to enter Tibet by way of the Lighten t'so in 35° 5' N. From this point they turned due east and continued, accompanied by the usual incidents experienced by all travellers in those regions—cold, storms, lack of food and of grass, loss of ponies and pack animals, &c.—until they reached the northern branch of the Dre chu, the Chumar. Passing into the valley of the Nomorong Gol, south of the Tsaidam, they made their way by Barong Tsaidam to Donkyr and Sining Fu by the high road along the northern shore of the Koko Nor.

Captain Deasy, of the British army, left Lhasa on the 27th of May 1896, and crossing the Lanak la, passed by the Mangtza t'so, north of the Horpa t'so, to Yeshil kul. Thence he endeavoured to proceed due east, but was obliged to turn south by the nature of the country to turn south, crossing Bower's route on the west side of the Aru t'so. He finally completed a valuable survey of an important part of western Tibet.

In 1898 a Dutch missionary in China named Rijnhart started with his wife from the vicinity of Koko Nor, with the intention of reaching Lhasa, but at the upper Mekong, to the east-north-east of the city, he was murdered, and his wife reached the Chinese province of Sze-ch'uen with great difficulty alone.

Sven Hedin, a Swede (1857- ), left Kopa, a point about 100 m. south of Cherchen, and after crossing the Arkha Tagh took an easterly course between that range and the western continuation of the Kokoshili range till he entered the valley of the most northerly feeders of the Dre chu, when he passed into the valley of the Naichi Gol and entered the Tsaidam. His careful observations concerning the meteorology of this region are of great value, and his surveys between Kopa and the Naichi Gol were in a country not previously explored. During his second and more important journey in Central Asia (1899-1902), Sven Hedin left Charikhik, on the edge of the Taktalanak desert, in May 1901, intending to cross Tibet in a diagonal direction to the sources of the Indus. He made crossings of the lofty Arkha Tagh and other parallel ranges to the south (running east and west). On his final penetration southward, arriving within fourteen days of Lhasa, he left the bulk of his caravan and pushed rapidly on towards that city, but was stopped when about five days from it (Aug. 5, 1901). Rejoining his caravan he turned westward, and passing through the country previously traversed by Bower and Littledale he reached Lhasa on the 20th of December 1901. His careful and detailed maps, lake soundings, hydrographic, geological, meteorological and other investigations gave him the highest rank among modern explorers.

On a third journey (1906-1908) he travelled by way of Turkish Armenia, Persia, Baluchistan and India, and entered Tibet by way of the Aksai Chin. Proceeding south-east, or diagonally across the country, he traversed 840 m. of unknown country, investigating the lake Ngannon t'so or Ngantse t'so, which had hitherto been only hypothetically mapped, and marched thence
over the watershed between this and the Tsangpo. This watershed was found to lie much farther north than had been supposed, and to consist of very lofty mountains, in complicated ranges from which large tributaries descend to the Tsangpo (Brahmaputra). After a journey of half a year Hedin reached Shigatse; on leaving it he turned north again, intending to explore the large sacred lake Dangra-yumso, west of Ngantse, but when within sight of it he was prevented by Tibetans from approaching it. He now followed a deviuous route to Lake Manasarowar, entering Nepal for a short distance from Tradum, discovering the main source of the Brahmaputra in a great mass of glaciers called Kubiang-tse, near the northerning of the Himalayas. He next investigated the sources of the Sutlej, made hydrographic investigations of the Manasarowar lakes, with the neighbouring underground waterways, and proceeded to Gartok. He confirmed the existence, long suspected, of a lofty mountain chain extending right across the country from the lake Tengri Nor (i.e. about 90° E.) to the district north of Gartok (about 81° E.). He reached to Ladak in 1908. He was then elected a K.C.I.E. in 1910.

In May 1900 Koslov, in command of the Russian Geographical Society’s expedition to Central Asia and Tibet, left Baron Tschudin and Captain varma), and took to the Dre chu (his Ndu chu, or Blue river), at about the same point as Rockhill in 1889. Assisted by the old chief of Nyamtsa, he crossed the river and reached Yokundo (his Jarku Lomba). One stage beyond this place he left the route followed by former travellers and pushed northwards to near the town of Chamdo, where a sharp fight with the natives he turned eastwards. The winter was passed in the valley of the Ra chu, a tributary of the Chamdo chu (his Dza chu), and encampments were made as far as Derge drencher. In the spring of 1901 the expedition resumed its march eastwards along the Dre chu and the Ja chu (Yalung river), followed up the left bank of the latter and got back to Russian Lelu (Oriente’so) on the 30th of May 1901.

In 1903 Captain C. G. Rawling and Lieut. A. J. G. Harleagues of the Serbian Light Infantry, starting from Leh as a base, carried out careful survey work (their chief object being to extend that of Captain Desay) in the territory lying east of the British frontier, i.e. about 80° to 83° 1' E., and 34° N.

The British expedition of 1904 performed a brilliant feat of marching and reached Lhasa, whose mysteries were thus unveiled, but this exploit belongs to the section dealing with history, below.

History.—Previous to the 7th century A.D. there was no indigenous recorded history of the country, the people being steeped in barbarism and devoid of any written language. The little that is known of this prehistoric period is gathered from the legends and the more trustworthy sidelights of contemporary Chinese records.

From the 11th century B.C. the Chinese used to call by the name of Kiang (or Shepherds) the tribes (about 150 in number) of nomads and shepherds in Koko Nor and the north-east of present Tibet; but their knowledge continued to be confined to the border tribes until the sixth century of our era. In the annals of the Tang dynasty it is said that the population of the country originated from the Bat-Kian or Fah Kiang; and, as the information collected in the first part of the notice concerning Tu-bat, afterwards Tu-ban, the modern Tu-fan, dates partly (as is proved by internal evidence) from a time anterior to the Tang dynasty (A.D. 618), some degree of reliance may be placed on it. There we are told that Fanning, a son of the southern Lian dynasty of the Tu-bat family (which flourished from 397 to 415 at Lia-n-chow in Kansuh), who had submitted to the northern Lian dynasty, fled in 433 with all his people from his governorship of Lin-sung (in Kan-chow) westwards across the Yellow river, and founded beyond Tibshih ("heavy stones") a state amidst the Kiang tribes, with a territory extending over a thousand li. By his mild and just rule he was soon enabled to establish his sway over an immense territory. His original state was apparently situated along the upper course of the Yalung river, an affluent of the Khin-ha-kiang.

Through the exertions of Prinsep, Csooa de Koros, Emil Schlag-}

Lundwe, Chandra Das, Rockhill, Huth, Waddell and others, we have copies of many of the annals of Tibet from the legendary beginnings between the 5th and 2nd century B.C. down to the end of the monarchy in 914. But the several interruptions (both in our knowledge of the Likiu and translated by Schlaghamph and Rockhill. The first king, Gnyah-khi bsan-po, is said to have been the fifth son of King Prasenajit of Kosala, and was born with "seven different heads." He fled north of the Himalayas into the Bod country, where he was recognized by the leaders of the tribes of southern and central Tibet. He took up his residence in the Yarlung country south of Lhasa. This Yarlung, which borrowed its name from the Yalung of the state of Hedin, is a river which flows into the Yar-lo tsangpo (Brahmaputra). The first king and his six successors are known as the seven celestial kings; the next series consists of six kings known as the earthly deities and they were followed by eight territories ded. This three-fold succession is apparently an imitation or a debased form of the ancient legend of heavenly, earthly and human rulers, which was carried into Persia and China, and from the latter country into Japan. In the Samy-tam—the relative number of kings being altered in the last-named countries to suit local convenience and the small amount of truth which they contain. Whilst giving an Aryan descent from the first king, the Bhutanese legends also. The Liko kings were followed by four rulers simply called bsam ("mysterious").

Then occurs a break in the lineal descent and the king next in order (c. 460) may be the Tatar Fanni Tu-bat, but most probably his son and successor. His name was Lha-tho thori gnyan-tsam, otherwise Gyan-tsam of Lha-tho thori, according to the custom of his family, was a daughter of his father and his princesses a divine origin, and called them lhama, "goddess." The gynaecocratic habits of the race are manifested in the names of all these kings, which were formed by a combination of those of their ancestors, the "roc" and the "crown." The Liko kings were followed by four rulers simply called bsam ("mysterious").

In the year 680 the country was divided into two kingdoms, each represented by a sovereign, and this division was to continue to the present time.

Koko-Nor, from the name of a small lake to the north of the Lhasa, was in the possession of the Tais, who called it Jangts'a ("salt").

The Chinese annals do not mention the discovery of the inexhaustible salt mine called Chang-gi-tsa'wa (Byang-gi-tsa'wa "northern salt"), which still supplies the greater portion of Tibet. The reign of his illustrious son, Grom-bha gam-po, was marked by the establishment of Buddhism, and the art of writing from India, and was the founder (in 639) of Lha-ldan, afterwards Lha-sa. He was greatly helped in his prosecution of these two by his two wives, one a Nepale princess, daughter of King Gyantse, another a daughter of Dzil Khori ("black woman"); his son and only child, who was childless, he took two more princesses from the Ru-yang ("left corner") and Mön (general appellative for the nations between Tibet and the Indian plains) countries. As a conqueror he extended his sway from the still unsubdued Kiang tribes of the north to Ladak in the west, and in the south he carried his power through Nepal to the Indian side of the Himalayas. How far southward this dominion at first extended is not known; but in 703 Nepal and the country of the Brahmanas rebelled, and the Tibetan king, the third successor of Grom tsan gam-po, was killed while attempting to restore his power. It is rather curious that Koko-Nor is said of him, while other conquerors of the Koko-Nor in 665, and attacked the Chinese; after some adverse fortune the latter took their revenge and penetrated as far as Lhasa, where they burnt the royal palace (Yumbo-lagang). Khri Imdun, a grandson of the second king, and the eldest son of Tashi, was made king in succession from him, promoted the spread of Buddhism and obtained for his son, Jangts'a Lhamon, who was famous for the beauty of his person, the hand of the accomplished princess Kuyim-tsho, and put to death the female conqueror (Ko-lo) of the Imdun (? Taih) tsung. But the lady arrived after the death of her betrothed, and after long hesitation became the bride of the father. She gave...
The Mongol dynasty of China passed away, the Ming confirmed and enlarged the territory of Tibet, and by 1450, the Tsang-pa family was the most important monastery to visit him. This lama was Sodnam rGyamtso, the third successor of Gedun grub, the founder of the first Dalai Lama in 1447, who had been elected to the most important abbots of Dalai Lama near Lhasa, and he paid a visit to the great, afterwards Dalai. The immediate successor of Gedun grub, who ruled from 1475 to 1541, had appointed a special officer styled to help the civil administration of the country. To Sodnam rGyamtso the Mongol khans gave the title of Vaja Dalai Lama in 1576, and this is the first use of the widely known title of Dalai Lama. During the minority of the fifth (really the third) Dalai Lama, when the Mongol king Tengri To, under the pretext of supporting the religion, intervened in the affairs of the country, the Pan-ch'en Lo-sang Chö-kyi Gyal-ten'ang lama obtained the throne by the support of the Chinese, who paid him the indemnity, and then applied for help to the first Manchu emperor of China, who had just ascended the throne. This step enraged the Mongols, and the advance of Gushri Khan, son and successor of the Great Khan, caught the Dalai Lama. The Chinese, princes, including the king of Tsang, and, after having subjugated the whole of China, made the fifth Dalai lama supreme monarch of all Tibet, in 1645. The Chinese government in 1653 confirmed the Dalai Lama in his authority, and he paid a visit to the emperor at Peking. The Mongol Khoshotes in 1706 and the Sungura in 1717 interfered again in the succession of the Dalai Lama, but the Chinese army finally conquered the country in 1710, and the present system of government was established. It is probable that the isolation of Tibet was inspired originally by the Chinese, with the idea of creating a buffer state against European aggression.

In 1872-1873 some attempt was made by Indian officials to open up trade with Tibet; further attempts followed in 1884, and in 1886 a mission was organized to proceed to Lhasa. The Chinese, however, although they had at first granted a passport to this mission, later objected to its advance, and it was abandoned. The Tibetans assumed this to show England's weakness; they invaded Sikkim, and in 1888 it was necessary to send a force under General Graham to expel them. In 1890 a treaty was concluded, and trade regulations under this treaty in 1893; but the Chinese authorities, and the lamas, considering themselves to have received insufficient recognition, repudiated them and offered further insults. A new development presently appeared in the situation. A lama, a Mongolian Buriat by birth and a Russian subject, whose Russianized name was Dorjiev, had come to Lhasa about 1880. When subsequently visiting Russia, he appears to have drawn the attention of the authorities towards Tibet as a field for their statecraft, and he established himself as the unofficial representative of Russia in Lhasa. He obtained a commanding influence over the Dalai Lama, and in 1893 he was ordered to threaten Tibet from England, and suggested the desirability of securing Russian protection and even the possibility of converting the tsar and his empire to Buddhism. The Dalai Lama assented, and was even prepared to visit St. Petersburg, but was checked by the Tsong-dü (assembly). He therefore sent a representative of high rank, who had audience of the tsar, and returned with proposals for a treaty and for the residence of a Russian royal prince in Lhasa in order to promote friendly relations. But both the Chinese authorities in Lhasa and the Tsong-dü were averse to all but the most limited relations inspired by Dorjiev, now took steps to bring on a crisis by provoking England. He felt sure of Russian support. Russian arms had been imported into Lhasa. It was suspected, although denied, that a treaty was in draft under which Russia should assume the suzerainty of Tibet. A further encroachment on
of the frontier states of Nepal, Bhutan and Sikkim must be respected. To the Dalai Lama, who had attempted to obtain British intervention at Peking, it was made clear that he personally had no claim to this, as the British government could only recognize the de facto government in Tibet.


**TIBETO-BURMAN LANGUAGES.**

The Tibeto-Burman family comprises a long series of dialects spoken from Tibet in the north to Burma in the south, and from the Ladakh wazārat of Kashmir in the west to the Chinese provinces of Sze-ch'uen and Yunnan in the east. In the first place we have the various Tibetan dialects, spoken all over Tibet and in the neighbouring districts of India and China. Another series of dialects, the Himalayan group, is spoken in the southern Himalayas, from Lahul in the west to Bhutan in the east. Some of these dialects approach Tibetan in structure and grammatical principles, while others have struck out new lines of development, probably under the influence of the dialects spoken by an older population. East of Bhutan, to the north of the Assam valley, we find a third small group, the North Assam group, which consists of three dialects. A fourth group, the Bodo group, can be followed in a series of dialects from Bhutan in the north to the Tippeerca state in the south. They have at one time extended over most of Assam west of Manipur and the Nāgā hills, and even far into Bengal proper. To the west of the Bodos, in and in the neighbourhood of the Nāgā hills we find a fifth group, the so-called Nāgā group. It comprises dialects of very different kinds. Some of them approach Tibetan and the dialect of the North Assam group. Others are more or less akin to the Bhutan languages, and others again connect the Nāgā dialects with the Sino-Tibetan languages of the west south and east. To the south of the Nāgā hills, in the long chain of hills extending southwards under various names such as the Lushai hills, the Chin hills and the Arakan Yoma, we find a sixth group, the Kuki-Chin dialects. The old Meitei language of Manipur lies midway between this group and the easternmost branch of the Tibeto-Burman family, the Kachin group. The Kachins inhabit the tract of country to the east of Assam and to the north of Upper Burma, including the headwaters of the

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An advance was made to Tuna, where part of the expedition wintered. A further advance being made on the 31st of March 1904, the first hostile encounter took place at Guru, when the Tibetans (the aggressors) were defeated. With the fall of Guru further the expedition reached and occupied Gyanwest on the 12th of April; here some of the British forces were subsequently beleaguered, and the most serious fighting took place. In fact the advance to Lhasa, resumed after the storming of the Gyanwest fort (on the 5th of July), met with comparatively little opposition, and the capital was reached on the 3rd of August. The Dalai Lama had fled with Dorijev. Partly on this account, and in spite of the attempts of the Chinese authorities to bring about a settlement, there was some delay owing to the attitude of the lamas, but finally a treaty of peace was concluded on the 7th of September. The principal provisions were—the Sikkim frontier violated by the Tibetans was to be respected; marts were to be established for British trade at Gyantse, Gartok and Yatung; Tibet was to pay an indemnity of £300,000 (subsequently reduced to one-third of this sum); and no foreign power was to receive any concession in Tibet, territorial or mercantile, or to concern itself with the government of the country. The expedition left Lhasa on the 23rd of September and reached India again at the close of the following month. The treaty was slightly modified later in matters of detail, while the adhesion of China to the treaty was secured by an agreement signed on the 1st of October 1906.

The Anglo-Russian convention of 1907 determined the following conditions with respect to Tibet—the recognition of the suzerain rights of China and the territorial and administrative integrity of the country; that no official representative at Lhasa should be appointed either by England or by Russia, and that no concessions for railways, mines, &c., should be sought by either power. An annex to the convention provided that, except by arrangement between England and Russia, no scientific expedition should be allowed to enter the country for three years.

In January 1908 the final instalment of the Tibetan indemnity was paid to Great Britain, and the Chumbi valley was evacuated. The Dalai Lama was now summoned to Peking, where he obtained the imperial authority to resume his administration in place of the provisional governors appointed as a result of the British mission. He retained in office the high officials then appointed, and pardoned all Tibetans who had assisted the mission. But in 1909 Chinese troops were sent to operate on the Sze-ch'uen frontier against certain insurgent lamas, whom they handled severely. When the Dalai Lama attempted to give orders that they should obey, his authority was disputed by his government, and summoned the Chinese troops to enter the city. They did so, and the Dalai Lama fled to India in February 1910, staying at Darjeeling. Chinese troops followed him to the frontier, and he was deposed by imperial decree. The British government, in view of the apparent intention of China to establish effective suzerainty in Tibet, drew the attention of the government at Peking to the necessity of strictly observing its treaty obligations, and especially pointing out that the integrity
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Chindwin and the Irrawaddy. The Kachins have not as yet settled down, and are still pushing southwards. The Kachins and the Kuki-Chins gradually and finally merge into Burmese, the language of the ancient kingdom of Burma.

It is impossible to bring the relationship existing between all these various groups under one single formula. The dialects spoken in the Himalayas and in Assam can be described as a double chain connecting Tibetan with Burmese, which are the two principal languages of the family. In the first place the Kachin group runs from the easternmost Tibetan dialects in Sze-ch'uen down to the Burmese and Assamese. The second chain, the Assam valley, appears to possess in the north. We can trace one line from the North Assam group, the Naga, Bodo and Kuki-Chin groups. Another line can be followed from Tibetan through the Himalayan and Bodo groups into Kuki-Chin. The latter dialects finally merge into Burmese.

The original home of the Tibeto-Burman race seems to have been on the Upper Hwangho and the Upper Yangtsze-kiang in the Chinese provinces of Sze-ch'uen and Yunnan. The oldest invaders followed the Tsangpo into Tibet and became the Tibetans of the present day. Other hordes crossed the Brahmaputra and set up camps in the southern slopes of the Himalaya range. From the headwaters of the Irrawaddy and the Chindwin successive waves entered Assam and Further India. Some followed the course of the Brahmaputra and settled in the hills to the south and east of the great bend of the river. Others entered the Naga hills, while numerous tribes must have followed the Chindwin into Manipur and the hills to the south. The inhabitants of Burma have probably come down along the Chindwin and the Irrawaddy, and the latest immigrants, the Kachins, have only in modern times begun their wanderings southwards through the hills. The tribes living in the hills not only occupy a mixed character. Their home can be considered as a kind of backwater which has been overflowed by the waves of successive invasions.

In their original home the Tibeto-Burmans were the neighbours of Chinese and Tai tribes. Their languages are also closely related to Chinese and Tai, more closely to the former than to the latter. The agreement is apparent in the phonetical system, in vocabulary and in grammar. The principal point in which they differ is the order of words. The Tibeto-Burman family arranges the words of a sentence in the order of subject, object, verb, while the order in Chinese and Tai is subject, verb, object. Together and separately the languages form one great family, which is usually called Indo-Chinese.

The Indo-Chinese family is usually considered as a typical instance of the so-called isolating languages. The single words do not consist of more than one syllable. They are incapable of inflexion because there are no form-words, which merely denote relation in time and space. Grammatical relations are therefore not indicated by prefixes, but simply by putting together, according to fixed rules, words of which each retains its independence. Thus a sentence such as "the father struck the boy" would be translated "father agent son striking completion." This state of affairs, which is the prevailing condition in Chinese, is not, however, the original one. While the bases of the words are monosyllabic, i.e. each word consists of one syllable, comparative and superlative forms are generally formed by adding a suffix, as in Burmese. As a result the meaning of which cannot always be ascertained, but which modified the meaning of the base in the same way as the terminations of other languages. Such prefixes were not accentuated, and in the course of time they were commonly reduced and often dropped altogether, so that each word (i.e. the prefix plus base) itself came to be monosyllabic. Such words were then pronounced in a higher tone, and this gave rise to the development of a complicated system of tones in Chinese, Tai and some Tibeto-Burman languages.

The existence of old prefixes can therefore still be inferred from the tones.

This discussion will be followed in the Tibeto-Burman languages. They have, to some extent, retained the old prefixes. This is, for example, the case in Old Tibetan and some modern Tibetan dialects, while the prefixes have been dropped in the modern dialects of the Indo-Chinese. In the Burmese, the Kuki-Chins and the Assamese there is no trace of these prefixes, while in Central Tibetan there has developed a system of tones corresponding to that prevailing in Chinese. The same
TIBULLUS is a Latin elegiac poet. The information which is also pass about him is extremely meager. We know the poems themselves—that is to say, the first and second books—we have only a few references in later writers and a short Life of doubtful authority. We do not know his praenomen; his gentile name has been questioned; nor is his birthplace ascertained. His station was not improbably that of a Roman knight (so the Life affirms); and he had inherited a very considerable estate. But, like Virgil, Horace and Propertius, he seems to have lost the greater part of it in 41 amongst the confiscations which Antony and Octavian found expedient to satisfy the rapacity of their victorious soldiery. Tibullus's chief friend and patron was M. Valerius Messalla Corvinus, himself an orator and poet as well as a statesman and a commander. Messalla, like Maecenas, was the centre of a literary circle in Rome; but the bond between its members was that of literature alone. They stood in no relations to the court; and the name of Augustus is not once to be found in the writings of Tibullus. About 30 B.C. Messalla was dispatched by Augustus to Gaul to quell a rising in Aquitania and restore order in the country, and Tibullus may have been in his retinue. On a later occasion, probably in 36, they are said to have accompanied him on a mission to the East, but he fell sick and had to stay behind in Corcyra. Tibullus had no liking for war, and though his life seems to have been divided between Rome and his country estate, his own preferences were wholly for the country life. His first love, the subject of book i., is called Delia in the poems, but we learn from Apuleius (A pol. 10) that her real name was Plania. Delia seems to have been a woman of middle station. It is impossible to give an exact account of the intimacy. The poems which refer to her are arranged in no chronological order. Now she appears as single, now as married, and her name bears various modifications, little of her husband's death. It is clear, however, that it was the absence of her husband on military service in Cilicia which gave Tibullus the opportunity of making or renewing the acquaintance. It was not dropped when he returned. It was not difficult to deceive the simple soldier; and Delia was an apt pupil in deception—too apt, as Tibullus saw with dismay when he found that he was not the only lover. His entreaties and appeals were of no avail; and after the first book we hear no more of Delia. In the second book the place of Delia is taken by Neaera, which is itself a fictitious name. Nemesis (like the Cynthia of Propertius) was a courtesan of the higher class; and she had other admirers besides Tibullus. He complains bitterly of his bondage, and of her rapacity and heartlessness. In spite of all, however, she seems to have retained her hold on him until his death. Tibullus died prematurely, probably in 19, and almost immediately after Virgil. His death made a deep impression in Rome, as we learn from his contemporary Domitius Marsus and from the elegy in which Ovid (Amores, iii. 19) has enshrined the memory of his predecessor. The character of Tibullus is reflected in his poems. Though not an admirable he is certainly an amiable one. He was a man of generous impulses and a gentle unsquishee disposition. He was loyal to his friends to the verge of self-sacrifice, as is shown by his leaving Delia to accompany Messalla to Asia, and constant to his mistresses with a constancy but ill deserved. His tenderness towards them is enhanced by a refinement and delicacy which are rare among the ancients. Horace and the rest taunt the cruel fair with the retribution which is coming with the years. If Tibullus refers to such a fate, he does it by way of warning and not in any pettish spirit of triumph or revenge. Cruelly though he may have been treated by his love, he does not invoke curses upon her head. He goes to her little sister's grave, hung so often with his garlands and wet with his tears, and bemoans his fate to the dumb ashes there. Tibullus has no leanings to an active life; his ideal is a quiet retirement in the country with the loved one at his side. He has no ambition and not even the poet's yearning for immortality. As Tibullus loved the country life so he clung to its faiths, and in an age of crude materialism and the grossest superstition, he was religious in the old Roman way. As a poet he reminds us of Collins and Longfellow. His clear, finished and yet unaffected style made him a great favourite with his countrymen and placed him, in the judgment of Quintilian, at the head of their elegiac writers. And certainly within his own range he has no Roman rival. For natural grace and tenderness, for exquisiteness of feeling and expression, he stands alone. He has far fewer faults than Propertius, and in particular he rarely overloads his lines with Alexandrian learning. But, for all that, his range is limited; and in power and compass of imagination, in vigour and breadth of style, he is inferior. In the variegation of his treatment, he is much his rival's inferior. The same differences are perceptible in the way the two poets handle their metre. Tibullus is smoother and more musical, but liable to become monotonous; Propertius, with occasional harshnesses, is more vigorous and varied. It may be added that in many of Tibullus's poems a symmetrical composition can be traced, although the symmetry must never be forced into a fixed and unelastic scheme.

It is probable that we have lost some of the genuine poems of Tibullus. On the other hand, much has come down to us under his name which must certainly be assigned to others. Only the third book of the second hundred lines is genuine; the rest consists of poems written at various times between 30 and 26. About the second book we can only say that in all likelihood it was composed between 36 and 26, and, though containing only 428 verses, and apparently incomplete. In both books occur poems which give evidence of internal disorder; but scholars cannot agree upon the remedies to be applied. The third book, which contains some of the most beautiful lines, is much inferior hand. The writer calls himself Lygdamus and the fair that he sings of Neera. He was born in the same year as Ovid, but there is nothing Ovidian about his work. He has little poetical power, and he seems to be chiefly marked by the stern judgment and the mischievous and imitations of Tibullus and Propertius; and they are not always happy. The separation of the fourth book from the third has no ancient authority. It dates from the revival of letters, and is due to the Italian scholars of the 15th century. The fourth book consists of poems of very different quality. The first is a composition in 211 hexameters on the achievements of Messalla, and is very poor. The author is unknown; but he was certainly not Tibullus. The poem itself was written in 31, the year of Messalla's consulship. The next eleven poems relate to the love of Sulpicia and Cerinthus. Sulpicia was a Roman lady of high rank; his name is not certainly accurate. Cerinthus seems to have been a relations of Valeria, Messalla's sister. She had fallen violently in love with Cerinthus, about whom we know nothing but what the poet tells us. About Book iv. we have a bit more certain, for it is divided into two groups. The first comprises iv. 2-6, containing ninety-four lines, in which the theme of the attachment is worked up into five graceful poems. The second, iv. 8-12 (to which 7 short stanzas are added) is the author's own letters. They are very short, only forty lines in all; but they have a unique interest as being the only love poems by a Roman woman that have escaped the ravages of time. Their frank and passionate outpourings remind us of Catullus. The style and metrical handling betray a novice in poetical writing. The thirteenth poem (twenty-four lines) claims to be by Tibullus; but it is hardly more than a cento from Tibullus and Propertius. The fourteenth is a little epigram of four lines with nothing to determine its authorship. Last of all comes the epigram or fragment of Domitius Marsus already referred to. To sum up: the third and fourth books appear in the accepted tradition, and they contain poems which are divided by different authors in different styles, none of which can be assigned to Tibullus with any certainty. The natural conclusion is that we have here a collection of scattered compositions relating to Tibullus, and the collection, which has been added as an appendix to the genuine relics of Tibullus. When this "Messella collection" was made cannot be exactly determined; but it was done after the death of Tibullus, 19 B.C., and probably between 15 and 2 B.C. Besides the foregoing, two pieces in the collection called Priscus (one an epigram and the other a longer piece in lambs) have been attributed to Tibullus; but there is little external evidence of his authorship (see Hiller in Hermes, xxvii. 343-349).

The value of the short Vita Tibulli, found at the end of the Athosian, Vatican and inferior MSS., is also questioned. There is little in it that we could not once infer from Tibullus himself and from what Horace says about Albius, though it is
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possible that its compiler may have taken some of his statements from Sue tonius's book De poesi; it is as follows: "Albius Tibullus essentially follows Propertius in his (Propertius's) "cuiusque" (cf. MSS. the corruption regulus), insignis forma cultuque corpori observabili, ante alios Curvini Messaliam Oratorem (MSS. Or., since he is so closely associated with Tiberian and Augustan times, is 3, 6; 7). It is rejected, the authority of the Life is considerably impaired.

Ovid, Trist., lv. 10, 53 seq., "successor fuit hic [Tibullus] tibi, Galle, Propertius iii, quartus ab his serie temporis iapae ful. In the preceding couplet he had said, "Verum vidit tantum nec amara Tibullus tempus amicitiae data dedecre meae." Ovid was born in 43, would be only twenty-four at Tibullus's death if it occurred in 19. The loss of Tibullus's landed property is attested by himself (3, 19 seq.), "Felicitas quadram, nam panicis auribus custodes" (cf. 41, 42). Its cause is only an inference, though a very probable one. That he was allowed to retain a portion of his estate for his personal consumption (182, 290). Grainger does not press this point, and it is quite possible that Tibullus may have been Messalla's contubernialis in the Aquitanian War (Via Tib. and Tib. l. 7, 9 seq., a poem composed for Messalla's triumph), and may have received militia dona (Vita Tib., Epist. ii. 2, 18).

"Tibullus ... and tibi ..." As regards her station, it should be noticed that she was not entitled to wear the toga, the dress of Roman matrons (i. 6, 68). Her husband is mentioned as absent (i. 2, 67 seq.). She eludes the custodes placed over the temple gates of the temple of Venus, and is allowed to enter the temple of Venus, of whom she speaks in very affectionate terms (i. 6, 57 seq.). For Tibullus's illness at Corcyra, see i. 3, 1 seq., 55 seq. The fifth elegy was written after Tibullus's death and just before the return of the husband and during Delia's double indecency. Ovid, writing at the time of Tibullus's death (Am. iii. 9, 31), says: "Sic Nemesis longum, sic Delia, nomen habebunt, altera cura reperiet, siquid non secatur, Nenia vis, si Dianam i. 3, 4, 6. The mention of a lena (ii. 6) settles her position. The connexon had lasted a year when ii. 5 was written (see ver. 109). It is worth noticing that Martial selects Nemesis as the source of their malady (II. 7, 31; cf. Elegies of Ovid).

Specimens of Tibullus at his best may be found in i. 1, 89-94; 5, 19-26; 9, 45-68; ii. 6. Quintilian says (Inst. x. 1, 93), "Elegia quoque Graecas provocamus, cuiusque mihi tersus esse elegans maxime sidetor autor Tibullus; sunt qui Propertium malit; Ovidius utoque lascivior, sicut durior Gallus." Charissia (pp. 66 and 105) quotes part of a hexameter which is not from any of the four books of Tibullus.

Lydamus is probably the real name of the author of the first six elegies in book iii, but little further is known about him. His elegies and the other poems in the third book (' third " and " fourth " book) have been examined by various scholars. There are two passages between i. 5, 15-20, and three passages of Ovid, Ars. i. ii. 669 seq.; Tr. iv. 10, 6; "cum ceddit fato consilium uteque par" (Lydamus and others), are quoted in the same sense (for the year of their birth, the consularis of Hirtius and Pansa) and Am. xii. 4, 23 seq., much too close to be accidental. We do not know when they were added to the genuine poems of Tibullus.

Most scholars since Lachmann have condemned the "Panegyric on Messalla." It is an inflated and at the same time tasteless declaration, entirely devoid of poetic merit. The language is often absurdly exaggerated, e.g. 190 seq. The author himself seems to be conscious of his own deficiencies (i. seq. 177 seq. Like so many of his contemporaries, he had been reduced to poverty by the loss of his estates (181 seq.) If we could set the question of poetical merit aside, we might reasonably conclude that he was not Propertius as in fact is done by Némethy (op. cit. below). The date is fixed by 121 seq. Sulpicia was the daughter of Servius Sulpicius (iii. 16 iv. 10), and she seems to have been under the guardianship of Messalla, her uncle by marriage (Haupt, Opuscule, iii. 502 seq.).

Some scholars attribute i. ii. 8-12 iv. 2-6 to Tibullus himself; but the style is different, and it is best to answer the question, an open one.

The direct ascription of i. 19-iv. 13 (verse 13, "nunc licet e caelo mitatur amica Tibullo") to Tibullus probably led to its inclusion in the collection and later to the addition of the title to the poet's name. For the evidence against the ascription, see Postgate, Selections, app. C.

Manuscripts.—The two best MSS. of Tibullus are the Ambrosianus (Ambro. 706) and the Vaticanus (Vat. lat. 221) and most of the 19th century. Besides these we have a number of extracts from Tibullus in Florilegium Parisianum, an anthology from various Latin writers which probably goes back to the 11th century, and the Excerpta frisingensia, preserved in an 11th-century MS. now at Munich, unfortunately very few in number. Also excerpts from the lost second book of Tibullus (1819). The two best editions are those of Teuffel's (1871) and Postgate's (1872). An Essay towards a New Edition of the Elegies of Tibullus, with a Translation and Notes (London, 1872), contains only 1. i. and 4, 29-48. C. A. Elton's Selections of the Classic Poets (London, 1871-71) contains only 1. i. ii. iv. 2-4, 6, 36 to end, iv. 2, 3. To these should probably be added Tibullus, with other Translations from Ovid, Horace, &c., by Richard Whiffen (London, 1874). Cranston's is the only complete version of merit; but it is inferior to the translation of Elton. P. Fr.

TIBUR (mod. Tivoli, q.v.), a pleasant town of Latium, 18 m. E.N.E. of Rome by the Via Tiburtina (see Tiburtina, Via), it is finely situated at the point where the Anio forms its celebrated falls; it is protected on the E., N., and N.W. by the river and it commands the entrance to its upper course, with an extensive view over the Campagna below. The modern town is in part built upon the terraces of a large temple of Hercules Victor, the chief deity of Tibur, of which some remains exist: many small votive objects in terra-cotta were found in the gorge of the Anio below the town on the north-west in 1898. Below it, on the cliffs above the Anio, is a large building round a colonnaded court, the Opus cubicaturum, built over the Via Tiburtina (caves under it in an arched passage), generally known as the villa of Maecenas, but shown by the discovery of inscriptions to have been in reality the meeting place of the Herculean Augustales, connected probably with the temple.

In an ancient hall at one side of the modern cathedral two mensae ponderarie—marble tables with holes in them for measuring solids—erected by one M. Varesius Diphilus, a freedman, a magister herculaneus, were found in situ in 1833, and in 1902 two vases of statues erected by Diphilus, as inscriptions showed, in honour of his patron, and a bas-relief of a bearded Hercules entirely draped in a long tunic with a lion's skin on his shoulders.

Remains of two small temples—one circular, with Corinthian columns, the other rectangular with Ionic columns—stand at the north-east extremity of the town, above the waterfalls. They are traditionally, but without foundation, attributed to Vesta and the Sibyl of Tibur (Varro adds Albucena, the water goddess worshipped on the banks of the Anio as a tenth Sibyl to the nine mentioned by the Greek writers).

The so-called Tempio della Tosse, an octagonal domed structure just below the town, is probably a tomb of the 4th century B.C. Two Roman inscriptions in close vicinity were found after the falls in 1826.

Tibur was a favourite place of resort in Roman times, and both Augustus and Maecenas had villas here, and possibly Horace also. It is certain that a house was shown as being his in the time of Suetonius; and this has been identified with a villa of the Augustan period, the site of which is now occupied by the monastery of S. Antonio. In his poems he frequently mentions Tibur with enthusiasm. Catullus and Statius, too, have rendered it famous by their poems. The abundance of
TIBURTINA, VIA—TICHBORNE CLAIMANT

water from aqueducts and springs and the falls of the Anio were among its chief attractions. The remains of villas in the district are numerous and important (see T. Ashby in Papers of the British School at Rome, iii.1). The largest is that of Hadrian, situated in the low ground about 2 m. to the south-west of Tibur, and occupying an area of some 160 acres. The remains are extensive and well preserved, though the identifications of the existing buildings with those mentioned by Spartianus who records that Hadrian gave to them the names of various well-known edifices at Athens and elsewhere, cannot in most cases be treated as certain. A large number of statues have been found in the villa, and costly foreign marbles and fine mosaic pavements, some of the last being preserved in situ, while among others may be named the mosaic of the dove in the Capitolium and that of the masks in the Vatican. Of the fresco and stucco decorations of the walls and ceilings, less is naturally preserved. Excavations have gone on since the 16th century, the last having been carried on by the Italian government to which the greater part of the site now belongs: but little has been done since 1884.1

The ancient Tibur was founded, according to tradition, by Tiburtus, Corax and Catillus, grandsons of Amphiarous. Though on the edge of the Sabine Mountains, it was a member of the Latin League. The site is remarkable for ancient roads and outlying forts in its territory dating from the period of its independence. It allied itself with the Gauls in 361 B.C., and in the war which followed the towns of Empulum and Saxula were destroyed (their sites are unknown) and triumphs over Tibur were celebrated in 360 and 354 B.C., and again in 338, when its forces were defeated, with those of Praeneste. It did not, however, lose its independence, but became an ally of Rome, as is shown by an inscription, probably of the 2nd century B.C., in which it is recorded that the ambassadors of Tibur successfully cleared themselves before the Roman senate of a suspicion that they were not Romans. In 115 A.D. they were granted Roman citizenship in 90 B.C., though some of its citizens gained the franchise previously. Syphax, king of Numidia, died in the territory of Tibur as a captive in 202 B.C.; and in A.D. 273 Zenobia, queen of Palmyra, was assigned a residence here by Aurelian. Its prosperity during the imperial period was mainly due to the favour in which it stood as a summer resort. During the siege of Rome by Narses, Belisarius occupied Tibur: it was afterwards treacherously surrendered to Totila, whose troops plundered it, but who rebuilt it in A.D. 542.

See H. Dessau in Corp. inscrit. latin. xiv. 365 sqq. and reff. (T. As.)

TIBURTINA, VIA, an ancient road of Italy, leading E.N.E. from Rome to Tibur, a distance of about 18 m. It must have come into existence, as a track at any rate, during the establishment of the Latin League. Though it afterwards became an important thoroughfare, the first portion of it always retained its original name, that of Via Valeria (see VALERIA, VIA) being applied only to the portion of the road beyond Tibur. The road is in the main followed by a modern highroad. There is, however, a difficulty about the last portion of its course from the Albanæ Aquæ (q.v.) to Tibur; whereas, according to the milestones and itineraries, it should be 20 m. from Rome to Tibur, it is impossible to make the distance more than 18 m. along any probable line.

See T. Ashby in Papers of the British School at Rome, iii. 84 sqq. (T. As.)

TICHBORNE CLAIMANT, THE. Roger Charles Tichborne (1829–1854), whose family name became a household word on account of an attempt made by an impostor in 1868 to personate him and obtain his inheritance, was the eldest grandson of Sir Edward Tichborne, the 6th baronet, of a very ancient Hampshire family. Sir John de Tichborne, sheriff of Southampton, was created a baronet by James I. in 1621, and from him his descendants inherited great wealth and the position of one of the leading Roman Catholic families in the south of England. Roger Charles, born at Paris on the 5th of January 1829, was the eldest son of James Francis Doughty-Tichborne (who subsequently became 10th baronet and died in 1862) by Henriette Felicité, natural daughter of Henry Seymour of Knoule, in Wiltshire. This lady, who hated England, was intent upon bringing up her son as a Frenchman; the result was that he got hardly any education until he went in 1846 to Stonyhurst, whence he proceeded in 1849 to Dublin and joined the 6th Dragoon Guards. His eccentricity and his French accent made him a butt in his regiment, and, being disappointed of war service, he sold out in 1852, spent the next four years in the United States of America, and sailed in March 1853 from Havre for Valparaíso, whence he crossed the Andes, reaching Rio de Janeiro in 1854. In April of that year he sailed from Rio in the "Bella" and was lost at sea, the vessel foundering with all on board. His insurance was paid and his will proved in July 1855. The baronetcy and estates passed in 1862 to Roger's younger brother, Sir Alfred Joseph Doughty-Tichborne, who died in 1866. The only person unconvinced of Roger's death was his mother the dowager Lady Tichborne, from whom every tramp-sailor found a welcome at Tichborne Park. She advertised largely and incessantly for her nephew, and in November 1865, when her 86th birthday, sent, through an agency in Sydney, that a man "answering to the description of her son" had been found in the guise of a small butcher at Wagga Wagga, in Queensland. As a matter of fact, the supposed Sir Roger did not correspond at all to the lost heir, who was slim, with sharp features and straight black hair, whereas the claimant was enormously fat, with wavy, light-brown hair. His first letter to Lady Tichborne was not only ignorant and illiterate, but appealed to circumstances (notably a birth-mark and an incident at Brighton) of which she admitted that she had not recollection. But so enchanted was she by his theory that she soon overcame the first qualms of distrust and advanced money for the claimant to return to Europe. Like all pretenders, this one was impelled by his own purse, who regarded him in the light of an investment. He himself was reluctant to move, but the credulity of persons under the influence of a romantic story soon came to his aid. Thus an old friend of Sir James Tichborne's at Sydney, though puzzled by the claimant's answers, was convinced by a resemblance to his supposed father. At Sydney, too, he made the acquaintance of Bogle, a negro freedman, who reproduced a portion of the manuscript in Sydney in the summer of 1866, and coached him in the rudiments of the rôle which he was preparing to play. On reaching London on Christmas Day 1866 the claimant paid a flying visit to Tichborne House, near Aldershot, where he was soon to obtain two important allies in the old family solicitor, Edward Hopkins, and a Winchester antiquary, Francis J. Baignet, who was intimately acquainted with the Tichborne family history. He next went over to Paris, where in an hotel bedroom on a dark January afternoon he was promptly "recognised" by Lady Tichborne. This "recognition" naturally made an enormous impression upon the English press; but it was not the kind that the Lady Tichborne was a monomania. That such a term is no exaggeration is shown by the fact that she at once acquainted in her supposed son's absolute ignorance of French. She allowed the claimant £1000 a year, accepted his wife, a poor illiterate girl, whom he had married in Queensland, and handed over to him the diaries and letters written by Roger Tichborne from South America. From these documents the claimant now carefully studied his part; he learnt much, too, from Baignet and from two carabiniers of Roger's old regiment, whom he took into his service. The villagers in Hampshire, a number of the county families, and several of Tichborne's fellow officers in the 6th Dragoons, became eager victims of the delusion. The members of the Tichborne family in England, however, were unanimous in declaring the claimant to be an impostor, and they were soon put upon the track of discoveries which revealed that Tom Castro, as the claimant had been called in Australia, was

identical with Arthur Orton (1834–1898), the son of a Wapping butcher, who had deserted a sailing vessel at Valparaiso in 1850, and had received much kindness at Melipilla in Chile from a family named Castro, whose name he had subsequently elected to bear during his sojourn in Australia. It was shown that the claimant, on arriving in England from Sydney in 1866, had first of all directed his steps to Wapping and inquired about the surviving members of his family. It was discovered, too, that Roger Tichborne was never at Melipilla, an assertion to which the claimant, transferring his own adventures in South America to the account of the man whom he impersonated, had committed himself in an affidavit. These discoveries and the deaths of Lady Tichborne and Hopkins were so discouraging that the "claimant" would gladly have "retired" from the baronetage; but the pressure of his creditors, to whom he owed vast sums, was importunate. A number of "Tichborne bonds" to defray the expenses of litigation were taken up by the duces of the imposture, and an ejectment action against the trustees of the Tichborne estates (to which the heir was the 12th baronet, Sir Henry Alfred Joseph Doughty-Tichborne, then two years old) finally came into the hands of the Justices, who, on the 28th of February 1874, during a trial that lasted over one hundred days the claimant exhibited an ignorance, a cunning and a bulldog tenacity in brazening out the discrepancies and absurdities of his depositions, which have probably never been surpassed in the history of crime. Over one hundred persons swore to the claimant's identity, the majority of them—and they were drawn from every class—being evidently sincere in their belief in his cause. It was not until Sir John Coleridge, in a speech of unparalleled length, laid bare the whole conspiracy from its inception, that the result ceased to be doubtful. The evidence of the Tichbornes finally convicted the jury, who declared that they wanted no further evidence, and on the 5th of March 1875 Sergeant Ballantine, who led for the claimant, was non-suited. Orton was immediately arrested on a charge of perjury and was brought to trial at bar before Chief Justice Cockburn in 1873. The defendant showed his old qualities of impudence and endurance, but the indiscretion of his counsel, Edward Kenealy, the testimony of his former sweetheart, and Kenealy's refusal to put the Orton sisters in the box, proved conclusive to the jury, who, on the one hundred and eighty-eighth day of the trial, after half-hour's deliberation found that the claimant was Arthur Orton. Found guilty of perjury on two counts, he was sentenced on the 28th of February 1874 to fourteen years' penal servitude. The cost of the two trials was estimated at something not far short of £200,000, and of this the Tichborne estates were mulcted of fully £50,000. The claimant's better-class supporters had deserted him before the second trial, but the people who had subscribed for his defence were stanch, while the populace were convinced that he was a persecuted man, and that the Jesuits were at the bottom of a deep-laid plot for keeping him out of his own. There were symptoms of a riot in London in April 1875, when parliament passed the Orton (by Kenealy) Bill for restoring the Tichborne case to a royal commission, and the military assisted, and when Orton emerged from gaol in 1884 the fickle public took no interest in him. The sensation of ten years earlier could not be galvanized into fresh life either by his lectures or his alternate confessions of imposture and retractions of innocence, and Orton sank into poverty and oblivion, dying in obscure lodgings in Marylebone on the 2nd of April 1898.

**TICINO (Gen. Tessin, anc. Ticinum), a river of Switzerland and north Italy, which gives its name to the Swiss canton of Ticino (q.v.), and gave in classical times to the town of Ticinum (Pavia).** It rises at the foot of the Gries Pass to the west of Airolo; from Airolo to the Lago Maggiore its valley bears the name of Val Leventina, and is followed as far as Bellinzona by the St Gotthard road and railway. It flows through Lago Maggiore, leaving it at its south end at Sesto Calende, and thence flows S.S.E. into the Po which it joins a little west of Pavia.

**TICINO (Fr. and Ger. Tessin), a canton of Switzerland, the only one situated almost wholly on the southern slope of the Alps and inhabited by a population of which the majority is Italian-speaking. It takes its name from the Ticino river, the whole upper course of which (the Val Leventina, with its side glen of Val Belino, the so-called Riviera, extending from Biasca to near Bellinzona, and the bit beyond Bellinzona), till it swells into the Lago Maggiore, is within the canton. Not far from the head of the lake the elevation of the land is increased by the Maggia torrent which is formed by the junction of the waters from the mountain glens known as the valleys of Locarno, save the Val Verzasca, the stream from which falls into the lake without joining the Maggia. The third portion of the canton is that called Monte Ceneri, including the hilly region between Bellinzona on the Ticino and Lugano, together with most of the lake of that name, and stretching on the south as far as Mendrisio, not far from Como. These three districts were all formerly part of the duchy of Milan till conquered by the Swiss, and in 1803 were joined together to form a Swiss canton, of which the most artistic Blend (Como, opposite Lugano, is still an Italian "enclave"). Its total area is 1087.1 sq. m., of which 721.9 sq. m. are reckoned as "productive" (forests covering 267.2 sq. m. and vineyards 19.9 sq. m.), while of the rest part is taken up by the Lake of Lugano (the Swiss share of which is 73 sq. m.), and those of the Lago Maggiore (Swiss share 161 sq. m.), and by 134'4 sq. m. of glaciers. In point of size the canton is surpassed by only four other cantons (Bern, the Grisons, the Valais, and Vaud), while only Vaud can boast of a larger vine-growing district. The highest points in the canton are two of the loftiest summits of the two halves of the Leopontine Alps. The highest in the south is the Piz Pizurin (11,149 ft.) in the Adjula Alps. Save the Ticino valley between Biasca, Bellinzona and Locarno, and the environs of Lugano, the canton is principally composed of hills and mountains, and is therefore poor from the material point of view, though rich in fine scenery.

The canton is traversed from end to end, from Airolo at the southern mouth of the St Gotthard tunnel to beyond Mendrisio (about 74 m.), by the main line of the St Gotthard railway, many of the marvellous engineering triumphs of which occur between Airolo and Biasca. From Bellinzona there is a short branch railway to Locarno (14 m.), whence the line runs across the north end of the Italian Switzerland, and at the head of one of the side glens of the Val Maggia, and colonized before 1253 from the neighbouring Tosa or Pommat valley (now politically Italian), which is inhabited by German-speaking emigrants from the canton of the Valais. In 1900 there were in the canton 75,731 women to 62,907 men, the men being in the habit of emigrating in search of work. Up to 1881 Bellinzona, Locarno and Lugano were alternate capital cities, though Bellinzona is the permanent capital. Yet it is but the second town in size, being surpassed by Lugano (q.v.), while after it come Locarno (q.v.) and Mendrisio (3338 inhabitants). Bellinzona is by far Italy's most important industrial town, and the canton has produced many sculptors, painters and architects. But its industrial development is backward, though the opening of the St Gotthard railway has attracted many foreign travellers. Yet the region is in another respect a great source of wealth, as coffee-house keepers (such as Delmonico, of New York), waiters in cafés, messengers, plasterers, labourers, navvies, &c. Fruit, chestnuts and wine are among the principal exports. The canton is divided into 8 administrative districts, which comprise 265 communes. The cantonal constitution is still that of 1830, which, however, has been almost mended out of sight owing to the political struggles.
that have raged in the canton. The legislature (Grundbesitz) is composed of members elected (since 1880) in the proportion of one to 15,000 of the Swiss and holding office for four years. The executive (Consiglio di stato) is (since 1892) elected directly by the people, is composed (since 1875) of five members, and holds office for four years. Since 1883 500 citizens have the right (as to bills passed by the legislature, since 1892) to vote as to bills passed by the legislature, thus (since 1892) 5000 citizens have the right of "initiative" in legislative matters, though 7000 signatures are required in case of a proposal to revise the cantonal constitution. In 1891 the system of proportional representation was introduced for elections to the cantonal legislature and the communal assemblies. In 1904 a very complicated system of proportional representation was adopted, of which the major fraction of the people of Ticino. In elections to the cantonal legislature all fractions below that required to secure a member in the entire canton are added together and then divided by the number of members of the cantonal legislature, the resulting number, selected being, as far as possible, assigned to the constituencies in which they have obtained most votes (the point remains obscure). In 1904 also the "limited vote" was adopted as to the election of members of the executive, no one being allowed to vote for more than four out of the five members. In 1896, by a strange anomaly only to be explained by the previous political history of the canton, non-resident citizens were given a vote in all cantonal and communal matters, though residence is strictly required for all voters in Federal matters. The two members of the federal Ständerath and the seven members of the Federal Nationalrat are elected by a popular vote.

The canton is made up of all the permanent conquests (with one or two trifling exceptions) made by different members of the ancient confederacy, in a line south of the Alps. From an historical point of view Italian Switzerland falls into three groups: (1) the Val Leventina conquered by Uri in 1440 (previously held from 1403 to 1422); (2) Bellinzona (previously held from 1419 to 1422); the Riviera and the Val Blenio, all won in 1500 from the duke of Milan by men from Uri, Schwyz and Nidwalden, and confirmed by Louis XII. of France in 1503; (3) Locarno, Val Maggia, Lugano and Mendrisio, seized in 1512 by the Confederates when fighting for the Holy League against France, ruled by the twelve members then in the league, and confirmed by Francis I. in the treaty of 1516. These districts were governed by bailiffs holding office two years and purchasing it from the members of the League; each member of group 3 sent annually an envoy, who conjointly constituted the supreme appeal in all matters. This government was very harsh and is one of the darkest pages in Swiss history. Yet only one open revolt is recorded—that of the Val Leventina against Uri in 1755. In 1798 the people were distracted by the Swiss and "Cisalpine republic" parties, but sided with the Swiss. On being freed from their hated masters, they were formed into two cantons of the Helvetic Republic—Bellinzona (which included the Lago di Lugano) and Ticino. These districts were formed into one canton—Ticino—which became a full member of the Swiss Confederation. From 1810 to 1813 it was occupied by the troops of Napoleon. The carriage road over the St Gotthard (1820-1830) was made under the constitution of 1814. But many of the old troubles reappeared, and were only done away with by the constitution of the 23rd of June 1830. In 1848, on religious grounds and owing to fears as to customs duties, the canton voted in the minority against the Federal constitution of that year; but in 1874, though the people voted against the revised constitution, the legislature adopted it, and thus it was a triumph of the majority. Since 1830 the local history of the canton has been very disturbed owing to the fact that, though Roman Catholicism is the state religion, and all the population are Roman Catholic (the few Protestants having been expelled from Locarno in 1555), they are divided between the Radical and Ultramontane parties. Since 1876 the intervention of Federal troops (already known in 1870) has been frequent in consequence of conflicts of the local authorities inter se, or against the Federal Assembly. The political troubles of Ticino were increased in 1888 by the formation of the see of Lugano, considered by the Radicals as illegal; it freed the district from both foreign ecclesiastical rule. Hence in September 1890 the Radicals carried out a bloody revolution, which necessitated Federal intervention, but at a state trial at Zürich in July 1891 the leaders were acquitted. Political passions still run high in the canton, as the Radicals and Conservatives are nearly balanced in point of numbers.

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TIKELL, Thomas (1585-1746), English poet and man of letters, the son of a clergyman, was born at Bridgwater near Carlisle in 1586. After a good preliminary education he went (1707) to Queen's College, Oxford, taking his M.A. degree in 1709. He became fellow of his college in the next year, and in (T. A. S.)
TICKET—TICKING

1711 university reader or professor of poetry. He did not take orders, but by a dispensation from the Crown was allowed to retain his fellowship until his marriage in 1726. Tickell's success in literature, as in life, was largely due to the friendship of Addison, who procured for him (1717) an under-secretaryship of state, to the chaplain of Richard Steele, who thenceforth bore Tickell no goodwill. During the peace negotiations with France Tickell published in 1713 the Prospekt of Peace. In 1715 he brought out a translation of the first book of the Iliad contemporaneously with Pope's version. Addison's reported description of Tickell's version as the "best that ever was in any language" aroused the anger of Pope, who assumed that Addison himself was the author, or had at any rate the principal share in the work. Addison gave Tickell instructions to correct his works, which were printed in 1722 under Tickell's editorship. In 1724 Tickell was appointed secretary to the lords justices of Ireland—a post which he retained until his death, which took place at Bath on the 23rd of April 1740.

Kensington Gardens (1729), his longest poem, is inflated and pedantic. It has been said that Tickell's poetic powers were awakened and sustained by his admiration for the person and genius of Addison, and undoubtedly his best work is the sincere and dignified elegy addressed to the earl of Warwick on Addison's death. His ballad of Colin and Mary was long the most popular of his poems. Tickell contributed to the Spectator and the Guardian.

See "T. Tickell," in Johnson's Lives of the Poets; the Spectator; Ward's English Poets. His Works were printed in 1749 and are included in Chalmers's and other editions of the English Poets.

TICKET (O. Fr. esquiset, also esquitte, mod. étiquette, from Ger. stechen, to stick up), by origin a small bill stuck up for the purpose of giving notice or information, hence a small printed or written card or slip, containing a notice, order or the like, and more particularly such an one as embodies the terms under which the party issuing the ticket grants some right, privilege or licence to the party to whom it is issued; where there has been valuable consideration for such given by the holder the ticket is the method by which the parties enter into a contract. The most familiar of this last class of tickets is the passenger's ticket issued by railway companies, tramways or "common carriers" in general. The ticket does not usually contain the whole terms of the contract, but refers to the conditions under which it is issued, to which the holder is subjected if sufficient notice of them is given. A ticket of admission issued for a theatre, or place of entertainment, constitutes a licence to the holder to occupy and use a seat, whether particularized or not, and such parts of the building as may be open to him. Such a licence can be revoked by the issuer, and the holder may be ejected as a trespasser, subject to his right to bring an action for damages.

TICKET-OF-LEAVE, a term first invented for the "emancipists" in the days of Australian transportation (see Deportation); in the English penal system, a document or "pass" handed to a convict who has completed the second stage of his sentence and is about to enter the third and last, that of conditional or semi-freedom, in which he goes at large to earn his freedom, under certain restrictions and with less independence of the community. The "ticket" or "licence" is the outward sign of "remission" gained by industry and blameless conduct in prison (see Prison), and it may be forfeited for disobedience or neglect of certain conditions endorsed upon the licence. Convicts are by law required to report themselves at an appointed place within forty-eight hours after liberation and again every succeeding month at the police station nearest to their place of abode, between the hours of nine in the morning and nine in the evening. They must get their living by honest means and regular employment, and must reside—that is to say, sleep—at the address notified by them to the police in order that they may be found at once if required for any legal and justifiable purpose. If they change their address or withdraw from any known police district, they must give notice of their removal at the police station at which they have been reporting, stating the place to which they are going, and, as far as practicable, their address there, and also at the nearest police station within forty-eight hours of arriving in any other police district in any part of the United Kingdom. They must produce their licences whenever, they are called upon to do so by a police officer.

This treatment of offenders who have already expiated their crimes has been deemed to bear heavily on any who are anxious to turn over a new leaf. To be ever subject to the watchfulness of the police must often increase the licence-holder's difficulty of leading an honest life. The struggle is known to be often severe; employers of labour are not too ready to accept the services of "gaol birds," and free workmen often resent the admission of an old convict amongst their number. Private charity has come forward to diminish or remove this hardship, and many societies have been called into existence for the purpose of assisting discharged prisoners. They are to be found in most of the principal cities of the United Kingdom. London alone has those of the Church Army, the St Giles's Christian Mission, the Salvation Army, the Catholic Aid Society and the Royal Society for the Assistance of Discharged Prisoners, which was established in 1856 and has done a vast and meritorious work. It labours chiefly in the metropolis; it receives contributions from private subscriptions, but it has control also over the gratuities of the licencees who accept its aid. The prisoners on release are first examined at the society's office as to their prospects and wishes; they are given some pocket-money out of their own gratuities; and their "liberty clothing," a present from the prison, is changed for more suitable clothes. They are then placed in respectable lodging-houses until employment is obtained for them, after which the society undertakes the reporting to the police and by its own agents exercises a watch over its protégés. There are upwards of sixty-five societies, all certified by the secretary of state, of which the number is increasing; every year the subscriptions increase, more money is expended, more cases are aided and more ex-convicts are rehabilitated. Unfortunately a large number of those who solicit help belong to the class of "lazy loafers who like neither work nor honesty," and who, when the first is found, will not adhere to the latter. Most of the societies employ agents who act as intermediaries between employers and ex-convicts and fill a place analogous to that of the "probation officers" in parts of the United States (see Probation); but the probation officer generally interposes at an earlier stage and shields the first offender from the consequences of his act, by sparing him a visit to the gaol. In a speech on Prison Reform in the English House of Commons on the 20th of July 1910, the home secretary outlined a proposed scheme for abolishing ticket-of-leave altogether, and entrusting the after-supervision of released prisoners to a central agency of semi-official character.

Ticking, a strong linen or cotton fabric usually woven in stripes of colour; blue and pink with white being the most common. The name is derived from a word "tick," common in various forms to many languages, signifying a case or sheath.

1 See Warton's note in the Bathos (ed. Pope and Elwin, x. 388), where he quotes from Tickell's version and from Addison and says the same author.
TICKNOR, G.—TICKS

Ticking is used for mattresses, awnings and tents. In some qualities it is also used as a foundation for embroidery.

White, grey, or brownish warp threads are usually flax, while the coloured threads are often cotton. The weft is flax or tow. The warps of many of the cheaper kinds are made entirely of cotton, and jute is used for warps in the cheapest grades. A feather tick should be made of fine flax yarns set close, and there should also be a large number of weft threads per inch. Sometimes the inside of the tick is waxed in order to prevent the feathers from working out.

The structure of the fabric is termed a twill, of which four varieties, each showing four units, are illustrated. Fig. 1, the ordinary three-leaf twill, is more extensively used than any other. Occasionally the pattern or twill is in one direction only, but more often the direction is reversed at intervals, thus producing what is technically termed a "herring-bone" or an "arrow-head" twill. Fig. 2 complete on twenty-four threads and three picks such a pattern, where the twill is reversed every twelve threads. Figs. 3 and 4 are the four-thread and five-thread straight twills respectively, while fig. 5 is the five-thread seaten twill. These latter twills require a great number of threads and picks per inch, and are used only in the finest ticks. The plain weave is occasionally used for cheaper varieties.

Mattress ticks and awnings are woven with the same twills, but the colouring of these, especially of the former, is more elaborate.

TICKNOR, GEORGE (1791-1871), American educator and author, was born in Boston, Massachusetts, on the 1st of August 1791. He received his early education from his father, Elisha Ticknor (1757-1821), who had been principal of the Franklin public school and was a founder of the Massachusetts Mutual Fire Insurance Company, of the system of free primary schools in Boston, and of the first New England savings bank. In 1805 the son entered the junior class at Dartmouth, where he graduated in 1807. During the next three years he studied Latin and Greek with Rev. Dr John Sylvester Gardiner, rector of Trinity, Boston, and a pupil of Dr Samuel Parr. In 1810 Ticknor began the study of law, and he was admitted to the bar in 1813. He opened an office in Boston, but practised for only one year. He went to Europe in 1815 and for nearly two years studied at the university of Göttingen. In 1817 he became Smith professor of French and Spanish languages and literatures (a chair founded in 1816), and professor of belles-lettres at Harvard, and began his work of teaching in 1819 after travel and study in France, Spain and Portugal. During his professorship Ticknor advocated the creation of departments, the grouping of students in divisions according to proficiency, and the establishment of the elective system, and reorganized his own department. In 1835 he resigned his chair, in which he was succeeded in 1836 by Professor H. W. Longfellow; and he was again in Europe in 1835-1838. After his return he devoted himself to the chief work of his life, the history and criticism of Spanish literature. In many respects a new subject at that time in Europe, there being but inadequate treatment of the literature as a whole in Spanish, and both Bouterwek and Sismondi having worked with scanty or second-hand resources. Ticknor developed in his college lectures the scheme of his more permanent work, which he published as the History of Spanish Literature (New York and London, 3 vols., 1849). The book is not merely a story of Spanish letters, but, more broadly, of Spanish civilization and manners. The History is exhaustive and exact in scholarship, and direct and unpretentious in style. It gives many illustrative passages from representative works, and copious bibliographical references.

It was soon translated into Spanish (1851-1857) by de Gayangos and de Vedia; French (1864-1872), a poor version by Magnabahal; and German (1852-1867), by N. H. Julius and Ferdinand Wolf. The second American edition appeared in 1854; the third corrected and enlarged, in 1863; the fourth, containing the author's last revision, in 1872, under the supervision of George S. Hillard; and the sixth in 1888. Ticknor had succeeded his father as a member of the Primary School Board in 1832, and held this position until 1825; he was a trustee of the Boston Athenæum in 1833-1834, and was vice-president in 1833; and was a director (1827-1823) and vice-president (1841-1854) of the Massachusetts Hospital Life Insurance Company, and a trustee of the Massachusetts General Hospital (1826-1830) and of the Boston Provident Institution for Savings (1838-1850), the bank that his father had helped to found. He was especially active in the establishment of the Boston Public Library (1852), and served in 1821-1866 on its board of trustees, of which he was president in 1865. In its behalf he spent fifteen months abroad in 1856-1857, at his own expense, and it to he gave at various times money and books; a special feature of his plan was a free circulating department. He left to the library his own collection, which was particularly strong in Spanish and Portuguese literatures. He died in Boston on the 26th of January 1871.

Ticknor's minor works include, besides occasional reviews and papers, Syllabus of a Course of Lectures on the History and Criticism of Spanish Literature (1823); Outline of the Principal Events in the Life of General Lafayette (1823); Remarks on Changes lately Proposed or Adopted in Harvard University (1825); The Remains of Nathan Appleton Haven, with a Memoir of his Life (1827); Remarks on the Life and Writings of Daniel Webster (1831); Lecture on the Best Methods of Teaching the Living Language, delivered before the American Institute of Education; and the Life of William Hickling Prescott (1864).

See Life, Letters and Journals of George Ticknor (2 vols., 1876), by George S. Hillard and Mrs Anna (Eliot) Ticknor and Miss Anna Eliot Ticknor. This book was edited, with a critical introduction, in 1909, by Ferris Greenslet.

TICKS, the common name for Arachnida (q.v.) belonging to the order Acari, of which they constitute the two families, Ixodidae and Argasidae. Collectively the Ixodidae and Argasidae may be distinguished from other Acari by the presence of a median probe, armed with recurved hooks, which project forwards towards the mouth and extend the spiracular area above and usually behind the base of the fourth leg on each side. As compared with the majority of Acari, ticks are of large size, distended female specimens of some of the species measuring half an inch or more in length, while even the newly hatched young can hardly be regarded as microscopical. The integument is tough, leathery or horny. The mouth parts consist of two small retractor mandibles, of a pair of short palpi and of the toothed probe above mentioned. The palpi and probe or hypostome are attached to a movable sclerite or horny plate called the capitulum. The capitulum, with its associated structures, is sometimes called the rostrum, whereas sometimes the term rostrum is restricted to the hypostome alone. It is by means of the hypostome that ticks pierce the integument and firmly adhere to the host whose blood they suck for food. The two families Argasidae and Ixodidae may, be distinguished as follows. In the Argasidae the anterior portion of the dorsal surface of the body is extended forwards above the capitulum, so that this structure is concealed from above; the integument is fairly uniformly granular or coriaceous above and below; the palpi are simple and unmodified; there is a sucker beneath the claws in the adult, and there is only a slight structural difference between the sexes. In the Ixodidae the capitulum is not overlapped by a forward extension of the dorsal area, which is smooth and firmly chitinised either in front or all over; the palpi are usually modified, that is to say, their second and third segments are usually excavated internally to form a sheath for the hypostome; there is a distinct sucker beneath the claws and the difference between the sexes is well marked, the males having the dorsal integument thickly and continuously chitinised, whereas in the females only its anterior
portion bears a chitinous plate, the rest of the integument being soft to admit of its distension by the blood which is imbibed in quantity by members of this sex. For a longer or shorter period of their lives ticks are parasitic upon vertebrate animals of various kinds; but although the belief that the bite of certain tropical species is poisonous has long been held by the natives of the countries they infest and has been recorded with corroborative evidence in the European literature, it is only of recent years that accurate information has been acquired of the part played by these Arachnids in transmitting from one host to another protozoal blood-parasites which cause serious or fatal diseases to man and other animals.

Both the Argasidae and Ixodidae contain pathogenic species, of which the best known are the following: Ornithodoros moubata, belonging to the Argasidae, and called bbe in Uganda, monbata in Angola, and tampan on the Zambezi, is widely distributed in tropical Africa from Uganda in the north to the Transvaal in the south. This first was recorded as poisonous by Livingstone and is now known to be the carrier of the Spirochaete of relapsing fever in man, known as tick fever. Although Europeans suffer from this disease far more severely than negroes, death seldom or ever follows. An allied species, O. turecata, occurs in Mexico and Texas, which causes considerable destruction amongst poultry and is a pest to mankind as well. A similar bad reputation attaches to other species in different parts of the world, in America; while Argas minutus has been proved to be the carrier of the Spirochaete causing spirillosis in fowls in Rio Janeiro, and also in New South Wales whether it has been introduced with imported poultry. Argas persicus has been introduced in the same way into South Africa from Europe. As its name indicates, it was first discovered in Persia, where the belief in the venomous nature of its bite to human beings is both widespread and historical. It is held that the Argasidae, which are for the most part parasitic upon birds, contain the only species of ticks, especially O. moubata, which are known to be seriously harmful to mankind; whereas amongst the Ixodidae no human pathogenic species has been ascertained to be parasitic. The only species which have been proved to be highly destructive to domestic mammals of different species. The most important of these are the following: Dermacentor reticulatus, a species widely distributed in Europe, Asia and America, infects dogs in Europe with the haematozoon disease known as "biliary fever," and has been asserted to be answerable for the so-called spotted or tick fever in man in the Rocky Mountains.

The same canine disease results in South Africa from the bite of the Haemaphysalis leachi. Amblyomma hebraeum, the brown tick of the Cape Colonists, infects sheep with the Sporozoon causing "heart-water" sickness, and in Europe sheep are inoculated with the disease by the bite of Argas persicus, its European name, and is called "coast fever" in cattle in South Africa is conveyed by two distinct species of the genus Rhipicephalus, namely R. appendiculatus and R. simus, which are locally known respectively as the "brother tick" and the "sister tick." Finally Margarops annulatus, of which there are several geographical races, is the carrier of the germs causing the destructive cattle-disease variously known in India as "tick fever," 's Fokien fever, and "bursa" fever in Africa, South America, Australia and South Africa. In the United States alone an annual animal loss in cattle stock occasioned by the ravages of this tick disease was computed in 1907 at one hundred million dollars. With one or two possible exceptions, like Argas septentironis, which has only been observed from European bats, no species of tick is known to be confined to a particular host. The common sheep-tick (Ixodes ricinus) of England, for example, infects cattle and dogs as well as sheep; and the pathogenic mite, with above mentioned, occurs parasitically upon other mammals than those to which they convey the diseases specified. Reptiles are infested as well as mammals, and many insects, including lice, are occupied by Ixodidae of various kinds adherent to tortoises, snakes and lizards. Ticks belonging to the Ixodidae differ to a certain extent in their life-histories.

Mature males and females are found together upon the same host. Parallel with the sexual development the spermatophores penetrate into the genital orifice of the female by means of his proboscis. The gorgeted and fertilized female quits her hold of the host, and falling to the ground, proceeds after a short delay to lay her eggs in some sheltered place. The egg is a transparent, homogeneous, oval, colorless or whitish body, which assumes the position putting it at twenty thousand. After oviposition, which may extend over several weeks, the female dies. The newly-hatched young has only three pairs of legs and is without spiracular and genital orifices. These young or larvae, as they are called, after the integument has hardened by exposure to the air, climb up the stalks of grain or herbage and cling with outstretched legs waiting for passers-by to whom they hold on with a cover called brushes, by which, and crawling to a suitable place become engorged with blood. After about a week's feeding they drop to the ground, lie dormant for a month, during which time they acquire their fourth pair of legs and spiracles, and, molting, emerge from their old skin as nymphs. Nymphs repeat the behaviour of the larvae, and finally moult into the adult, showing the generative orifice, which is the mark of maturity. The adult secures a host in the same way as the young. Both sexes feed upon blood; whereas the male alters but little in appearance, the female becomes enormously distended.

From the foregoing it appears that many species, Rhipicephalus appendiculatus for example, it is evident that every individual tick has to find a host on three occasions, namely, as larva, nymph and adult. In R. bursa, however, the moth that

![Fig. 1](image_url) - *Hyalomma aegyptium* Savigny. Undistended female: a, Rostrum or hypostome; b, b, Palpi; c, Capitulum; f, Abdomen.

![Fig. 2](image_url) - The same, under side: a, Rostrum or hypostome; b, Palpi; e, Genital aperture; d, Anal orifice; e, e, Ventral surface of capitulum; g, Sternum; 1-7, segments of leg.

transforms the larva into the nymph takes place on the host, and in *Margarops annulatus* the transformation of larva into nymph and nymph into adult is effected without the temporary sojourn on the ground. Another species, *Hyalomma aegyptium*, the so-called camel-tick of Egypt and Arabia, is alleged to be parasitic only in its mature stage. Again, in *Ornithodoros moubata*, which is parasitic apparently only at night, the young does not hatch from the egg until it has attained the nymphal stage.

It is an interesting and important fact that the newly hatched young of certain species, *Margarops annulatus* for instance, before it has fed, if produced by a female carrying the germs of spirillosis, can infect healthy organisms with the disease. From this it is evident that the Spirochaetes pass directly from the mother tick to her offspring.

Duration of life in ticks depends upon the conditions of their existence. Under favourable conditions, when food is obtainable, growth is rapid, the time from the hatching of the young until it reaches maturity and dies after oviposition being, for example, about eleven weeks in *R. appendiculatus* and only about three weeks in *M. annulatus*. On the other hand, when food is not obtainable, life may be indefinitely prolonged if the tick be guarded from enemies and from atmospheric conditions iminical to existence. Examples of *Ixodes ricinus* have been kept for two years and three months without feeding, and specimens of *Argas persicus* were still alive after four years' starvation.

**TICONDEROGA**, a village in the township of Ticonderoga, Essex county, New York, U.S.A., on the outlet of Lake George, 100 m. by rail N. by E. of Albany. Pop. (1890), 2267; (1900), 1911; (1905), 1740; (1910), 2475. Ticonderoga is served by the Delaware & Hudson and the Rutland railways. The water
TIDE

from Lake George falls here about 30 ft., providing water-power, and among the manufactures are paper pulp, paper-making machinery and lumber. Flake graphite was discovered in this vicinity as early as 1815, and for years two mines (with quartzite veins, respectively 1-5 and 2-15 ft. thick) at Ticonderoga were the principal source of supply of good crystalline graphite. Commanding a portage on the line of water communication between Canada and the English colonies, Ticonderoga was a place of considerable strategic importance during the Seven Years' War. On a commanding elevation overlooking the present village and Lake Champlain the French began building a fort of earth and timber in 1755 and called it Fort Carillon; later it was named Fort Ticonderoga. Sir William Johnson led an expedition in the same year against this fort and Crown Point; though he failed to capture the forts he defeated Baron Ludwig August Dieskau in the battle of Lake George and erected at the head of the lake Fort William Henry, which was captured by the marquis de Montcalm in 1757. On the 8th of July 1758 less than 4000 Frenchmen were confronted at Fort Carillon by about 6000 British regulars and 10,000 provincials under Lt.-Gen. James Abercrombie and Brigadier-General George A. Howe, but Howe, the controlling spirit of the British force, had been killed on the 6th of July, and Abercrombie, after an ineffectual attack which cost him nearly 2000 men killed or wounded, retreated. In 1758, however, when Montcalm had gone to Quebec to oppose Wolfe and a force of only 400 men was left at Ticonderoga, Lord Amherst with 11,000 men invested it, and on the 26th of July the garrison blew up and abandoned the fortifications. At the beginning of the War of Independence, on the 10th of May 1775, the fort was surprised and captured by Ethan Allen. It was recovered by the British on the 4th of July 1777, during Burgoyne's campaign, was abandoned immediately after Burgoyne's surrender in October 1777, but was re-occupied by the British in 1780. After the close of the war it was allowed to fall into ruins. In 1909, on the occasion of the tercentenary celebration of the discovery of Lake Champlain, the restoration of the fort was begun under the direction of the owner of the site. The settlement of this region was begun soon after the close of the Seven Years' War, and the township of Ticonderoga was set apart from the township of Crown Point in 1804. The village of Ticonderoga was incorporated in 1889. The name "Ticonderoga" is a corruption of an Indian word said to mean "sounding waters."

TIDE (O. Eng. tid, cf. Ger. Zelt, time or season, connected with root of Sanskrit a-diti, endless), a term used generally for the daily rising and falling of the water of the sea, but more specifically defined below.

I.—GENERAL ACCOUNT OF TIDES AND TIDAL THEORIES

§ 1. Definition of Tides.—When, as occasionally happens, a ship in the open sea meets a short succession of waves of unusual magnitude, we hear of tidal waves; and the large wave caused by an earthquake is commonly so described. But the use of the adjective "tidal" appears to us erroneous in this context, for the tide is a rising and falling of the water of the sea produced by the attraction of the sun and moon. A rise and fall of the sea produced by a regular alternation of day and night, by regular rainfall and evaporation, or by any influence which the moon may have on the weather cannot strictly be called a tide. Such alterations may be inextricably involved with the rise and fall of the astronomical tide, but we shall here distinguish them as meteorological tides. It is well known that there are strongly marked diurnal and semi-diurnal inequalities of the barometer due to the sun's heat, and they may be described as atmospheric meteorological tides. These movements both in the case of the sea and in that of the atmosphere are the result of the action of the sun, as a radiating body, on the earth. True astronomical tides in the atmosphere would be shown by a

regular rise and fall in the barometer, but such tides are undoubtedly very minute, and we shall not discuss them in this article, merely referring the reader to the Mécanique céleste of Laplace, bks. i. and xii. We shall in the present article extend the term "tide" to denote an elastic or viscous periodic deformation of a solid or viscous globe under the action of tide-generating forces.

§ 2. General Description of Tidal Phenomena.—If we live by the sea or on an estuary, we see that the water rises and falls nearly twice a day; speaking more exactly, the average interval from high-water to high-water is about 12h 25min, so that the average retardation from day to day is about 50min. The times of high-water are then found to bear an intimate relation with the moon's position. Thus at Ipswich high-water occurs when the moon is nearly south, at London Bridge when it is south-west, and at Bristol when it is east-south-east. For a very rough determination of the time of high-water it is sufficient to add the solar time of high-water on the days of new and full moon (called the "establishment of the port") to the time of the moon's passage over the meridian, either visibly above or invisibly below the horizon. The interval between the moon's rise and fall of water is also subject to great variability. On the days after new and full moon the range of tide is at its maximum, and on the day after the first and third quarter at its minimum. The maximum range is called "spring tide" and the minimum "neap tide," and the range of spring tide is usually nearly three times as great as that of neap tide. At many ports, however, especially non-European ones, two successive high-waters are of unequal heights, and the law of variability of the difference is more a matter of opinion; a statement of that law will be easier when we come to consider tidal theories. In considering any single oscillation of water level we find, especially in estuaries, that the interval from high to low-water is longer than that from low to high-water, and the difference between these two intervals is greater at springs than at neaps.

In a river the current continues to run up stream for some considerable time after high-water is attained and to run down similarly after low-water. Much confusion has been occasioned by the indiscriminate use of the term "tide" to denote a tidal current and a rise of water, and it has often been incorrectly inferred that high-water must have been attained at the moment of cessation of the upward current. The distinction between "rising and falling" and "flowing and ebbing" must be maintained in rivers, whilst it is unnecessary at the seaboard. If we examine the progress of the tide-wave up a river we find that high-water occurs at the sea earlier than higher up. If, for instance, on a certain day it is high-water at Margate at noon, it is high-water at Gravesend at a quarter past two, and at London Bridge a few minutes before three. The interval from low to high-water diminishes also as we go up the river; and at some time up the river, for example, the Severn—the rising water spreads over the flat sands in a roaring surf and travels up the river almost like a wall of water. This kind of sudden rise is called a "bore" (p. 96). In other cases where the difference between the periods of rising and falling is considerable there are, in each high-water, two or three rises and falls. A double high-water exists at Southampton.

When an estuary contracts considerably, the range of tide becomes largely magnified as it narrows; for example, at the

1 Lord Kelvin shows that the attraction of the sun on these tides must produce an excessively small acceleration of the earth's rotation. See Société de physique (September 1881), or Proc. Roy. Soc. Edin. (1881-1882), p. 356.


3 See a series of papers bearing on this kind of wave by Sir W. Thomson (Lord Kelvin) in Phil. Mag. (1886-1887).
entrance of the Bristol Channel the range of spring tides is about 18 ft., and at Chesport about 50 ft. This augmentation of the height of the tide-wave is due to the concentration of the energy of motion of a large mass of water into a narrow space. At oceanic ports the tidal phenomena are much less marked, the range of tide being usually only 2 or 3 ft., and the interval from high to low-water sensibly equal to that from low to high-water. The changes from spring to neap tide and the relation of the time of high-water to the moon’s transit are, however, the same both on the open coast and in rivers.

In long narrow estuaries such as the English Channel, the tide in the inland-channel follows the same law as at a station near the mouth of a river, rising and falling in equal times; the current runs in the direction analogous to up-stream for three hours before and after high-water, and down-stream for the same period before and after low-water. But near the sides of channels and near the mouths of bays the changes of the currents are very complex; and near the headlands separating two bays there is usually at certain times a very swift current, termed a race.

In bays and sounds, such as the Mediterranean, the tides are nearly insensible except at the ends of long inlets. Thus at Malta the tides are not noticed by the ordinary sailors, whilst at Venice they are conspicuous.

The effect of a strong wind on the height of tide is generally supposed to be strongly marked, especially in estuaries. In the case of an exceptional gale, when the wind veered round appropriately, Airy states that the water has been known to depart from its predicted height at London by as much as 5 ft. The effect of wind will certainly be different at each port. The discrepancy of opinion on this subject appears to be greatest—so much so that we hear of some observers concluding that the effect of the wind is insensible. Variations in barometric pressure also cause departures from the predicted height of water, high barometer corresponding to decrease of height of water. Roughly speaking, an inch of the mercury column will correspond to about a foot of water, but the effect seems to vary much at different ports.

Mariners and hydrographers make use of certain technical terms which we shall now define and explain.

The “establishment of the port,” already referred to above, is the average high-water or low-water mark of the moon’s transit across the meridian, at full moon and at change of moon, and the occurrence of high-water. Since at these times the moon crosses the meridian at twelve o’clock either of those days the term “establishment” is the hour of the clock of high-water at full and change.

It has already been remarked that spring tide occurs at most places a day or a day and a half after full and change of moon. Now it is more important in the theory of the tides to know what occurs at spring tide than what occurs at full and change of moon. Thus the term “the corrected establishment of the port” is used to denote the interval in hours elapsing at spring tide between moon’s transit and high-water. The difference between the ordinary and the corrected establishments is of small amount. At any other state of the moon, except full and change, the “interval” or “lunital interval” is the interval between the moon’s upper or lower transit and high-water.

The average interval elapsing between full or change of moon and spring tide is called the “age of the tide”; as already remarked this interval is commonly about a day or a day and a half, but it may be twice as great in some places. The use of this term arises from the idea that spring tides are generated at some undefined place exactly at full or change of moon, and that an interval of time denoted the “age” to reach the place of observation. The term is not altogether satisfactory, since it implies a theory, but it must be referred to as in general use.

The phrase “spring tide” is used at high and low-water marks is called “the spring rise”; the similar height at neap tides is however, called “the neap range.” “Neap rise” is used to mean the average height between high-water of neap tides and low-water of spring tides. This term “rise” refers to the rise above the level of low-water at spring tide. French hydrographers call half the spring rise “the unit of height.”

The “diurnal inequality” of the tide denotes the fact that successive high-water and successive low-water are unequal to one another. In England the diurnal inequality scarcely exists. When the phase of the moon is at either the first or last quarter, the tide is transferred to “medium low-water mark of ordinary spring tides.” This datum is found by taking the mean of all the available observations of spring tides, excluding, however, from the mean any spring tides which may be considered at fault, and then, if necessary, correcting the mean of the whole by linear interpolation. If the tide still persist, we may use a different procedure; if not, then, the tide is used for the mean of the high and low water, which is defined as being below mean sea-level by the sum of the ordinates of the tides M, S, K₁, O (see §§ 24, 25 on Harmonic Analysis below).

In ordinary parlance sailors very commonly use the term “tide” when they mean what may be more accurately described as a tidal current.

§ 3. Tidal Observation: the Tide-gage.—Tide prediction is only possible when accurate observations have been made of the phenomena to be predicted; and the like is true of verification after prediction. It was formerly thought sufficient to note the heights of the water at high and low-water, together with the times of those events, and the larger part of the observations which exist are still of this character, but complete investigation of the law of tidal oscillations demands that the height of the water should be measured at other times than at high and low-water.

With whatever degree of thoroughness it is proposed to observe the tides the procedure is much the same. The simplest sort of observation is to note the height of the water on a graduated staff fixed in the sea, with such allowance as may be possible for wave-motion. It is, however, far preferable to sink a tube into the sea into which the water penetrates through small holes; and the wave motion is thus annulled. In the calm water inside the tube there lies a float, to which is attached a cord passing over a pulley and counterpoised at the end. The motion of the counterpoise against a scale is observed. In either case the observations may be made every hour, or the times and heights of high and low-water may be noted.

In more careful observations than those referred to above the tidal record is automatic and continuous and is derived by means of an instrument called a tide-gage.

This gauge should be placed in a place where we may obtain a fair representation of the oscillation of the surrounding sea. In such a site a well or tank is built on the shore communicating by a channel with the sea. At the mouth of this channel water meters, artificially constructed well may be dispensed with, where some lagoon or pool exists near to the sea as to permit junction with the sea by means of a narrow channel. The water in that channel is measured by an instrument which is always in a vertical position. When the tide is rising the water is provided rising and falling with the tide, without much wave-motion. A cylindrical float, usually a hollow metallic box or a block of greenheart wood, hangs and floats in the well, and is of such density as just to sink without support. The float hangs under very light tension by a platinum wire, or a metallic ribbon, or by a chain. The suspension wire is wrapped round a wheel, and imparts to it rotation proportional to the rise and fall of tide. By a simple gearing this wheel drives another, by which the range is reduced to any convenient extent. A fine wire wound on the final wheel of the train drops a pencil or pen up and down and to and fro, so as to literally to represent the wave motion by a line that is lightly pressed against a drum, which is driven by clockwork so as to make one revolution per day. The pen leaves its trace or tide-curve on paper wrapped round the drum. The paper is fixed to the drum with the edges of the paper at the XII o’clock line, and the record of a fortnight may be taken without change of paper. An example of a tide-curve for Apollo Bunder, Bombay, from the 1st to the 15th of January 1884, is shown in fig. 1.

We have chosen an example from a sub-tropical region because it illustrates the remarkable regularity of the tides in a region where the weather is equable. Further, if the reader will note the successive maxima or minima of the tides, he will see on any one day, he will see a strongly marked “diurnal inequality,” which would have been barely perceptible in a European tide-curve.


2 See J. N. Shoobridge on datum levels, Brit. Assoc. Reports (1879).
§4. Tide-Tables and the Degree of Accuracy in Tidal Prediction.

The connexion between the tides and the movements of the moon and sun is so obvious that tidal predictions were regularly made and published long before mathematicians had devoted their attention to them; and these predictions attained considerable success, although they were founded on empirical methods. During the 18th century, and even in the earlier part of the 19th, the art of prediction was regarded as a valuable family secret to be jealously guarded from the public. The best example of this kind of tide-table was afforded by Holden's tables for Liverpool, founded on twenty years of observation by a harbour-master named Hutchinson.

About 1832 the researches of W. Whewell and of Sir John Lubbock (senior) pointed the way to improvement on the empirical tables prepared by secret methods, and since that time the preparation of tide-tables has become a branch of science.

A perfect tide-table would tell the height of the water at the place of observation at every moment of the day, but such a table would be cumbrous; it is therefore usual to predict only the times and heights of high-water and of low-water. The best kind of tide-table contains definite forecasts for each day of a definite year, and we may describe it as a special table. Although the table is only made for one definite place, yet it is often possible to give fairly accurate predictions for neighbouring ports by the application of corrections both for time and height. Special tide-tables are published by all civilized countries for their most important harbours.

But there is another kind of table, which we may describe as a general one, where the heights and times are given by reference to the time at which the moon crosses the meridian. Although such a table is only applicable to a definite place, yet it holds good for all time. In this case it is necessary to refer to the Nautical Almanac for the time of the moon's transit, and a simple calculation then gives the required result. In a general tide-table the heights and times are tabulated according to the hour of the clock at which the moon will cross the meridian at the place of observation, distinguishing between the visible and invisible transits. Certain simple corrections have also to be applied. A considerable degree of elaboration has to be given to the table, in order that it may give accurate results, and it would occupy some half-dozen to a dozen pages of a book, its extension varying according to the degree of accuracy aimed at.

It might occupy about five minutes to extract a prediction from the more elaborate form of such a table. There are many ports of considerable commercial importance where, nevertheless, it would hardly be worth while to incur the great and repeated expenditure involved in the publication of special tables. But this kind of elaborate general table has been used in few cases, and the information furnished to mariners usually consists either of a full prediction for every day of a future year, or of a meagre statement as to the average rise and interval, which must generally be almost useless.

The success of tidal predictions varies much according to the place of observation. In stormy regions the errors are often considerable, and the utmost that can be expected of a tide-table is that it shall be correct with a steady barometer and in calm weather. But such conditions are practically non-existent, and therefore errors are inevitable.

Notwithstanding these perturbations, tide-tables are usually of surprising accuracy even in northern latitudes; this may be seen from the following table showing the results of comparison between prediction and actuality at Portsmouth.

The importance of the errors in height depends, of course, on the range of the tide; it is well, therefore, to note that the average ranges of the tide at springs and neaps are 13 ft. 9 in. and 7 ft. 9 in. respectively.

Prediction at such a place as Portland is difficult, on account of the instability of the weather, but, on the other hand, the tides in themselves are remarkably simple in character. Let us now turn to such a port as Aden, where the weather is very uniform, but the tides very complex on account of the large diurnal inequality, which frequently obliterates one of two successive high-waters. The short series of comparisons between actuality and prediction which we give below may be taken as a fair example of what would hold good when a long series is examined. The results refer to the intervals 20th of March to the 9th of April and the 12th of November to the 12th of December 1884. In these two periods there should have been 118 high waters, but the tide-gauge failed to register on one occasion.

Darwin, "Tidal Prediction," quoted above. This kind of table has been applied with some success at Cairns in North Queensland, where there is a large diurnal inequality.
so that one comparison is lost. We thus have 117 cases to consider, but on one occasion the diurnal inequality obliterated a high-water, leaving 116 actual comparisons. The maximum range of the tide at Aden is 8 ft. 6 in., and this serves to give a standard of importance for the errors in height.

Table of Errors in the Prediction of High-Water at Portsmouth in the months of January, May and September 1897.

<table>
<thead>
<tr>
<th>Time</th>
<th>Height</th>
<th>Magnitude of Error</th>
<th>Number of Cases</th>
<th>Magnitude of Error</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>0° to 5°</td>
<td>69</td>
<td>Inches</td>
<td>0</td>
<td>69</td>
<td>89</td>
</tr>
<tr>
<td>6° to 10°</td>
<td>50</td>
<td></td>
<td>7</td>
<td>50</td>
<td>58</td>
</tr>
<tr>
<td>11° to 15°</td>
<td>25</td>
<td></td>
<td>13</td>
<td>25</td>
<td>24</td>
</tr>
<tr>
<td>16° to 20°</td>
<td>10</td>
<td></td>
<td>13</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>21° to 25°</td>
<td>11</td>
<td></td>
<td>19</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>26° to 30°</td>
<td>7</td>
<td></td>
<td></td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>31° to 35°</td>
<td>4</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>36° to 38°</td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>117</td>
<td></td>
<td></td>
<td>117</td>
<td></td>
</tr>
</tbody>
</table>

Table of Errors in the Prediction of High-Water at Aden in March–April and November–December 1884.

<table>
<thead>
<tr>
<th>Time</th>
<th>Height</th>
<th>Magnitude of Error</th>
<th>Number of Cases</th>
<th>Magnitude of Error</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>0° to 5°</td>
<td>35</td>
<td>Inches</td>
<td>0</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>5° to 10°</td>
<td>32</td>
<td></td>
<td>1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>10° to 15°</td>
<td>19</td>
<td></td>
<td>2</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>15° to 20°</td>
<td>10</td>
<td></td>
<td>3</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>20° to 25°</td>
<td>5</td>
<td></td>
<td>4</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>26° and 28°</td>
<td>No high water</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>33° and 36°</td>
<td>2</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>39° and 57°</td>
<td>2</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>No high water</td>
<td></td>
<td></td>
<td></td>
<td>117</td>
<td></td>
</tr>
</tbody>
</table>

It would be natural to think that when a prediction is erroneous by as much as fifty-seven minutes it is a very bad one, but such a conclusion may be unjust. There was one case in which the high-water was completely obliterated by the diurnal inequality, but there were many others in which there was nearly complete obliteration, so that the water stood nearly stagnant for several hours. A measure of the degree of stagnation is afforded by the amount of rise from low to high-water. Now, on examining all the eleven cases where the error of time was equal to or over twenty minutes, we find five cases in which the range from low to high-water was less than 8 in., and these include the errors of fifty-six and of fifty-seven minutes. There is one case of a rise of 17 in. with an error of twenty-two minutes; one of 19 in. rise with thirty-three minutes error. The remaining three cases have rises of 2 ft. 10 in., 3 ft. 9 in., 3 ft. 11 in., and errors of twenty-two, twenty-three, twenty minutes. Thus all the very large errors of time correspond with approximate stagnation, and are unimportant. It is fair to conclude, therefore, that the predictions as to time are very good. The predictions as to height are obviously good, for more than half were within 1 in., and only eleven had an error of as much as 4 in.

When it is considered that the incessant variability of the tidal forces, the complex outlines of the coast, the depth of the sea, the earth's rotation and the perturbations by meteorological influences are all involved, it should be admitted that the success of tidal prediction is remarkable. If further evidence were needed, we might appeal to tidal prediction as a convincing proof of the truth of the theory of gravitation.

§ 5. General Explanation of the Cause of Tides.—The moon attracts every particle of the earth and ocean, and by the law of gravitation the force acting on any particle is directed towards the moon's centre, and is jointly proportional to the squares of the particle and of the moon, and inversely proportional to the distance between the particle and the moon's centre. If we imagine the earth and ocean subdivided into a number of small portions or particles of equal mass, then the average, both as to direction and intensity of the forces acting on these particles is equal to the force acting on that particle which is at the earth's centre. For there is symmetry about the line joining the centres of the two bodies, and, if we divide the earth into two portions by an ideal spherical surface passing through the earth's centre and having its centre at the moon, the portion remote from the moon is a little larger than the portion towards the moon, but the nearer portion is under the action of forces which are a little stronger than those acting on the farther portion, and the resultant of the weaker forces on the larger portion is exactly equal to the resultant of the stronger forces on the smaller. If every particle of the earth and ocean were being urged by equal and parallel forces there would be no cause for relative motion between the ocean and the earth. Hence it is the departure of the force acting on any particle from the average which constitutes the tide-generating force. Now it is obvious that on the side of the earth towards the moon the departure from the average is a small force directed towards the moon; and on the side of the earth away from the moon the departure is a small force directed away from the moon. Also these two departures are very nearly equal to one another, that on the near side being so little greater than that on the other that we may neglect the excess. All round the sides of the earth along a great circle perpendicular to the line joining the moon and earth the departure is a force directed inwards towards the earth's centre. Thus we see that the tidal forces tend to pull the water towards and away from the moon, and to depress the water at right angles to that direction.

If it were permissible to neglect the earth's rotation and to consider the system as at rest, we should find that the water was in equilibrium when elongated into a prolate ellipsoidal or oval form with its longest axis directed towards and away from the moon.

But it must not be assumed that this would be the case when there is motion. For, suppose that the ocean consisted of a canal round the equator, and that an earthquake or any other cause were to generate a great wave in the canal, this wave would travel almost along it with a velocity dependent on the depth. If the canal were about 15 miles deep the velocity of the wave would be about 1000 miles an hour, and with depth about equal to the depth of our seas the velocity of the wave would be about half as great. We may conceive the moon's tide-generating force as making a wave in the canal and continually outstripping the wave it generates, for the moon travels along the equator at the rate of about 1000 miles an hour, and the sea is less than 13 miles deep. The resultant oscillation of the ocean must therefore be the summation of a series of partial waves generated at each instant by the moon and always falling behind her, and the aggregate wave, being the same at each
TIDE

instant, must travel 1000 m. an hour as to keep up with the moon.

Now it is a general law of frictionless oscillation that, if a slowly varying periodic force acts on a system which would oscillate quickly if left to itself, the maximum excursion on one side of the equilibrium position occurs simultaneously with the maximum force in the direction of the excursion; but, if a quickly varying periodic force acts on a system which would oscillate slowly if left to itself, the maximum excursion on one side of the equilibrium position occurs simultaneously with the maximum force in the direction opposite to that of the excursion. An example of the first is a ball hanging by a short string, which we push slowly to and fro; the ball will never quit contact with the hand, and will agree with its excursions. If, however, the ball is hanging by a long string we can play at battledore and shuttlecock with it, and it always meets our blows. The latter is the analogue of the tides; for, in a free wave in our shallow canal goes slowly, whilst the moon's tide-generating action goes quickly. Hence, when the system is left to settle into steady oscillation it is low-water under and opposite to the moon, whilst the forces are such as to tend to make high-water at those times.

If in this case we consider the moon as revolving round the earth, the water assumes nearly the shape of an oblate spheroid or orange-shaped body with the shortest axis pointed to the moon. The rotation of the earth in the actual case introduces a complexity which it is not easy to unravel by general reasoning. We can see, however, that if water moves from mid-night to a higher latitude it arrives at the higher latitude with more velocity from west to east than is appropriate to its latitude, and it will move accordingly on the earth's surface. Following out this conception, we see that an oscillation of the water to and fro between south and north must be accompanied by an eddy. The solution of the difficult problem involved in working out this idea will be given below.

The conclusion at which we have arrived about the tides of an equatorial canal is probably more nearly true of the tides of a globe partially covered with water than if we were to suppose the ocean at each moment to assume the prolate figure of equilibrium. In fact, observation shows that it is more nearly low-water than high-water when the moon is on the meridian. If we consider how the oscillation of the water would appear to an observer carried round with the earth, we see that he will have low-water twice in the lunar day, somewhere about the time when the moon is on the meridian, either above or below the horizon, and high-water half-way between the low waters.

If the sun be now introduced we have another similar tide of about half-hour duration and this lunar diurnal tide, giving a low-water somewhere about noon and a lower, to the ocean at each moment to assume the prolate figure of equilibrium. In fact, observation shows that it is more nearly low-water than high-water when the moon is on the meridian. If we consider how the oscillation of the water would appear to an observer carried round with the earth, we see that he will have low-water twice in the lunar day, somewhere about the time when the moon is on the meridian, either above or below the horizon, and high-water half-way between the low waters.

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the tides on the English coasts would be profoundly modified if the Straits were completely closed.

It will be noticed that between Yarmouth and Holland the cotidal lines cross one another. Such an intersection of lines is in general impossible; it is indeed only possible if there is a region in which the water neither rises nor falls, because at such a place the cotidal line ceases to have a definite meaning. A set of observations by Captain Hewitt, R.N., made in 1840, appears to prove the existence of a region of this kind at the part of the chart referred to.

![Diagram of Cotidal Lines in British Seas]

(From Berghaus's Atlas.)

**Fig. 3.**—Cotidal Lines in British Seas.

§ 7. **Historical Sketch.**—The writings of various Chinese, Arabic and Icelandic authors show that some attention was paid by them to the tides, but the several theories advanced are fantastic. It is natural that the writings of the classical authors of antiquity should contain but few references to the tides, for the Greeks and Romans lived on the shores of an almost tideless sea. Nevertheless, Strabo quotes from Posidonius a clear account of the tides on the Atlantic coast of Spain, and connects the tides correctly with the motion of the moon. He also gives the law of the tide in the Indian Ocean as observed by Seleucus the Babylonian, and the passage shows that Seleucus had unravelled the law which governs the diurnal inequality of the tide in that sea.

We shall not give any details as to the medieval speculations on the tides, but pass on to once to Newton, who in 1687 laid the foundation for all that has since been added to the theory of the tides when he brought his grand generalization of universal gravitation to bear on the subject. Johann Kepler had indeed at an early date recognized the tendency of the water of the ocean to move towards the centres of the sun and moon, but he was unable to submit his theory to calculation. Galileo expresses regret that so acute a man as Kepler should have produced a theory which appeared to him to reintroduce the occult qualities of the ancient philosophers. His own explanation referred the phenomenon to the rotation and orbital motion of the earth, and he considered that it afforded a principal proof of the Copernican system.

In the 19th corollary of the 66th proposition of bk. i. of the *Principia*, Sir Isaac Newton introduces the conception of a canal circling the earth, and he considers the influence of a satellite on the water in the canal. He remarks that the movement of each molecule of fluid must be accelerated in the conjunction and opposition of the satellite with the centre; that is to say when the molecule, the earth's centre and the satellite are in a straight line, and retarded in the quadratures, that is to say when the line joining the molecule and the earth's centre is at right angles to the line joining the earth's centre and the satellite. Accordingly the fluid must undergo a tidal oscillation. It is, however, in propositions 26 and 27 of bk. iii. that he first determines the tidal force due to the sun and moon. The sea is here supposed to cover the whole earth and to assume at each instant a figure of equilibrium, and the tide-generating bodies are supposed to move in the equator.

Considering only the action of the sun, he assumes that the figure is an ellipsoid of revolution with its major axis directed towards the sun, and he determines the ellipticity of such an ellipsoid. High solar tide then occurs at noon and midnight, and low-tide at sunrise and sunset. The action of the moon produces a similar ellipsoid, but of greater ellipticity. The superposition of these ellipsoids gives the principal variations of the tide. He then proceeds to consider the influence of latitude on the height of tide, and to discuss other peculiarities of the phenomenon. Observation shows, however, that spring tides occur a day and a half after full and change of moon, and Newton falsely attributed this to the fact that the oscillations would last for some time if the attractions of the two bodies were to cease.

The Newtonian hypothesis, although it fails in the form which he gave to it, may still be made to represent the tides if the lunar and solar ellipsoids have their major axes always directed toward a fictitious sun and moon, which are respectively at constant distances from the true bodies; these distances are such that the full and change of the fictitious moon as illuminated by the fictitious sun occur about a day or a day and a half later than the true full and change of moon. In fact, the actual tides may be supposed to be generated directly by the action of the real sun and moon, and the wave may be imagined to take a day and a half to arrive at the port of observation. This period has accordingly been called "Tide of the Sun." The Age of Tide.

In 1738 the Academy of Sciences of Paris offered, as a subject for a prize, the theory of the tides. The authors of four essays received prizes, viz. Daniel Bernoulli, Leonhard Euler, Colin Maclaurin and Antoine Cavalleri. The first three adopted not only the theory of gravitation, but also Newton's method of the superposition of the two ellipsoids. Bernoulli's essay contained an extended development of the conception of the two ellipsoids, and, under the name of the equilibrium theory, it is commonly associated with his name. Laplace gives an account and critique of the essays of Bernoulli and Euler in the *Mécanique céleste*. The essay of Maclaurin presented little that was new in tidal theory, but is notable as containing certain important theorems concerning the attraction of ellipsoids. In 1746 Jean-le-Rond D'Alembert wrote a paper in which he treated the tides of the atmosphere; but this work, like Maclaurin's, is chiefly remarkable for the importance of its applications.
interesting account of the manner in which he was led to attack the problem. We shall give below the investigation of the tides of an ocean covering the whole earth; the theory is substantially Laplace's, although presented in a different form, and embodying an important extension of Laplace's work by S. S. Hough. This theory, although very wide, is far from representing the tides of our ports. Observation shows, in fact, that the irregular distribution of land and water and the various depths of the ocean in various places produce irregularities in the oscillations of the sea of such complexity that the rigorous solution of the problem is altogether beyond the power of analysis. Laplace, however, rested his discussion of tidal observation on this principle—The state of oscillation of a system of bodies in which the primitive conditions of movement have disappeared through friction is coteriodic with the forces acting on the system.

Hence if the sea is acted on by forces which vary periodically according to the law of simple oscillations (a simple time-harmonic), the oscillation of the sea will have exactly the same period, but the moment at which high-water will occur at any place and on any important of the coast will be derived from observation. Now the tidal forces due to the moon and sun may be analysed into a number of constituent periodic parts of accurately determinable periods, and each of these will generate a corresponding oscillation of the sea of unknown amplitude and phase. These amplitudes and phases may be found from observation. But Laplace also used another principle, by which he was enabled to effect a synthesis of the various oscillations, so that he does not discuss a very large number of these constituent oscillations. As, however, it is impossible to give a full account of Laplace's methods without recourse to technical language, it must suffice to state here that this procedure enabled him to discuss the tides at any port by means of a combination of theory with observation. After the time of Laplace down to 1870, the most important workers in this field were Sir John Lubbock (senior), William Whewell, and Sir G. B. Airy. The work of Lubbock and Whewell (see § 33 below) is chiefly remarkable for the co-ordination and analysis of enormous masses of data at various ports, and the construction of trustworthy tide-tables and the attempt to construct cotidal maps. Airy contributed an important lesson to the tide theory. He also studied profoundly the theory of waves in canals, and explained the effects of frictional resistance on the progress of tidal and other waves.

The comparison between tidal theory and tidal observations has been carried out in two ways which we may describe as the synthetic and the analytic methods. Nature is herself synthetic, since at any one time and place we only observe one single tide-wave. All the great investigators from Newton down to Airy have also been synthetic in their treatment, for they have sought to represent the oscillation of the sea by a single mathematical expression, as will appear more fully in chapter V. below. It is true that a presupposed analysis lay behind and afforded the basis of the synthesis. But when at length tide-gauges, giving continuous records, were set up in many places the amount of data to be co-ordinated was enormously increased, and it was found that the simple formulae previously in use had to be overloaded with a multitude of corrections, so that the simplicity became altogether fictitious. This state of matters at length led Lord Kelvin (then Sir William Thomson) to suggest, about 1870, the analytic method, in which the effort is to represent the whole synthesis is frankly abandonded and the complex whole is represented as the sum of a large number of separate parts, each being a perfectly simple wave or harmonic oscillation. All the best modern tidal work is carried on by the analytic method, of which we give an account below in chapter IV.

Lord Kelvin's other contributions to tidal theory are also of profound importance; in particular we may mention that he established the correctness of Laplace's procedure in discussing the dynamical theory of the tides of an ocean covering the whole

earth, which had been impugned by Airy and by William Ferrel. We shall have frequent occasion to refer to his name hereafter in the technical part of this article.

Amongst all the grand works which has been bestowed on the theory of this difficult subject, Newton, notwithstanding his errors, stands out first, and next to him we must rank Laplace. However original any future contribution to the science of the tides may be, it would seem as though it must perforce be based on the work of these two.

§ 8. The Tide-Predicting Instrument.—In the field of the practical application of theory Lord Kelvin also made another contribution of the greatest interest, when in 1872 he suggested that the laborious task of constructing a tide-table might be effected mechanically. Edward Roberts bore a very important part in the first practical realization of such a machine, and a tide-predictor now in regular use at the National Physical Laboratory for the Indian government was constructed by Léger under his direction. We refer the reader to Sir William Thomson's (Lord Kelvin's) paper on "Tidal Instruments" in Inst. C.E., vol. lv., and to the subsequent discussion, for a full account and for details of the share borne by the various persons concerned in the realization of the idea.

Fig. 4 illustrates diagrammatically the nature of the instrument. A cord passes over and under a succession of pulleys, every other pulley forming a fixed support. A wheel C sliding in a slot attached to the pulley frame. All the wheels and the drum are geared together so that, as the drum turns, all the movable pulleys rock up and down. The gearing is of such a nature that if one revolution of the drum were made each side of the dent in the frame represents one of the simple constituent oscillations or tides into which the aggregate tide-wave is analysed. The nature of the gearing is determined by theoretical considerations derived from the motions of the sun and moon and earth, but the throw of each crank, and the angle at which it has to be set at the start are derived from observation at the particular port for which the tide-curve is required. When the tide-predictor has been set appropriately, it will turn off a complete tide-curve for a whole year; the curve is subsequently measured and the heights and times of high and low water are tabulated and published for a year or two or three in advance.

The Indian instrument possesses about 20 units, so that the tide-curve is regarded as being the sum of 20 different simple tides; and tide-tables are published for 40 Indian and Oriental ports. A tide-predictor has been made for the French government under the supervision of Lord Kelvin and is in use at Paris; another has been made by the United States Coast Survey at Washington; in India the work was undertaken at the request of the British government. These instruments, although differing considerably in detail from the Indian predictor, are essentially the same in principle.

§ 9. Tidal Friction.—All solid bodies yield more or less to stress; if they are perfectly elastic they regain their shapes after the stresses are removed, if imperfectly elastic or viscous they yield to the stresses. We may thus feel certain that the earth yields to tide-generating force, either with perfect or imperfect elasticity. Chapter VIII. will contain some discussion of this
subject, and it must suffice to say here that the measurement of the minute elastic tides of the solid earth has at length been achieved. The results recently obtained by Dr O. Heck at Potsdam constitute a conspicuous advance on all the previous attempts.

The tides of an imperfectly elastic or viscous globe are obviously subject to frictional resistance, and the like is true of the tides of an actual ocean. In either case it is clear that the system must be losing energy, and this leads to results of so much general interest that we propose to give a short sketch of the subject, referring to chapter VIII. A more rigorous investigation. It is unfortunately impossible to give even an outline of the principles involved without the use of some technical terms.

In fig. 5 the paper is supposed to be the plane of the orbit of a satellite M revolving in the direction of the arrow about the planet C, which rotates in the direction of the arrow about an axis perpendicular to the paper. The rotation of the planet is supposed to be more rapid than that of the satellite, so that the day is shorter than the month. Let us suppose that the planet is either entirely fluid, or has an ocean of such depth that it is high-water under or nearly under the satellite. When there is no friction, with the satellite at r, the planet is elongated into the ellipsoidal shape shown, and an ocean of the same is drawn with much exaggeration and the satellite is shown as very close to the planet in order to illustrate the principle more clearly. Now, when there is a deflection of the direction of motion, the tide is retarded, and high-tide occurs after the satellite has passed the meridian. In this case, as in the previous one, the same figure to represent the tidal deformation, the satellite must be at M, instead of at N, and if we number the four quadrants as shown, the satellite must be in quadrant 1. If the force acting on the satellite far from C than it would be dragged back by the central force towards C. The satellite would describe a spiral, the coils of which would be very nearly circular and very nearly coincident. Now if we resolve the central component force along CM tangentially and perpendicular to the spiral, the component tends to retard the velocity of the satellite, whereas the disturbing force, already considered, tends to accelerate it. With the gravitational force as the disturbing influence, the central component must prevail over the acceleration. The action of tidal friction may appear somewhat paradoxical, but it is the exact converse of the acceleration of the linear velocity and the diminution of the angular momentum occurring when a body moving through a resisting medium. The latter result is generally more familiar than the action of tidal friction, and it may help the reader to realize the result in the present case. Tidal friction then diminishes planetary frequency, increased frequency of oscillation being the consequence of increased friction. The angular velocity decreases, and the orbital angular velocity diminishes the orbital angular velocity. The comparative rate of diminution of the two angular velocities is generally very different. If the satellite be close to the planet, the rate of increase of the satellite's periodic time or month is large compared with the rate of increase of the period of planetary rotation or day; but if the satellite is far from the planet the month a little longer than the day, since the satellite

recedes, the month soon increases so that it contains many days. The effect of this is to increase the rate of planetary rotation and to diminish the rate of the satellite's rotation; but if too small compared with the rate of increase of the period of planetary rotation or day; if the satellite is far off the converse is true. Hence, if the satellite starts very near the planet, with the moon a little longer than the days, since the satellite

8 This way of presenting the action of tidal friction is due to Sir George G. Stokes.

9 See that work (ed. 1835), § 83; P. H. Cowell, M. N. R. A. Soc. (1905), b.xvi. 861.

10 For a discussion of the subject without mathematics, see G. H. Darwin's Tides

whole 1889, and with important changes (1901, 1911); (Boston, 1988); translations: German, by A. Pockels (Leipzig, 1902, 1911); Italian, by G. Magrini (Turin, 1905), with appendices by translator; Magyar, by Rádó von Kövesligethy (Budapest, 1904), with appendices by translator.
TIDE

B in 1904. This work contains an enormous mass of useful work, and gives not only complete technical developments both on the theoretical and practical sides but also has chapters of general interest. The present writer feels it his duty, however, to dissent from Mr. Harris's courageous attempt to construct the cotidal lines of the various oceans.

The work contains the most complete account of the history of tidal theories of which we know. Laplace's admirable history of the subject down to his time can be seen in the Bibliography, summarized in § 7. Dr. Giovanni Magriani has an appendix to his translation of Darwin's book, entitled La Conoscenza della maree nell'antichità, founded on the researches of the Observatorio Almagia. Dr. Almagia himself gives the results of his researches more fully in a memoir, presented to the Accademia dei Lincei of Rome (5th series, vol. v. fascic. x., 1905, 137 pp).

Another paragraph on tides, treating especially the mathematical developments, is Maurice Levy's La Théorie des marées (Paris, 1898). Colonel Baird's Manual of Tidal Observation (1886) contains instructions for the installation of tide-gauges, and auxiliary tables for harmonic analysis.

Dr. Almagia's article on Tides and Waves in the Ency. Metrop., although superseded in many respects, still remains important. Harris's Manual contains a great collection of results of tidal observations made at ports all over the world.

The article "Die Bewegung der Hydrospheäre" in the Encyklopädie der mathematischen Wissenschaften (vi. 1, 1908) gives a technical account of the subject, with copious references. The same article is given in English in vol. iv. (1911) of C. H. Darwin's collected Scientific Papers; and vols. i. and ii. contain reprints of the several papers by the same author referred to in the present article.

Since the date of the 9th edition of the Ency. Brü. some technical discussion of the tides has appeared in textbooks, such as H. Lamb's Hydrodynamics. 1 That work also reproduces in more modern form Airy's investigation of the effects of friction on the tides of rivers.

We are unable to abide the present article, but we shall present the extension by Hough of Laplace's theory of the tides of an ocean-covered planet, which is still only to be found in the original memoirs.

II.-TIDE-GENERATING FORCES


We have already given a general explanation of the nature of tide-generating forces; we now proceed to a rigorous investigation. If a planet is attended by a single satellite, the motion of any body relatively to the planet's surface is found by the process described as reducing the planet's centre to rest. The planet's centre will be at rest if every body in the system has impressed on it a velocity equal and opposite to that of the planet's centre; and this is accomplished by impressing on every body an acceleration equal and opposite to that of the planet's centre.

Let $M$, $m$ be the masses of the planet and the satellite; $r$ the radius vector of the satellite, measured from the planet's centre; $\rho$ the radius vector, measured from the same point, of the particle whose motion we wish to determine; and $z$ the angle between $r$ and the radius vector of the particle whose motion we wish to determine. We may set $\mathbf{a}_r = \mathbf{a}_s$, the acceleration relative to the planet's centre of the satellite is $(M+m)\mathbf{a}_r$ towards the planet along the radius vector $r$. Now the acceleration of interest of the planet and satellite remains fixed in space, and the centre of the planet describes an orbit round that centre of inertia similar to that described by the satellite round the planet but with linear dimensions reduced in the proportion of $m$ to $M+m$. Hence the acceleration of the planet's centre is $m\mathbf{a}_r$ towards the centre of inertia of the two bodies. Thus, in order to reduce the planet's centre to rest, we apply to every particle of the system an acceleration $m\mathbf{a}_r$ parallel to $r$, and directed from satellite to planet.

Now take a set of rectangular axes fixed in the planet, and let $Mx, My, Mz$ be the co-ordinates of the satellite referred thereto; and let $x, y, z$ be the co-ordinates of the particle whose radius vector is $\rho$. Also, the component accelerations for reducing the centre of inertia to rest are $-mMx/\rho^2$, $-mMy/\rho^2$, $-mMz/\rho^2$, and since these are the differential coefficients with respect to $\rho, \phi, \psi$ of the function

$$-m \frac{M}{\rho^2} \left( Mx + MMy + MMz \right),$$

and since $z = Mx + MMy + MMz$, it follows that the potential of the forces by which the planet's centre is reduced to rest is

$$-m \frac{M}{\rho^2} z.$$

1 The theory as presented in the Mécanique céleste is unnecessarily difficult, and was much criticized by Airy. Before the publication of the 9th edition of this dictionary, air was considered as an entirely new subject, and the student to read a number of controversial papers published all over the world in order to get at the matter.

Now let us consider the other forces acting on the particle. The planet is spheroidal, and therefore does not attract equally in all directions; but in this investigation we may make abstraction of the ellipticity of the planet and of the ellipticity of the ocean due to the planetary rotation. This, which we set aside, is considered in the theories of gravity and of the figures of planets. Outside its body, then, the planet contributes forces of which the potential is $M/p$. Next the direct attraction of the satellite contributes forces of which the potential is the mass of the satellite divided by the distance between the point $P$ and the satellite; this is

$$m \frac{1}{\sqrt{r^2 + p^2 - 2rp \cos z}}.$$

To determine the forces from this potential we regard $\rho$ and $z$ as the variables for differentiation, and we may add to this potential any constant we please. As we are seeking to find the forces which urge $P$ relatively to $M$, we add such a constant as will make the whole potential at the planet's centre zero, and thus we take as the potential of the forces due to the attraction of the satellite

$$m \frac{1}{\sqrt{r^2 + p^2 - 2rp \cos z}} - \frac{M}{p}. $$

It is obvious that in the case to be considered $r$ is very large compared with $\rho$, and we may therefore expand this in powers of $\rho/r$. This expansion gives us

$$m \left( \frac{p^2}{r^4} + \frac{p^4}{r^6} + \frac{p^6}{r^8} + \cdots \right),$$

where $p = \cos z$, $p = \frac{1}{2} \cos^2 z - \frac{1}{4}$, $p = \frac{1}{3} \cos^3 z - \frac{1}{6} \cos z$, &c.

The reader familiar with spherical harmonic analysis of course recognizes the spherical harmonic functions; but the result for a few terms, which is all that is necessary, is easily obtainable by simple algebra.

Now, collecting together the various contributions to the potential, and noticing that $\frac{m^2}{\rho^2} p^2 = \frac{m^2}{\rho^2} \cos z$, and is therefore equal and opposite to the potential by which the planet's centre was reduced to rest, we have as the potential of the forces acting on a particle whose co-ordinates are $\rho$, $\phi$, $\psi$;

$$\frac{M}{\rho} + m \frac{p^2}{r^4} \left( \frac{1}{2} \cos^2 z - \frac{1}{4} \right),$$

and thus

$$V = \frac{m^2}{\rho^2} \left( \cos z - \frac{1}{2} \right).$$

(2)

as the tide-generating potential. 1

1 The first term of (1) is the potential of gravity, and the terms of the series, of which two only are written, constitute the tide-generating potential. In all practical applications this series converges so rapidly that the first term is amply sufficient, and thus we shall generally denote

$$V = \frac{m^2}{\rho^2} \left( \cos z - \frac{1}{2} \right).$$

(2)

As the surface of the earth $\rho$ is equal to $a$ the earth's radius.

§ 12. Form of Equilibrium.—Consider the shape assumed by an ocean of density $\epsilon$, on a planet of mass $M$, density $\delta$ and radius $a$, when acted upon by the potential $\phi$. This potential has a harmonic character, and its coefficients are found as in the previous section. Let $S_i$ denote a surface spherical harmonic of order $i$, such a potential is given at the point whose radius vector is $\rho$ by

$$V = \frac{m^2}{\rho^2} \left( \cos z - \frac{1}{2} \right),$$

(3)

In the case considered in § 11, $i = 2$ and $S_i$ becomes the second zonal harmonic $\cos z - \frac{1}{2}$. The theory of harmonic analysis tells us that the form of the ocean, when in equilibrium, must be given by the equation

$$\rho = a - e \cos S_i,$$

(4)

Our problem is to evaluate $e$. We know that the external potential of a layer of matter, of depth $eS_i$ and density $\epsilon$, has the value

$$\frac{4\pi e}{21 + 1 \left( \frac{1}{2} \right)^2} S_i,$$

(5)

Hence the whole potential externally to the planet and up to its surface is

$$\frac{M}{\rho} + \frac{m^2}{\rho^2} \left( \cos z - \frac{1}{2} \right),$$

(6)

The first and most important term is the potential of the planet, the second that of the disturbing force, and the third that of the departure from sphericity.

The ocean must stand in a level surface, the expression (5) equated to a constant must be another form of (4). Hence, if we put $\rho = a - e \cos S_i$ in the first term of (5) and $e = a$ in the second and third terms, (5) must be constant; this can only be the case if the
coefficient of $S$ vanishes. Hence on effecting these substitutions and equating that coefficient to zero, we find
\[ M = 2\pi a^2 = gS, \]
where $g$ is gravity, and therefore
\[ e_i = -\frac{2\pi a^2}{2gr^2} \]
\[ = -\frac{3\pi}{(2\pi + 1)^2}. \quad (6) \]

In the particular case considered in §11 we therefore have
\[ \rho = a \left[ 1 + \frac{3\pi a^2}{2gr^2} \left( \cos z - 1 \right) \right] \]
\[ = 1 + 3\pi \left( \cos z - 1 \right). \quad (7) \]

The axis of $C$ is taken as the polar axis, and $AB$ is the equatorial plane, so that the functions of $\xi$, $\eta$, $\zeta$ are functions of the latitude and longitude of the point $P$, at which we wish to find the potential. The functions of $M_1$, $M_2$, $M_3$ depend on the moon's position, and we shall have occasion to develop them in two different ways—first, in terms of her hour-angle and declination, and secondly (§25) in terms of her longitude and the elements of the orbit.

Now let $A$ be on the equator in the meridian of $P$, and $B$ go east of $A$ on the equator. Then, if $M$ be the moon, the inclination of the plane $MC$ to the plane $CA$ is the moon's easterly hour-angle.

\[ \hat{h}_a = \text{Greenwich westward hour-angle}; \]
\[ \hat{h}_d = \text{the west longitude of the place of observation}; \]
\[ \lambda = \text{the latitude of the place}; \]
\[ \delta = \text{moon's declination}; \]
\[ \text{then we have} \]
\[ M_1 = \cos \delta \cos (\hat{h}_2 - \hat{h}_1), \]
\[ M_2 = \cos \delta \sin (\hat{h}_2 - \hat{h}_1), \]
\[ M_3 = \sin \delta, \]
\[ \hat{h}_2 = \text{the longitudes}, \quad \eta = \text{a constant}. \quad (9) \]

Also the radius vector of the place of observation on the earth's surface is $a$. Whence we find
\[ V = \frac{3\pi a^2}{2r^2} \left( \cos \theta - 1 \right) \]
\[ \times \left[ \cos \hat{h}_2 \cos 2(\hat{h}_2 - \hat{h}_1) + \sin 2\theta \sin \hat{h}_2 \cos \theta \right] \]
\[ + \left[ \cos \theta \sin \hat{h}_1 + \sin \theta \sin \hat{h}_2 \right]. \quad (10) \]

The tide-generating forces are found by the rates of variation of $V$ for latitude and longitude, and also for radius $a$, if we care to find the radial disturbing force.

The westward component of the tide-generating force at the earth's surface, where $\rho = a$, is $dV/a \cos \theta$, and the northward component in the equatorial plane is the cross product of the $z$-axis and $\rho$ with the attraction due to $a$. These are the forces which produce a constant heaping up of the water at the equator; or, in other words, the moon's attraction has the effect of causing a small permanent ellipticity of the earth's mean figure. This augmentation of ellipticity is of course very small, but it is necessary to mention it.

If we consider the motion of a pendulum-bob under the influence of these forces during any one day, we see that in consequence of the semi-diurnal changes of level it twice describes an ellipse with its greatest axis east and west and its minor axis north and south; when developed shows that the ratio of axes is equal to the sine of the latitude, and the linear dimensions proportional to $\cos^3 \theta$.

It describes once a day an ellipse whose north and south axis is proportional to $\sin 2\phi$ and whose east and west axis is proportional to $\sin 2\phi \sin \lambda$. Obviously the latter is circular in latitude $30^\circ$.

When the moon is on the equator, the maximum deflexion occurs when the moon's local hour-angle is $45^\circ$, and is then equal to
\[ \frac{3\pi a^2}{2M^2} \left( \cos \lambda ight). \]

This angle is equal to $0.017^\circ \cos \lambda$. Attempts actually to measure the deflexion of the vertical have at length proved successful (see Seismometer).

III.—Dynamical Theory of the Tides.

§14. Recent Advances in the Dynamical Theory of the Tides.—The problem of the tidal oscillation of the sea is essentially dynamical. In two papers in the second volume of Liouville's Journal (1860) H. Poincaré has considered the mathematical principles involved in the problem, where the ocean is interrupted by land as in actuality. He has not sought to obtain numerical results applicable to any given configuration of land and sea, but he has aimed rather at pointing out methods by which it may some day be possible to obtain such solutions.

Even when the ocean is taken as covering the whole earth, the problem presents formidable difficulties, and this is the only case in which it has been solved hitherto.

Laplace gives the solution in bks. i. and iv. of the Mécanique céleste; but his work is unnecessarily complicated. In the 9th edition of the Encyc. Brit. we gave Laplace's theory without these complications, but the theory is now accessible in H. Lamb's Hydrodynamics and other works of the kind. It is therefore not reproduced here.

In 1867 and 1889 S. S. Hough undertook an important revision of Laplace's theory and succeeded not only in introducing the effects of the mutual gravitation of the ocean, but...
also in determining the nature and periods of the free oscillations of the sea. A dynamical problem of this character cannot be regarded as fully solved unless we are able not only to discuss the "forced" oscillations of the system but also the "free." Hence we regard Mr. Hough's work as the most important contribution to the dynamical theory of the tides since the time of Laplace. We shall accordingly present the theory briefly in the form due to Mr. Hough.

The analysis is more complex than that of Laplace, where the mutual attraction of the ocean was neglected, but this was perhaps inevitable. Our first task is to form the equations of motion and continuity, which will be equally applicable to all forms of the theory.

§ 15. Equations of Motion.—Let \( r, \theta, \phi \) be the radius vector, colatitude and east longitude of a point with reference to an origin, a polar axis and a zero-meridian rotating with a uniform angular velocity \( \eta \) from west to east. Then if \( R, H, \Xi \) be the radial, colatitudinal and longitudinal accelerations of the point, we have

\[
R = \frac{\partial^2 \phi}{\partial t^2} - \frac{\partial (\partial \phi / \partial t)}{\partial t} - r \sin \theta \left( \frac{\partial^2 \phi}{\partial t^2} + \eta \right),
\]

\[
\Xi = \frac{\partial^2 \phi}{\partial t^2} - r \sin \theta \cos \phi \frac{\partial^2 \phi}{\partial t^2} + \frac{\partial^2 \phi}{\partial t \partial \phi} + \frac{\partial \phi}{\partial t} \frac{\partial \phi}{\partial t}.
\]

If the point were at rest with reference to the rotating meridian we should have

\[
R = -r^2 \sin \theta, \quad \Xi = -r^2 \sin \theta \cos \phi, \quad H = 0.
\]

When these considerations are applied to the motion of an ocean relative to a rotating planet, it is clear that these accelerations, which still remain when the ocean is at rest, are annulled by the permanent oblateness of the ocean. As then they take no part in the oscillations of the ocean, and as we are not considering the figure of the planet, we may omit these terms from \( R \) and \( \Xi \) for this being so we must replace \( \frac{\partial^2 \phi}{\partial t^2} \) as it occurs in \( R \) and \( \Xi \) by \( \frac{\partial \phi}{\partial t} \frac{\partial \phi}{\partial t} \).

Now suppose that the point whose accelerations are under consideration never moves far from its zero position, and that its displacements \( \xi, \eta \) in colatitude and longitude are very large compared with \( \rho \) its radial displacement. Suppose, further, that the velocities of the point are so small that their squares and products are negligible compared with \( \rho^2 \); then we have

\[
r \sin \theta \frac{\partial \phi}{\partial \eta} = \text{a very small quantity};
\]

\[
r \sin \phi \frac{\partial \phi}{\partial \xi} = \left( \frac{\partial \phi}{\partial \xi} \right) / \sin \theta .
\]

Since the radial velocity always remains very small it is not necessary to concern ourselves further with the value of \( R \), and we only require the two other components which have the approximate forms,

\[
\Xi = \frac{\partial^2 \phi}{\partial t^2} - 2n \sin \theta \cos \phi \frac{\partial^2 \phi}{\partial t^2} + \frac{\partial \phi}{\partial t} \frac{\partial \phi}{\partial t},
\]

\[
H = \sin \phi \frac{\partial^2 \phi}{\partial t^2} + 2n \sin \theta \cos \phi \frac{\partial^2 \phi}{\partial t^2} .
\]

We have now to consider the forces by which an element of the ocean is urged in the direction of colatitude and longitude. These forces are those due to the external disturbing forces, to the pressure of the water, surrounding an element of the ocean, and to the attraction of the ocean itself. The latter denotes the equilibrium height of the tide, it is a function of colatitude and longitude, and may be expanded in a series of spherical surface harmonics \( \epsilon_i \). Thus we may write the equation to the equilibrium tide in the form

\[
r = a + \epsilon = a + \Xi + \epsilon.
\]

Now it appears from (10) and (11) that the value of the potential, at the surface of the sphere where \( r = a \), under which this is a figure of equilibrium, is

\[
V = \Xi + \epsilon.
\]

We may use this as supplying the external disturbing force due to the known attractions of the moon and sun, so that \( \epsilon_i \) may be regarded as known.

But in our dynamical problem the ocean is not a figure of equilibrium, and we may denote the elevation of the surface at any moment of time by \( b \). Then the equation to the surface may be written in the form

\[
r = a + b + \epsilon = a + b + \Xi + \epsilon,
\]

where \( \epsilon \) denotes a spherical harmonic just as \( \epsilon_i \) did before.

3 Phil. Trans., 189 A, pp. 201—258 and 191 A, pp. 139—185.
Solving (20), we have
\[
(2b_a(x)) \left( f^2 - \cos^2 \theta \right) \int \frac{d}{d\theta} \left[ (1 + \frac{b_a}{b_b}) \sin \theta \right] \left( f^2 - \cos^2 \theta \right) \left( \frac{d}{d\theta} \left[ \frac{b_a}{b_b} \sin \theta \right] \right) \left( f^2 - \cos^2 \theta \right).
\]
This is almost the same as Laplace's equation for tidal oscillations in an ocean whose depth is only a function of latitude. If indeed we treat \(b_a\) as unity (thereby neglecting the mutual attraction of the water) and replace \(b_a\) and \(b_b\) by \(u\) and \(e\), we obtain Laplace's equation.

When \(b_a\) is found from this equation, its value substituted in (21) will give \(x\) and \(y\).

§ 17. Zonal Oscillations.—We might treat the general harmonic oscillations first, and proceed to the zonal oscillations by putting \(x = 0\). These waves are, however, comparatively simple, and it is well to begin with them. The zonal tides are those which Laplace describes as of the first species, and are now more usually called the tides of long period. As we shall only consider the case of an ocean of uniform depth, \(y\) the depth of the sea is constant. Then since in this case \(x = 0\), our equation (22), to be satisfied by \(u\) or \(k - \epsilon\), becomes
\[
\frac{d}{d\theta} \left[ \sin \theta \left\{ \frac{d}{d\theta} \left[ \frac{b_a}{b_b} \sin \theta \right] \right\} \right] = \frac{4ma}{\gamma} \sin \theta \frac{dK}{d\theta} = 0.
\]
This may be written
\[
\frac{d}{d\theta} \left[ \sin \theta \frac{d}{d\theta} \left[ \frac{b_a}{b_b} \sin \theta \right] \right] = \frac{4ma}{\gamma} \sin \theta \frac{dK}{d\theta} = 0,
\]
where \(A\) is a constant.

Let us assume
\[
h = C_P i, \quad \epsilon = E_P i,
\]
where \(P_i\) denotes the 7th zonal harmonic of \(\cos \theta\). The coefficients \(C_P\) are unknown, but the \(E_P\) are known because the system oscillates under the action of known forces.

If the term involving the integral in this equation were expressed in terms of differentials of harmonics, we should be able to equate to zero the coefficient of each \(dP_i/d\theta\) in the equation, and thus find the conditions for determining the \(C_P\).

The task then is to express \(f^2 - \cos^2 \theta\) in terms of \(P_i\) and \(d\theta\) in differentials of zonal harmonics.

It is well known that \(P_i\) satisfies the differential equation
\[
\frac{d}{d\theta} \left( \sin \theta \frac{d}{d\theta} \right) P_i = \frac{2 \epsilon_i}{\sin \theta} P_i, \quad \text{and} \quad \frac{d}{d\theta} \left( \sin \theta \frac{d}{d\theta} \right) dP_i = \frac{2 \epsilon_i}{\sin \theta} dP_i.
\]

If we differentiate (25) and use (24) we have
\[
\frac{d}{d\theta} \left[ \frac{d}{d\theta} \right] P_i = P_i \frac{d}{d\theta}\left( \frac{d}{d\theta} \right), \quad \text{and} \quad \frac{d}{d\theta} \left[ \frac{d}{d\theta} \right] dP_i = \frac{d}{d\theta}\left( \frac{d}{d\theta} \right) P_i.
\]

Multiplying (25) by \(\sin \theta\) and using (26) twice over,
\[
\sin \theta \frac{d}{d\theta} P_i = \frac{2 \epsilon_i}{\sin \theta} P_i, \quad \text{and} \quad \sin \theta \frac{d}{d\theta} dP_i = \frac{2 \epsilon_i}{\sin \theta} dP_i.
\]

Then we have
\[
\sin \theta \frac{d}{d\theta} \left[ \frac{d}{d\theta} \right] P_i = P_i \frac{d}{d\theta}\left( \frac{d}{d\theta} \right), \quad \text{and} \quad \sin \theta \frac{d}{d\theta} \left[ \frac{d}{d\theta} \right] dP_i = \frac{d}{d\theta}\left( \frac{d}{d\theta} \right) P_i.
\]

This expression, when multiplied by \(4ma/\gamma\) and with \(C_P\) and \(\epsilon_P\) and summed, is our second equation of motion.

The first term is
\[
\sum_{b_i}(C_i - E_i) \frac{dP_i}{d\theta}.
\]
In order that the equation may be satisfied, the coefficient of each \(dP_i/d\theta\) must vanish identically. Accordingly we multiply the whole by \(\gamma/4ma\) and equate to zero the coefficient in question, and obtain
\[
\sum_{b_i}(C_i - E_i) \frac{dP_i}{d\theta} = 0.
\]
equilibrium tide $\epsilon$, which is as we know equal to $E_2 P_4 \cos (3\nu t + \alpha)$.

Whence we find
\[
b = \frac{\delta h_{S3}}{P_3} \left[ 3 \cos \theta P_3 + 1.5 \cos \theta (\cos \theta + \sin \theta) \right].
\]

The number $b$ is a fraction such that its reciprocal is twice the number of sidereal days in the period of the tide. The greatest value of $f$ is that pertaining to the lunar fortnightly tide (M in notation of harmonic analysis), and in this case $f$ is in round numbers $1/28$, or more exactly $f = 0.0113$. The ratio of the density $\sigma$ of sea-water to $\delta$ the mean density of the earth is $18003$; which gives us
\[
b = 1.3 \times 10^{-3}.
\]

The quantity $m$ is the ratio of equatorial centrifugal force to gravity, and is equal to $1/289$. Finally, $\gamma$ is the depth of the ocean expressed as a fraction of the earth's radius.

With these numerical values Mr Hough has applied the solution to determine the lunar fortnightly tide for oceans of various depths. Of his results we give two:

First, when $\gamma = 0.0562$ ft. = 1210 fathoms, which makes $\gamma / \delta m = 1/40$, he finds
\[
b = 1.04 \times 10^{-2} P_3.
\]

Thus we see how widely the dynamical solution differs from the equilibrium value.

Secondly, when $\gamma = 0.0808$ ft. = 9680 fathoms, and $\gamma / \delta m = 1/5$, he finds
\[
b = 1.04 \times 10^{-2} P_3.
\]

From this we see that the equilibrium solution presents some sort of resemblance to the dynamical solution; and it is clear that the equilibrium solution would be fairly accurate for oceans which are still quite shallow when expressed as fractions of the earth's radius, although far deeper than the actual sea.

The tides of long period were not investigated by Laplace in this manner, for he was of opinion that a very small amount of friction would suffice to make the ocean assume its form of equilibrium. In the arguments which he adduced in support of this view the friction contemplated was such that the integral effect was proportional to the velocity of the water relatively to the bottom. It is probable that proportionality to the square of the velocity would have been nearer the truth, but the distinction is unimportant.

The most rapid of the oscillations of this class is the lunar fortnightly tide, and the water of the ocean moves northward for a week and then southward for a week. In oscillating systems, where the resistances are proportion to the velocities, it is usual to specify the resistance by a "modulus of decay," namely the time in which a velocity is reduced by friction to $e^{-4}$ or $1/2.78$ of its initial value. Now in order that the result contemplated by Laplace may be true, the friction must be such that the modulus of decay is short compared with the semi-period of oscillation. It seems certain that the friction of the ocean bed would not reduce a slow ocean current to one-third of its primitive value in a day or two. Hence we cannot accept Laplace's discussion as satisfactory, and the investigation which has just been given becomes necessary. (See § 34).

§ 18. Tesserla Oscillations.—The oscillations which we now have to consider are those in which the form of surface is expressible by the tesserall harmonics. The results will be applicable to the diurnal and semi-diurnal tides—

Laplace's second and third species.

If we write $a \cdot \sigma$ the equation (22) becomes
\[
d \left[ \sin \sigma \frac{D}{D} \sin \sigma \cos \theta \right] + \left[ \sigma \cos \theta \frac{D}{D} \sin \sigma \cos \theta \right] + \frac{1}{2} \left( \frac{\delta h_{S3}}{P_3} \right) \sin \theta \Sigma h_{S3} = 0.
\]

If we write $D$ for the operation $\sin \sigma \frac{D}{D} \sin \sigma \cos \theta$ the middle term may be arranged in the form
\[
\sigma \cos \theta D + \sigma \cos \theta \sin \theta \Sigma h_{S3} = 0.
\]

Therefore on multiplying by $\sin \theta$ the equation becomes
\[
\frac{D}{D} \sigma \cos \theta \left( D + \sigma \cos \theta \right) \left( \Sigma h_{S3} \right) = 0.
\]

We now introduce two auxiliary functions, such that
\[
\Sigma h_{S3} = \mu(1 - P_3) C \cos \theta + (\mu - P_3) \sin \theta \cos \theta \Phi.
\]

It is easy to prove that
\[
(D + \sigma \cos \theta) (D + \sigma \cos \theta) = D^2 - \sigma^2 \cos \theta \sin \theta + (\sigma^2 - \sigma^2 \cos \theta) \sin \theta.
\]

Similarly
\[
(D - \sigma \cos \theta) (D - \sigma \cos \theta) = D^2 - \sigma^2 \cos \theta \sin \theta + (\sigma^2 - \sigma^2 \cos \theta) \sin \theta.
\]

Also
\[
(D + \sigma \cos \theta) (D + \sigma \cos \theta) = D^2 - \sigma^2 \cos \theta \sin \theta + (\sigma^2 - \sigma^2 \cos \theta) \Phi.
\]

Now perform $D + \sigma \cos \theta$ on (31), and use the first of (32) and (33), and we have
\[
\frac{d}{d} \left( \sigma \cos \theta \right) \left( \Sigma h_{S3} \right) = \frac{1}{2} \left( \frac{\delta h_{S3}}{P_3} \right) \sin \theta \cos \theta \Phi.
\]

The functions $\Phi$ and $\Phi$ are as yet indeterminate, and we may impose another condition on them. Let that condition be
\[
(D^2 - \sigma^2 \sin \theta) \Phi = 2 \sigma^2 \sin \theta \cos \theta \Phi.
\]

Then (34) may be written
\[
\frac{d}{d} \left( \sigma \cos \theta \right) \left( \Sigma h_{S3} \right) = \Phi + (D + \sigma \cos \theta) \Phi.
\]

Substituting from this (30), and using the second of (32), the function $\Phi$ disappears and the equation reduces to
\[
(D^2 - \sigma^2 \sin \theta) \Phi = \frac{1}{2} \left( \frac{\delta h_{S3}}{P_3} \right) \sin \theta \cos \theta \Phi.
\]

Since by (35) $\sigma \cos \theta \Phi = \frac{1}{2} \left( \frac{\delta h_{S3}}{P_3} \right) \sin \theta \cos \theta \Phi$, (31) may be written
\[
\Sigma h_{S3} = \frac{1}{2} \left( \frac{\delta h_{S3}}{P_3} \right) \sin \theta \cos \theta \Phi.
\]

The equations (35), (36), and (37) define $\Phi$ and $\Phi$, and furnish the equation which must be satisfied.

If we denote $\cos \theta$ by $\mu$ the zonal harmonics are defined by
\[
P_1 = \frac{1}{2} \left( \frac{d}{d} \right) \left( D^2 - \sigma^2 \sin \theta \right) \Phi.
\]

The following are three well-known properties of zonal harmonics:
\[
d \left[ \frac{1}{2} \left( \frac{d}{d} \right) \left( D^2 - \sigma^2 \sin \theta \right) \Phi \right] = (D - \sigma \cos \theta) \left( \Sigma h_{S3} \right).
\]

If $P_{i1}$ are the two tesseral harmonics of order $i$ and rank $s$, it is also known that
\[
P_{i1} \sin \theta = \frac{1}{2} \left( \frac{d}{d} \right) \left( D^2 - \sigma^2 \sin \theta \right) \Phi.
\]

Let us now assume
\[
h_i = C_i P_{i1}, \quad e_i = P_{i1}, \quad \Psi = 2 \sigma \Phi P_{i1}, \quad \Phi = 2 P_{i1} \Phi.
\]

These must now be substituted in our three equations (35), (36), and (37), and the result must be expressed by series of the $P_{i1}$ functions.

It is clear then that we have to transform into $P_{i1}$ functions the following functions of $P_{i1}$, namely
\[
\frac{1}{2} \left( \frac{d}{d} \right) \left( D^2 - \sigma^2 \sin \theta \right) \Phi = \frac{1}{2} \left( \frac{d}{d} \right) \left( D^2 - \sigma^2 \sin \theta \right) \Phi.
\]

If we differentiate (36) $s$ times, and express the result by means of the operator $D$, we find
\[
(D - \sigma \cos \theta) P_{i1} + (i + s) P_{i1} = 0.
\]

Again, differentiating (39) $s$ times and using (40), we find
\[
(i - s + 1) P_{i1} + (i + s + 1) \sigma \cos \theta P_{i1} + (i + s + 1) P_{i1} = 0.
\]

Lastly, differentiating (41) once and using (38), (40) and (43)
\[
P_{i1} = \frac{2}{21} \left( D^2 - \sigma^2 \sin \theta \right) \Phi.
\]

By means of (42), (43) and (44) we have
\[
\frac{1}{2} \left( \frac{d}{d} \right) \left( D^2 - \sigma^2 \sin \theta \right) \Phi = \frac{1}{2} \left( \frac{d}{d} \right) \left( D^2 - \sigma^2 \sin \theta \right) \Phi.
\]

Therefore the equations (35), (36), (37) give
\[
\Sigma \left[ e_i \right] \left( i - s + 1 \right) P_{i1} + 2 \sigma \Phi P_{i1} \left( i - s + 1 \right) P_{i1} = 0.
\]

\[
\Sigma \left[ e_i \right] \left( i - s + 1 \right) P_{i1} + 2 \sigma \Phi P_{i1} \left( i - s + 1 \right) P_{i1} = 0.
\]

\[
\Sigma \left[ e_i \right] \left( i - s + 1 \right) P_{i1} + 2 \sigma \Phi P_{i1} \left( i - s + 1 \right) P_{i1} = 0.
\]
Since those equations must be true identically, the coefficients of $P'_i$ in each of them must vanish. Therefore

$$a_i[i-(i+1)-3]+b_i[i-(i+1)+3]+c_i[i-(i+1)-1]=0,$$

$$-b_i[i-(i+1)+1]+i_0 C_i=0. \tag{45}$$

$$b_i(C_i-E_i)+a_i[i-(i+1)-(i-2)]+c_i[i-(i+1)+(i-2)]\beta_i^2=0.$$

If we eliminate the $a_i$'s and $b_i$'s from the third equation (45), by means of the first two, we find

$$L_i^2=\frac{3-2b_i}{35} \text{ and } \zeta_0=0.$$

The equation (46) for the successive $C_i$'s is available for all values of $i$ provided that $C_4$, $E_1$, $E_2$, $E_3$, $E_4$ are regarded as being zero.

As in the case of the semi-diurnal oscillations, the equations with odd suffixes separate themselves from those with even suffixes, so that the two series may be treated independently of one another. Indeed, as we shall see immediately, the series with odd suffixes are all equal and independent, but $i$ and $s$ are rigorously integers, whereas $\eta$ depends on the "speed" of the tide; accordingly in the case referred to we must regard terms involving $i-(i-2)$ as vanishing in the limit when $\eta$ approaches to equality with $i-(i-1)$. For this particular case we find

$$L_i^2=\frac{3-2b_i}{35} \text{ and } \zeta_0=0.$$
It must be premised that when the profile of a wave does not present the simple harmonic form it is convenient to analyze its shape into a series of partial waves superposed on a fundamental wave; and generally the principle of harmonic analysis is adopted in which the actual wave is regarded as the sum of a number of simple waves.

Suppose that the water is contained in a straight and shallow canal of uniform depth $h$, and that at one end the canal debouches on to the open sea. Suppose further that in the open sea there is a forced oscillation of water level, given by this formula

$$
\eta = H \sin \pi n \left(1 - \frac{x}{\sqrt{gk}}\right).
$$

where $\eta$ is the elevation of the water at time $t$ above its mean level, $2\pi h$ the period of the oscillation and $H$ the amplitude of the oscillation.

Waves will clearly be transmitted along the canal, and the problem is to obtain a formula which shall represent the oscillations of level at any distance $x$ measured from the mouth of the canal.

The mathematical investigation shows that, if $g$ denotes gravity, the formula for the oscillation of water level at the point defined by $x$ is

$$
\eta = H \sin \left(\frac{\pi n x}{\sqrt{gk}} - \frac{2\pi h n}{\sqrt{gk}} \sin \frac{2\pi n x}{2\pi h} \right).
$$

The second of these terms is proportional to $x$, and if the canal were infinitely long it would become infinite. The difficulty thus occasioned may be eluded by supposing the canal to debouch on a second sea in which a second appropriate oscillation is maintained. In actual friction gradually annuls all motion, and no such difficulty arises.

The first term of the formula is called the fundamental tide, the second gives what is called the first over-tide; and further approximation would give second and third over-tides, &c. All the over-tides (as he the river tide, for instance) are distinct from the fundamental, but they have double, treble, quadruple frequencies or "speeds," and the ratio of the amplitude of the first over-tide to the fundamental is

$$
\frac{3H}{4\sqrt{gk}}.
$$

As a numerical example, let the range of tide at the river mouth be 20 ft., and the depth of the river 50 ft. The "speed" of the semi-diurnal tide, which is an angular velocity, is 28.98° per hour or 11/9 radians per hour; $\sqrt{gk} = 27$ miles per hour; hence $\frac{3H}{4\sqrt{gk}} = \frac{1}{342}$. Therefore 34 miles up the river the over-tide is 1/10th of the fundamental and has a range of 2 ft. If the river shallows very gradually, the formula will still hold, and we see that the height of the over-tide varies as (depth)⁻¹.
Fusion of Terms affected by Motion of Moon's Node

TIDE

Let the axes fixed in the earth be taken as follows: the axis C the north pole axis; the axis A through the earth's center and a point on the equator on the same meridian as the place of observation; the axis B at right angles to the two eastward of A. Then if $\lambda$ be the latitude of the place of observation

$$\xi = \cos \lambda, \eta = \sin \phi, \zeta = \sin \lambda$$

With these values we have

$$\cos^2 z - 1 = \frac{1}{2} \cos \lambda (M_1 + M_3 - M_2) + \sin 2\lambda M_4$$

$$+ \frac{1}{2} (1 - \sin^2 \phi) (M_1 + M_3 - 2M_2)$$

In fig. 7 let ABC be the axes fixed in the earth; XYZ a second set of axes, XY being the plane of the moon's orbit; M the projection of the moon's node on the earth's surface at $\phi = 2\pi / 3$; the obliquity of the lunar orbit to the equator; $x = AX = BCY$; $l = MX$, the moon's longitude in her orbit measured from X, the descending node of the equator on the lunar orbit, hereafter called the "intersection."

Then

$$M_1 \cos \phi \cos x + \sin \phi \cos \lambda = \cos \phi \cos (\chi - \phi) + \sin \phi \cos (\chi + \phi)$$

$$M_2 = \cos \phi \sin x + \sin \phi \cos \lambda = - \cos \phi \sin (\chi - \phi) \cos \phi \sin (\chi + \phi)$$

When these expressions are substituted in $M_1^2 - M_3^2, M_2M_4, M_1^2 + M_3^2 - 2M_2$, it is clear that the first will have terms in the cosine of $2(\chi - \phi), 2x, 2(x+\phi)$; the second in sines of $2\chi - 2x$, $x + \phi$, the third in $\cos 2l$, together with a term depending only on $l$.

Now let $e$ be the moon's mean distance, $\epsilon$ the eccentricity of her orbit, and let

$$X = \left[\left\{1 - (\epsilon^2)\right\}M_3 \right]Y, \quad Y = \left[\left\{1 - (\epsilon^2)\right\}M_3 \right]X_2 = \left[\left\{1 - (\epsilon^2)\right\}M_5 \right]$$

Then we have for the lunar tide-generating potential at the place of observation

$$V = \frac{r_0^2}{(1 - \epsilon^2)^2} \left[\left(\cos^2 \phi \cos \lambda (X^2 + Y^2) + \sin 2\lambda XZight.ight. \left.\left.\right. + (1 + \sin^2 \phi) (X^2 + Y^2 - 2Z^2)\right]$$

The only parts of this expression which are variable in time are the functions of $X, Y, Z$.

To complete the development the formulae of elliptic motion are introduced in these functions, and terms which appear numerically negligible are omitted. Finally, the three $X, Y, Z$ functions are often divided into component semi-diurnal and diurnal terms, the components of the sines and cosines being linear functions of the earth's rotation, the moon's mean motion, and the longitude of the moon's perigee. The next step is to pass, according to the principle of forced oscillations, from the potential to the height of the generated forces by the forces corresponding to that potential. The $X, Y, Z$ functions being simple time-harmonics, the principle of forced oscillations allows us to conclude that the first of the generating terms in the oceans of the same periods and types as the terms in $V$, but of unknown amplitudes and phases. Now let $X \neq 0, Y, Z,$ $(X^2 + Y^2 + 2Z^2)$ be three functions having respectively similar forms to those of

$$X' = X - Y, \quad Y' = \left(1 - \epsilon^2\right)^2 X, \quad Z' = \left(1 - \epsilon^2\right)^2$$

but differing from them in that the argument of each of the simple time-harmonics has some angle subtracted from it, and that the term is multiplied by a numerical factor. Then, if $g$ be gravity and $h$ the height at the place of observation, we must have

$$h = \frac{r_0^2}{(1 - \epsilon^2)^2} \left[\left(\cos^2 \phi \cos \lambda (X' - 2Y' - 2Z') + (1 - \sin^2 \phi) (X' - 2Y' - 2Z')\right)\right]$$

The factor $r_0^2/g$ may be more conveniently written $3m/(2gR)$, where $R$ is the earth's mass. It has been shown that if the equilibrium theory of tides were fulfilled with water covering the whole earth, the numerical factors in the $X, Y, Z$ functions would each unity and the alterations of phase would be zero. The terms in $(X^2 + Y^2 + 2Z^2)$ require special consideration because of the function of the latitude being $\cos^2 \phi$, and the higher terms of the southern hemisphere. It is best to adopt a uniform system for the whole earth, and to regard high-tide and high-water as
TIDE

consentaneous in the equatorial belt, and of opposite meanings outside the critical latitudes. We have conceived the function always to be written \(\sin^k\), so that outside the critical latitudes high-tide is low-water. We may in continuing the development write the \(X, Y, Z\) functions in the form appropriate to the equilibrium theory with water covering the whole earth, for the actual case it is only then necessary to multiply by the reducing factor, and to subtract this from the already given unknown constants for each place, they would only occur in the development as symbols of quantities to be deduced from observation. It will be understood, therefore, that in the following schedules the "argument" is that part of the argument which is derived from theory, the true complex argument being the "argument" \(-\theta\), where \(\kappa\) is derived from observation.

Up to this point we have supposed the moon's longitude and the earth's position to be measurable from the "intersection" \(l\); but in order to pass to the ordinary astronomical formulæ we must measure the longitude and the earth's position from the vernal equinox. Hence we shall now write down the result in the form of a schedule; but we must first state the notation employed: \(e, \epsilon\) = eccentricities of lunar and solar orbits; \(l, \omega\) = obliquities of equator to lunar orbit and ecliptic; \(p, \psi\) = longitudes of lunar and solar positions; \(s, \delta\) = mean sun's and sun's mean longitudes; \(a, \varepsilon\) = hourly increments of \(s, \delta\); \(i\) = local mean solar time reduced to angle; \(\gamma - \pi = 15^\circ\) per hour; \(\lambda = \) latitude of place of observation; \(\xi, \eta\) = longitudes in lunar orbit, and R.A. of the intersection: \(N = \) longitude of moon's node; \(i\) = inclination of lunar orbit. The "speed" of any tide is defined as the rate of increase of its argument, and is expressible, therefore, as a linear function of \(\gamma, \eta, \xi, \delta, \varepsilon\); for we may neglect \(\sigma\) as being very small.

The following schedules, then, give the height of tide. The arrangement is as follows. First, there is a universal coefficient \(\frac{3}{2} \frac{M}{a} (\frac{2}{\pi})^5\), which multiplies every term of all the schedules. Secondly, there are general coefficients, one for each schedule, viz. \(\cos^2\) for the semi-diurnal terms, \(\sin 2\lambda\) for the diurnal, and \(\frac{1}{2} - \sin^2\lambda\) for the terms of long period. In each schedule the third column, headed "coefficient," gives the functions of \(J\) and \(\epsilon\). In the fourth column is given the mean semi-range of the corresponding term in numbers, which is approximately the value of the coefficient in the first column when \(I = \omega\), but we pass over the explanation of the mode of combination of the values. The fifth column contains argument linear functions of \(l, \omega, s, p, \psi, \xi, \eta\). In \(A, A, i, j\) \(\pm 2(\pi - r)\) and in \(A, ii, j\) \(\pm (\pi - r)\) are common to all the arguments. The arguments chosen for the coefficients of subsequent columns, respectively subsequent columns, are chosen so as to give the most convenient form for the coefficients. Lastly, the sixth is a column of speeds, being the hourly increases of the arguments in the preceding column, estimated in degrees per hour. It has been found practically convenient to determine the whole of those tables of hourly coefficients by an initial argument, arbitrarily chosen. In the first column we give a descriptive name for the tide, and in the second the arbitrarily chosen initial.

The schedule for the solar tides is drawn up in precisely the same manner, the only difference being that the coefficients are absolute constants. In order that the comparison of the importance of the solar tides with the lunar may be complete, the same universal coefficient \(\frac{3}{2} \frac{M}{a} (\frac{2}{\pi})^5\) is retained, and the special coefficient for each term is made to involve the factor \(\frac{1}{2}\). Here \(r, \frac{M}{a}, \frac{1}{2}\), \(\frac{1}{2}\), \(\frac{1}{2}\) being the sun's mass. With

\[
\frac{M}{a} = 81.5, \quad \frac{M}{a} = 46035 = 2^{-17226}
\]

To write down any term, take the universal coefficient, the general coefficient for the class of tides, the special coefficient and multiply by the cosine of the argument. The result, taken with the positive sign, is a term in the equilibrium tide, with water covering the whole earth. The translation to the actual case by the introduction of a factor and a delay of phase (to be derived from observation) has been already explained. The sum of all the terms is the complete expression for the height of tide at any place. It must be remarked that the coefficient of tides is here largely abridged, and that the reader who desires fuller information must refer to the Brit. Assoc. Report for 1853, or vol. i. of G. H. Darwin's Scientific Papers, or to Harris's Manual of Tides.

### A. Schedule of Lunar Tides.

Universal Coefficient = \(\frac{3}{2} \frac{M}{a} (\frac{2}{\pi})^5\).

#### i.—Semi-diurnal Tides; General Coefficient = \(\cos^2\lambda\).

<table>
<thead>
<tr>
<th>Description Name</th>
<th>Initial</th>
<th>Coefficient of</th>
<th>Argument</th>
<th>Speed in Degrees per M. A. Hour.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal</td>
<td>M</td>
<td>(\frac{3}{2} (l - \frac{1}{2} \cos^2 l))</td>
<td>(-\sin \epsilon)</td>
<td>28-9841045</td>
</tr>
<tr>
<td>Lunar-solar (lunar portion)</td>
<td>K</td>
<td>(\frac{3}{2} \cos^2 l)</td>
<td>(-\sin \epsilon)</td>
<td>30-0821375</td>
</tr>
<tr>
<td>Lunar-solar (lunar portion)</td>
<td>N</td>
<td>(\frac{3}{2} \cos^2 l)</td>
<td>(-\sin \epsilon)</td>
<td>28-4397260</td>
</tr>
</tbody>
</table>

#### ii.—Diurnal Tides; General Coefficient = \(\sin 2\lambda\).

<table>
<thead>
<tr>
<th>Description Name</th>
<th>Initial</th>
<th>Coefficient of</th>
<th>Argument</th>
<th>Speed in Degrees per M. A. Hour.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lunar diurnal</td>
<td>O</td>
<td>(\frac{3}{2} \sin I \cos I)</td>
<td>(-\sin \epsilon)</td>
<td>13-0403535</td>
</tr>
<tr>
<td>Lunar-solar (lunar portion)</td>
<td>K</td>
<td>(\frac{3}{2} \sin I \cos I)</td>
<td>(-\sin \epsilon)</td>
<td>15-0613686</td>
</tr>
<tr>
<td>Lunar-solar (lunar portion)</td>
<td>Q</td>
<td>(\frac{3}{2} \sin I \cos I)</td>
<td>(-\sin \epsilon)</td>
<td>13-3986009</td>
</tr>
</tbody>
</table>

#### iii.—Long Period Tides; General Coefficient = \(\frac{1}{2} - \sin^2\lambda\).

<table>
<thead>
<tr>
<th>Description Name</th>
<th>Initial</th>
<th>Coefficient of</th>
<th>Argument</th>
<th>Speed in Degrees per M. A. Hour.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change of mean of longitudes</td>
<td>O</td>
<td>(\frac{3}{2} \sin I \cos I)</td>
<td>(-\sin \epsilon)</td>
<td>19°54&quot;</td>
</tr>
</tbody>
</table>

### B. Schedule of Solar Tides.

Universal Coefficient = \(\frac{3}{2} \frac{M}{a} (\frac{2}{\pi})^5\).

#### i.—Semi-diurnal Tides; General Coefficient = \(\cos^2\lambda\).

<table>
<thead>
<tr>
<th>Description Name</th>
<th>Initial</th>
<th>Coefficient of</th>
<th>Argument</th>
<th>Speed in Degrees per M. A. Hour.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principal</td>
<td>S</td>
<td>(\frac{3}{2} (l - \frac{1}{2} \cos^2 l))</td>
<td>(-\sin \epsilon)</td>
<td>30-004999</td>
</tr>
<tr>
<td>Solar-solar (lunar portion)</td>
<td>K</td>
<td>(\frac{3}{2} (l - \frac{1}{2} \cos^2 l))</td>
<td>(-\sin \epsilon)</td>
<td>30-0821375</td>
</tr>
<tr>
<td>Solar-solar (lunar portion)</td>
<td>T</td>
<td>(\frac{3}{2} (l - \frac{1}{2} \cos^2 l))</td>
<td>(-\sin \epsilon)</td>
<td>20-859318</td>
</tr>
</tbody>
</table>

#### ii.—Diurnal Tides; General Coefficient = \(\sin 2\lambda\).

<table>
<thead>
<tr>
<th>Description Name</th>
<th>Initial</th>
<th>Coefficient of</th>
<th>Argument</th>
<th>Speed in Degrees per M. A. Hour.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar diurnal</td>
<td>F</td>
<td>(\frac{3}{2} \sin I \cos I)</td>
<td>(-\sin \epsilon)</td>
<td>15-0613686</td>
</tr>
<tr>
<td>Solar-solar (lunar portion)</td>
<td>K</td>
<td>(\frac{3}{2} \sin I \cos I)</td>
<td>(-\sin \epsilon)</td>
<td>15-0403535</td>
</tr>
</tbody>
</table>

#### iii.—Long Period Tides; General Coefficient = \(\frac{1}{2} - \sin^2\lambda\).

<table>
<thead>
<tr>
<th>Description Name</th>
<th>Initial</th>
<th>Coefficient of</th>
<th>Argument</th>
<th>Speed in Degrees per M. A. Hour.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-lunar</td>
<td>Ssa</td>
<td>(\frac{3}{2} (l - \frac{1}{2} \cos^2 l))</td>
<td>(-\sin \epsilon)</td>
<td>0-0821375</td>
</tr>
</tbody>
</table>

From the fourth columns we see that the coefficients in descending order of magnitude are \(M, K, K_1\) (both combined), \(S, K, K_1\) (lunar), \(N, P, K\) (solar) \(K_2\) (both combined), \(K_3\) (lunar), \(M_1, Q, K_3\) (solar). Ssa.

The tides which we omit from the schedules are relatively unimportant, but nevertheless commonly evaluated in accurate tidal work, viz. the following semi-diurnal tides: the smaller elliptic tide \(L\), the larger and smaller ejectional tides \(v, \lambda\), the variational tide \(\mu\). Also the following diurnal tides, viz. the smaller elliptic tide \(M\), a tide of speed \(\gamma - \beta - \theta\) called \(J\). Also amongst the tides of long period, the luni-solar fortightly called MSF.

The tides depending on the fourth power of the moon's parallax

\[4\text{The mean value of this coefficient is }\left(1 + \frac{1}{E^2}\right)\left(1 - \sin^2\epsilon\right) \approx 0.25,\] and the variable part is approximately \(1 - \frac{1}{E^2}\sin \omega \cos \omega \cos \epsilon = N - 0.0236\cos N.\]
TIDE
955

come out the same from each year's reductions. It is only
when the results are presented in such a form as this that it will be possible
to judge whether the harmonic analysis is yielding satisfactory results.
This method of presentation is also essential for the use of a tide-predicting machine
(see § 8).

We must now show how to determine $H$ and $\kappa$ from $R$ and $\gamma$. It
is obvious that
\[ H = -1883 \kappa + 1883 \gamma \]

and that
\[ \kappa = 1883 \kappa + 1883 \gamma \]

so that
\[ \kappa = \frac{1}{2} \gamma + \frac{1}{2} H \]

Thus the rule for the determination of $\kappa$ is: \textit{Add to the value of $\gamma$ the value of the argument $\alpha$ of the first day.}

The results of harmonic analysis are usually tabulated by giving
$H$ and $\kappa$ at the initial time and the results are then comparable
from year to year. 1 For the purpose of using the
tide-predicting machine the process of determining
$H$ and $\kappa$ from $R$ and $\gamma$ has simply to be reversed,
with the difference that the instant of time to which to refer
the argument is $\kappa$ of the first day of the new year, and we must
have note of the different values of $\kappa$ and $\gamma$ for the new year.

1. Tables may be computed for $\kappa$ and $\gamma$ for all longitudes of the tidal
node and for each kind of tide, and the mean longitudes of moon,
sun, and lunar perigee may be extracted from any ephemeris.

Thus when the mean semi-range $H$ and the retardation $\kappa$ of
any tidal factor is given in terms of the geocentric co-ordinate,
the tidal height of water above the datu at every mean solar
hour. The period chosen for analysis is about one year and the
first measurement corresponds to noon.

If $T$ be the period of any one of the diurnal tides, or the double
period of any one of the semi-diurnal tides, it approximates more
or less nearly to 24 solar hours, and if we divide it into 24 equal
parts, we find that the corresponding hourly tide will fall at all hours of any other special
day.

The final outcome is that we obtain the height of water at each
of the 24 T-hours of a T-day, freed from the influence of all the other
tides. We may see that it is thus possible to isolate the T-tide
when this has been done let $t$ denote T-time expressed in T-hours,
and let $n$ be $\frac{\pi}{2}$. Then we express the height $h$ as given by the
average process above indicated by the formula
\[ h = A_s + A_n \cos (n + 1883 \kappa) + A_n \cos (n - 1883 \gamma) \]

or $h = A_s + A_n \cos (n + \kappa) + A_n \cos (n - \gamma)$.

An actual numerical example of harmonic
analysis of tidal observations is given in the \textit{Admiralty Scientific Manual} (1886) in the article "Tides," or G. H. Darwin's \textit{Scientific Papers}, vol. i.

V.—SYNTHETIC METHOD
§ 29. On the Method and Notation.—The general nature of the
synthetic method has already been explained; we now propose
to show how the expressions for the tide may be developed from the
result as expressed in the harmonic notation. If it should be
desired to make a comparison of the results of tidal observation
as expressed in the synthetic method with those of the harmonic
method, or the converse, or to compute a tidal table from the
harmonic constants by reference to the moon's co-ordinates and parallelly to the analytical expressions founded on
a procedure indicated in the following sections are necessary.

In chapter iv. the mean semi-range and angle of retardation of
anomalous of each of the tides as a T-tide by $H$ and $\kappa$. We shall
here, however, require to introduce several of the $H$'s and $\kappa$'s into
the same expression, and they must therefore be distinguished
from one another. This may in general be done conveniently by
calling $H_m, \kappa_m$ will be taken to denote the $H$ and $\kappa$ of the tidal
node. This notation does not suit the $K_s$ and $K_t$ tides.

1 See, for example, a collection of results by Baird and Darwin, Proc. Roy. Soc. (1885), No. 239, and a more extensive one in Harris's \textit{Monthly Weather Review} (London, 1867).
3 See Darwin's \textit{Tides} for an account without mathematics.
and we shall therefore write $H^*$, $x^*$ for the semi-diurnal $K_h$ and $K_s$, $x^*$ for the diurnal $K_t$ tide. These two tides proceed according to the mean time and arise from the sun and moon tides, and the synthesis of the two parts of each is effected in the harmonic method, although that synthesis is not explained in chapter iv. It is now necessary to reverse this part of the method, in order to obtain a more complete one. We must therefore note that the ratio of the solar to the lunar part of the total $K_h$ tide is $0.683$; so that $0.683 H^*$ is the lunar portion of the total $K_h$. There will be no occasion to separate these portions of the tide, and we shall retain the synthesis which is effected in the harmonic method.

Mean Longitudes and Elements of the Planetary Nuclei

§ 30. Semi-Diurnal Tides.—The process adopted is to replace the mean longitudes and elements of the orbit in each term of the harmonic development of the schedules of § 25 by hour-angles, declinations, and parallaxes.

At the time 1 (mean solar time of port reduced to angle) let $\psi$ be the $K_h$, $R$, and $H$, and $\nu$ the longitude measured from the "intersection." These and other symbols when written with a subscript accent are to apply to the sun. Then $\varphi$ being the $R$, $A$, of the intersection, we have from the rightangled spherical triangle of which the sides are $l$, $a$, $r$ the relations

$$\tan (a-r) = \cos t \tan l, \quad \sin \delta = \sin l \sin \varphi$$

Now $s = \varphi$ is the $s$'s mean longitude measured from the intersection and $\varphi - r$ is the mean anomaly; hence approximately

$$s = \varphi - e \sin \varphi - \sin (\varphi - r)$$

From (49) and (50) we have approximately

$$\begin{align*}
a &= \frac{e^2}{2} (e - \cos \varphi) + e \sin \varphi - \sin (\varphi - r) \\
\nu &= \frac{e^2}{2} (e - \cos \varphi) + e \sin \varphi - \sin (\varphi - r)
\end{align*}$$

Next, if $h$ be the $\lambda$'s mean longitude, $1+h$ is the sidereal hour-angle, and

$$\varphi = \frac{1+h-s-r}{2}$$

Again, if we put

$$\begin{align*}
s &= \cos \delta = 1 - \sin \delta^2 \\
\cos \Delta &= \cos (s-r) \\
\sin \delta &= \cos \delta \sin \delta \\
\cos \Delta &= \cos (s-r)
\end{align*}$$

Obviously $\Delta$ is such a declination that $\sin \Delta$ is the mean value of $\sin \delta$ during a lunar month. Again, $F$ is the ratio of the $\varphi$'s parallax to her mean parallax, the equation to the ellipse described

$$\begin{align*}
\varphi &= \frac{1}{1+F} \varphi - e \sin \varphi - \sin (\varphi - r) \\
\varphi &= \frac{1}{1+F} \varphi - e \sin \varphi - \sin (\varphi - r)
\end{align*}$$

Now it appears in schedule A of § 25 that the arguments of all the lunar semi-diurnal tides are of the form $2(t-h-r) = 2(s-r) + 4n + \sigma$, and $a = e \sin \varphi$. From this, the arguments of such angles may be given by the relations (51), (52), (53) by Expressions in hour-angles, declinations and parallaxes. Also by means of (52) we may introduce $\Delta$ in place of $I$ in the coefficients of each term. An approximate formula for $\Delta$ is

$$\Delta = 1 + e \cos \varphi + \frac{e^2}{2} (e - \cos \varphi) + e \sin \varphi - \sin (\varphi - r)$$

and $\Delta = 1 + e \cos \varphi + \frac{e^2}{2} (e - \cos \varphi) + e \sin \varphi - \sin (\varphi - r)$. Obviously $\Delta$ is such a declination that $\sin \Delta$ is the mean value of $\sin \delta$ during a lunar month. Again, $F$ is the ratio of the $\varphi$'s parallax to her mean parallax, the equation to the ellipse described

$$\begin{align*}
\varphi &= \frac{1}{1+F} \varphi - e \sin \varphi - \sin (\varphi - r) \\
\varphi &= \frac{1}{1+F} \varphi - e \sin \varphi - \sin (\varphi - r)
\end{align*}$$

Reference to Moon's Transit.

Let us write them

$$\begin{align*}
M &= \frac{P \cos \theta}{\cos \delta} \\
M &= \frac{P \cos \theta}{\cos \delta}
\end{align*}$$

Then we find that the height $h^2$ of the complete lunar and solar semi-diurnal tides is represented by the expression

$$\begin{align*}
h^2 &= M \cos \theta \left(\psi + \mu\right) + M \cos \theta \left(\psi - \mu\right) \\
h^2 &= M \cos \theta \left(\psi + \mu\right) + M \cos \theta \left(\psi - \mu\right)
\end{align*}$$

The first of these is the lunar tide, and it will be observed that the height $\Delta$ depends on the angle of the moon's parallax at a time earlier than that of observation by the "age of the lunar parallactic inequality," and that it depends also on the angle of the moon's declination at a time earlier by the "age of the declination inequality of the moon, represented by the angle $\Delta$, also has a declinational inequality.

The second term is the solar tide, and it also has parallactic and declinational inequalities.

The formulae (53), (54) have been used in an example from the computation of a tide-table given in the Admiralty Scientific Manual (1889).

§ 31. Synthesis of Lunar and Solar Semi-Diurnal Tides.—Let $A$ be the excess of $\mu$'s over $Q$'s R.A., so that $A = q - a$,

$$\begin{align*}
\mu &= \frac{A + M \cos \theta (\psi + \mu) + M \cos \theta (\psi - \Delta)}{M} \\
\mu &= \frac{A + M \cos \theta (\psi + \mu) + M \cos \theta (\psi - \Delta)}{M}
\end{align*}$$

and $\mu = q + M \cos \theta (\psi + \mu) + M \cos \theta (\psi - \Delta)$.

The synthesis is then completed by writing $H \cos 2 (\theta - \psi) = M + M \cos 2 (\theta - \Delta)$, or

$$\begin{align*}
H &= M + M \cos 2 (\theta - \psi) - \mu - M \cos 2 (\theta - \Delta) \\
H &= M + M \cos 2 (\theta - \psi) - \mu - M \cos 2 (\theta - \Delta)
\end{align*}$$

The height $H$ of the sun is given in degrees, is the "interval" from the moon's transit to high water.

The formulae for $H$ and $\psi$ may be written

$$\begin{align*}
H &= \frac{M^2 + M \cos 2 (\theta - \psi) - \mu - M \cos 2 (\theta - \Delta)}{M} \\
H &= \frac{M^2 + M \cos 2 (\theta - \psi) - \mu - M \cos 2 (\theta - \Delta)}{M}
\end{align*}$$

Since $A$ goes through its period in a lunation, it follows that $H$ and $\psi$ have inequalities with a period of half a lunation.

These are called the "fortnightly inequalities in the height and interval.

Spring tide obviously occurs when $A = \mu - \mu$. Since the mean value of $\mu$ is $h$ (the difference of the mean longitudes), and since the mean value of $\mu$ and $\mu_0$ are $h$, $\mu$, it follows that the mean value of the period elapsing after full moon and change of moon up to spring tide is $(h - h)/2 (\eta - \eta)$. The association of spring tide with full and change is obvious, and a fiction has been adopted by which the tide is calculated in those configurations of the moon and sun, but takes some time to reach the port of observation. Accordingly $2 (\eta - \eta)/2 (\eta - \eta)$ has been called the "age of the tide." The average age is about 36 hours as far as observations have been made. The age of the tide appears not in general to differ very much from the ages of the declinational and parallactic inequalities.

The spring- and spring tide is found practically convenient not to use $A$, which is the difference of R.A.'s at the unknown time of high-water, but to refer the tide to $A$, the difference of R.A.'s at the time of the moon's transit. We have already remarked that $\phi (\eta - \eta)/2 (\eta - \eta)$ is the interval from transit to high-water, and hence at high-water

$$\begin{align*}
A &= \frac{A + \sin \Delta - \sin \Delta}{\cos \Delta - \cos \Delta} \phi \\
A &= \frac{A + \sin \Delta - \sin \Delta}{\cos \Delta - \cos \Delta} \phi
\end{align*}$$

As an approximation we may attribute to all the quantities in the second term their mean values, and we then have

$$\begin{align*}
A &= \frac{A + \sin \Delta - \sin \Delta}{\cos \Delta - \cos \Delta} \phi \\
A &= \frac{A + \sin \Delta - \sin \Delta}{\cos \Delta - \cos \Delta} \phi
\end{align*}$$

This approximate formula (61) may be used in computing from (59) the fortnightly inequality in the "height" and "interval." In this investigation we have supposed that the declinational and parallactic corrections are applied to the lunar and solar tides before they are synthesized; but it is obvious that the process may be reversed, and that we may find a table of the fortnightly inequality based on mean values $H_0$ and $H_1$ and afterwards apply corrections. This is the process usually adopted, but it is less exact. The labour of computing the fortnightly inequality, especially by graphical methods, is not great, and the plan here suggested seems preferable.

§ 32. Diurnal Tides.—These tides have not been usually treated.
with much completeness in the synthetic method. In the tide-
tables of the British Admiralty we find that the tides at some ports are ‘affected by diurnal inequality’; such a statement may be interpreted to mean that the time of high-water at that port is not the time of high-water at the same port at another time of the day. The information given in the so-called tide-table. The diurnal tides are indeed complex, and do not lend themselves easily to a complete synthesis. In the harmonic notation the three important tides are represented by the series

\[ T \approx \sum_{j} A_{j} \cos(j \omega t + \phi_{j}) \]

where \( T \) is the tide, \( A_{j} \) is the amplitude of the \( j \)-th harmonic, \( \omega \) is the angular frequency, and \( \phi_{j} \) is the phase angle. These equations represent a series of oscillations, with amplitudes, frequencies, and phases. The method of Laplace by taking into account all the observed tides, and not merely those appertaining to certain configurations. He divided the observations into a number of classes. First, the tides is divided into paroxysms, one for each month; then each paroxysm is divided into a number of semi-diurnal tides, and then into the diurnal tides. This method was followed in the treating of the tides of London, Brest, St Helena, Plymouth, Portsmouth and Sheerness. Whewell (Phil. Trans. 1834, seq.) did much to reduce Laplace's results to a mathematical form, and to extend the synthesis to include the introduction of graphical methods by means of curves. The method explained above is due to him. A review of Whewell's papers that they appear to be the best specimens of reduction of new observations that we have ever seen.

VI.—TIDAL DEFORMATION OF THE SOLID EARTH

§ 34. Elastic Tides.—The tide-generating potential varies as the square of the distance from the earth's centre, and the corresponding forces act at every point throughout its mass. No solid matter possesses the property of absolute rigidity, and we must therefore admit the probable existence of tidal elastic deformation of the solid earth. The problem of finding the state of strain of an elastic sphere under given conditions first was solved by G. Lamé; he made, however, but few physical deductions from his solution. An independent solution was found by Lord Kelvin, who drew some interesting conclusions concerning the phenomenon.

His problem, in as far as it is now material, is as follows. Let a sphere of radius \( a \) and density \( \varrho \) be made of an elastic material and limited by a rigid and rigidly fixed and rigidly fixed to the origin of the co-ordinates. This sphere is not considered as subject to forces due to a potential equal to \( r^{-2} \sin^2 \lambda \), where \( \lambda \) is latitude. Then it is required to find the strain of the sphere. We refer the reader to the original sources for the methods of solution applicable to spherical shells and to solid spheres. The investigation applies either to tidal or to rotational stresses. In the case of tides \( r^m \varrho a^3 \), \( m \) being the mass of the moon and distance, and in the case of rotation \( r^{-\varrho} \), \( \omega \) being the angular velocity about the polar axis. The equation to the surface is found to be

\[ r = \frac{a}{1 + \frac{2\varrho}{1 - \varrho} \left( 1 + \frac{\sin^2 \lambda}{1 + \frac{k^2}{1 - k^2}} \right) \Delta } \]

In most solids the bulk modulus is considerably larger than the rigidity modulus, and in this discussion it is sufficient to neglect \( k \) compared with \( \varrho \). With this approximation, the ellipticity of the surface becomes

\[ e = \frac{2\varrho}{1 - \varrho^2} \]

Now suppose the sphere to be endued with the power of gravitation, and write

\[ e = \frac{g}{1 + \frac{g}{1 + \frac{2\varrho}{1 - \varrho}} \left( 1 + \frac{\sin^2 \lambda}{1 + \frac{k^2}{1 - k^2}} \right) \Delta } \]

where \( g \) is gravity at the surface of the globe. Then, if there were no elasticity, the ellipticity would be given by \( e = r^2 \varrho \), and without gravitation by \( e = r^2 \varrho^2 \). And it may be proved in several ways that, gravity and elasticity co-operating,

\[ e = \frac{2\varrho}{1 - \varrho^2} \]

If \( \mu \) be the rigidity of steel, and if the globe have the size and mean density of the earth, \( r^2 = 2 \), and with the rigidity of glass \( r^2 = 1 \). Hence the ellipticity of an earth of steel under tide-generating forces would be \( \frac{1}{2} \) of that of a fluid earth, and the fraction for glass would be \( \frac{1}{2} \). If an ocean be superposed on the globe, the visible tide will be the excess of the fluid tide above the solid tide. Hence for steel the oceanic tide would be reduced to \( \frac{1}{2} \), and for glass to \( \frac{1}{0} \) of the tides on a rigid earth.

It is not possible in general to compute the tides of an ocean lying on an unyielding nucleus. But Laplace argued that friction would cause the tides of long period (§ 17) to conform to the equilibrium law, and thus be amenable to calculation. Acting on this belief, G. H. Darwin discussed the tides of long period as observed during the years 1833-1840, and found a simple relation between the tidal force as on an unyielding globe, indicating an elasticity equal to that of steel. Subsequently W. Schwedler repeated the calculation from 184 years of observation with nearly the same result. But as Laplace's approximation, to be used in (§ 37), the conclusion seems to be of doubtful validity. Yet subsequently Lord Rayleigh showed

that the existence in the ocean of continental barriers would have the same effect as that attributed by Laplace to friction, and thus help to explain the similar peculiarities of the tides of the two large oceans.

A wholly independent estimate derived from what is called the variability of the tide, the tides of an elastic planet, *mutatis mutandis*, that of the tides of a viscous spheroid. The reader who desires to know more of this subject and to obtain references to original memoirs may refer to C. G. Darwin.

VII.—TIDAL FRICTION

§ 35. Investigation of the Secular Effects of Tidal Friction.—We have indicated in general terms in § 9 that the theory of tidal friction leads to an interesting speculation as to the origin of the moon. We shall therefore investigate the theory mathematically in the complex of the earth as a planet, and one or more satellites moving in a circular orbit, and rotating about an axis perpendicular to that orbit. In order, however, to abridge the investigation we shall only consider the case where the planetary rotation is more rapid than the satellite.

Suppose an attractive particle or satellite of mass *m* to be moving in a circular orbit, with an angular velocity *ω*, round a planet of mass *M* and suppose the planet to be rotating about an axis perpendicular to the plane of the orbit, with an angular velocity *n*; suppose, also, the mass of the planet to be partially or wholly imperfectly elastic or viscous, or that there are oceans on the surface of the planet; then the attraction of the satellite on the planet by a spheroid moving in an orbit and rotating about an axis perpendicular to the plane of the orbit, and that motion must be subject to friction, or, in other words, there must be frictional tidal forces. The system must accordingly be losing energy by friction, and its configuration must change in such a way that its whole energy diminishes.

Such a system does not differ much from those of actual planets and satellites, and, therefore, the results deduced in this hypothetical case must agree pretty closely with the actual course of evolution, provided that time enough has been and will be given for such changes. Let *C* be the moment of inertia of the planet about its axis of rotation, *r* the distance of the satellite from the centre of the planet, *h* the resultant moment of momentum of the whole system, *e* the whole energy, both kinetic and potential, of the system. It is assumed that the figure of the planet and the distribution of its mass are such that the attraction of the satellite on the planet causes no couple about any axis perpendicular to that of rotation. A special system of units of mass, length and time will now be adopted such that the tidal forces can be reduced to their simplest forms. Let the unit of mass be *Mm/(M+m)*. Let the unit of length *γ* be a distance such that the moment of inertia of the planet about its axis of rotation may be equal to the moment of inertia of the planet and satellite, treated as particles, about an axis of inertia, when distant *γ* apart from another. This condition gives

\[ M \frac{M}{M+m} + m \frac{m}{M+m} = C; \]

Let the unit of time *e* be the time in which the satellite revolves through 57°3′ about the planet, when the satellite's radius vector is equal to *γ*. This system of units will be found to make the following functions each equal to unity, viz.

\[ \mu^2 M (M+m)^2, \mu Mm, \text{ and } C, \]

where *μ* is the attraction of the earth's mass about the earth and the earth's moment of inertia as 3/4\( M^2 \) (as is very nearly the case), it may easily be shown that the unit of mass is 3/4 of the earth's mass, the unit of length 5-26 earth's radii or 33,506 kilometres (20,807 miles), and the unit of time 2 hrs. 41 mins.

In these units the present angular velocity of the earth's diurnal rotation is expressed by 0-7044, and the angular velocity of a spheroid is equal to the angular velocity of the earth, the earth's moment of inertia is the earth's moment of inertia about an axis of inertia, and the earth's moment of inertia about an axis of inertia is the earth's moment of inertia about an axis of inertia, and the earth's moment of inertia about an axis of inertia is 3-384. Adding to this the rotational momentum of the earth, which is 0-704, we obtain 4-088 for the total moment of momentum of the moon and earth. The ratio of the orbital to the rotational momentum of the earth is 4-8, so that the total moment of momentum of the system would, but for the obliquity of the elliptic, be 5-80 times that of the earth's rotation. Again, the kinetic energy of orbital motion is

\[ \frac{1}{2} \frac{1}{2} \frac{M}{M+m} \omega^2 + \frac{1}{2} \frac{m}{M+m} \omega^2 = \frac{1}{2} \frac{Mm}{M+m} \omega^2 = \frac{1}{2} \gamma^2. \]

The kinetic energy of the planet's rotation is 1/2\( C \). The potential energy of the system is \(-\mu Mm/r\). Adding the three energies together, and transforming into the special units, we have

\[ 2e = n^2 - 1/r. \]

Now let

\[ x = r/E. \]

It will be noticed that *x*, the moment of momentum of orbital motion is equal to the square root of the satellite's distance from the planet. Then equations (62) and (63) become

\[ h = y + x \]

\[ y^2 - 1/e^2 = (h - x)^2 - 1/e^2 \]

(64) is the equation of conservation of moment of momentum, or, ably, the equation of momentum; (65) is the equation of moment of momentum.

Now consider a system started with given positive moment of momentum *h*; and we have all sorts of ways in which it may be started. If the two rotations be of opposite kinds, it is clear that we may start the system with any amount of energy, however great, but the true maxima and minima of energy capable with the given moment of momentum determined by *h* / \(1/2 C\) = 0, or

\[ x^2 - h^2 + 1 = 0. \]

We shall presently see that this quartic has either two real roots and two imaginary, or all imaginary roots. The real roots may be derived from the equation for the satellite may move round the planet so that the planet shall always show the same face to the fact, that they move as parts of one rigid body. The condition is simply that the satellite's orbital angular velocity *ω* = the planet's angular velocity of rotation, or *Y* = 1/\(k^2\), since *π* and \(r = x - y \). By substituting this value of *Y* in the equation of momentum (64), we get as before

\[ x^2 - h^2 + 1 = 0. \]

At present we have only obtained one result, viz. that, if with given moment of momentum it is possible to set the satellite and planet moving as a rigid body, it is possible to do so in two ways, and that these two ways require a maximum amount of energy and the other a minimum; from this it is clear that one must be in general rotation with the satellite near the planet and the other a slow one with the satellite remote from the planet. Of the three equations (64), (65) and (66) is the equation of momentum, (68) that of energy, and (69) may be called the equation of rigidity, for it indicates that the two bodies move as though parts of one rigid body.

To illustrate these equations geometrically, we may consider a mass *x*, which is fixed to the axis of revolution, and a mass *y*, which is the moment of momentum of the planet's rotation, so that the axis of *y* may be called the axis of rotational momentum. For (68) we may take as ordinate *Y*, which is the energy of the system, so that the axis of *y* may be called the axis of energy. Then, as it will be convenient to exhibit all three curves in the same figure, with a parallel axis of *x*, we must have the axis of energy identical with that of rotational momentum. It will not be necessary to consider the motion when the moment of momentum is negative, because this would only be equivalent to reversing all the rotations, and is therefore to be taken as essentially positive. The line of momentum whose equation is (65) is a straight line inclined at 45° to one axis, having positive values on both axes. The curve of rigidity whose equation is (69) is clearly of the same nature as a rectangular hyperbola, but it has a much more rapid rate of approach to the axis of orbital momentum than to that of rotational momentum. The intersections (64) and (65) and (66) may be as ordinates to the *y* the ordinate of 0 on the axis of rotational, and a straight line parallel to the *y* through the origin. Then, since *Y* = *h* - *x*, the intersection which is the result of the integration with the satellite is remote from the planet; the other gives the configuration where the satellite is closer to the planet. We have already learnt that these two correspond respectively to minimum and maximum energy. When *x* is very large the equation to the curve is *y* = *(h - x)*, which is the equation to a parabola with a vertical axis parallel to *y* and distant *h* from the origin, so that the axis of the parabola passes through the intersection of the line of momentum
with the axis of orbital momentum. When $z$ is very small, the equation becomes $Y = e^z$. Hence the axis of $Y$ is asymptotic on both sides to the curve of energy. If the line of momentum intersects the curve of rigidity, the curve of energy has a maximum vertically underneath the point of intersection near the origin and a minimum underneath the point more remote. But if there are no intersections, it has no maximum or minimum.

Fig. 8 shows these curves when drawn to scale for the case of the earth and moon. The points $a$ and $b$, which are the maximum and minimum of the curve of energy, are supposed to be on the same ordinates as $A$ and $B$, the intersections of the curv of rigidity and the line of momentum. The intersection of the line of momentum with the axis of orbital momentum is denoted by $D$, but in a figure of this size it necessarily remains indistinguishable from $B$. As the zero of energy is quite arbitrary the origin of the axes of curv and $O$ and the radii corresponding to the points $a$ and $b$ prevent the two curves from crossing one another in a confusing manner.

On account of the limitation imposed we neglect the case where the quartic has no real roots. Every point of the line of momentum gives by its abscissa and ordinate the square root of the satellite's distance and the rotation of the planet, and the ordinate of the energy curve gives the energy corresponding to each distance of the satellite. Part of the figure has no physical meaning, for it is impossible for the satellite to move round the planet at a distance less than the sum of the radii of the planet and satellite. For example, the moon's diameter being about 2200 m. and the earth's about 8000 m., the moon could not in reality be on the line $o$.

The actual value of $k$ for the moon and earth is about 4; hence, if the moon-earth system were started with less than $\frac{1}{k}$ of its actual moment of momentum, it would not be possible for the two bodies to move so that the earth would always show the same face to the moon. Again, if we travel along the line of momentum, there must be some point for which $y^2 = 1$, and this is a maximum when $z = \frac{h}{k}$ and the maximum number of days in the month $n = \frac{2\pi}{\sqrt{k/2}}$.

Maximum

$$n = \frac{2\pi}{\sqrt{k/2}}$$

$\text{Maximum Number of Days in Month.}$

$$h^2 = 4/4^2, or k = 4/4 \approx 1.75.$$ The actual value of $k$ for the moon and earth is about 4; hence, if the moon-earth system were started with less than $\frac{1}{k}$ of its actual moment of momentum, it would not be possible for the two bodies to move so that the earth would always show the same face to the moon. Again, if we travel along the line of momentum, there must be some point for which $y^2 = 1$, and this is a maximum when $z = \frac{h}{k}$ and the maximum number of days in the month $n = \frac{2\pi}{\sqrt{k/2}}$.

Discussion of Figure.

We will now consider the physical meaning of the figure. It is seen that the energy of the moon-earth system corresponds to a positive rotation. Now imagine two points with the same abscissa, one on the momentum line and the other on the energy curve, and suppose the one on the energy curve were to move along the momentum line and the energy must degrade, however the two points are set initially on the point on the energy curve must always slide down a slope, carrying with it the other point. Looking at the figure, we see that there are four slopes in the energy curve, two running down to the planet and two down to the minimum. There are no line of momentum curves except the nearest one of Mars. The satellite was placed in the condition $A$—that is to say, moving rapidly On a planet which is a satellite—the condition is clearly dynamically unstable, for the least disturbance will determine whether the system shall degrade down the slopes $ac$ or $a$, that is to say, whether it falls into or recedes from the planet. If the equilibrium is broken down by the satellite receding, the recession will go on until the system has reached the state corresponding to $B$. It is clear that, if the intersection of the edge of rigidity of the system is identical with the point A, which indicates that the satellite is just touching the planet, then the two bodies are in effect parts of a single body in an unstable configuration. If, therefore, the moon was originally part of the earth and moon, there is no curve drawn to scale to represent the earth and moon, there is so close an approach between the edges of the shaded band and the intersection of the line of momentum and curve of rigidity that it would be impossible to distinguish them. Hence, there seems a probability that the two bodies once formed parts of a single one, which broke up in consequence of some kind of instability. This conclusion is confirmed by the author of the paper in the "Proc. of a Viscous Spheroid," already referred to, and subsequent papers, in the Phil. Trans. 1 § 50. Effects of Tidal Friction on the Elements of the Moon's Orbit.

"The effects of the tides on the orbit of the earth and the satellite at the present time are so slight as to be unimportant; the limits of the present article to discuss completely the effects of tidal friction; we therefore confine ourselves to certain general considerations which throw light on the nature of those effects. We have in the preceding section supposed that the planet's axis is perpendicular to the orbit of the satellite, and that the latter is circular; we shall now suppose the orbit to be oblate to the equator and the satellite to be that of the earth, and the satellite the moon. The complete investigation was carried out on the hypothesis that the planet was a viscous spheroid, because this was the only theory of frictionally resisted systems that had been proposed. We may say, then, that practically the same for any system of frictionally resisted tides, we shall speak below of the planet or earth as a viscous body. We shall show that if the tidal retardation is small the obliquity of the ecliptic increases, the earth's rotation is retarded, and the moon's distance and periodic time are increased.

Obliquity of the Ecliptic Increases.

The expressions of the tidal force, the moon's orbit and the earth's rotation are given in the paper. The dotted lines indicate the energy of various parts of the figure which are below the plane of the paper. If the moon were cut in two and one half retained at the place of the moon and the other transported to a point diametrically opposite to the first half with reference to the earth, there would be no material change in the tide-generating forces. It is easy to verify this statement by reference to § 11. These two halves may be described as moon and anti-moon, and suppose a satellite to be placed between them. Let $M'$ be the directions of the moon and anti-moon to the terrestrial sphere. If the fluid in which the tides are raised were perfectly frictionless, or if the earth were a perfect fluid or perfectly elastic, the apices of the tidal spheroid would be at $M$ and $M'$. If, however, there is internal friction, due to any sort of viscosity, the tides will lag, and we may suppose the tidal apices to be at $T$ and $T'$. Now suppose the tidal protuberances to be replaced by two equal and opposite circles at $T$ and $T'$, which are instantaneously rigidly connected with the earth. Then the attraction of the moon on $T$ is greater.

Footnotes:

1. For further consideration of this subject see a series of papers by G. H. Darwin in Proc. of a Viscous Spheroid. 1879. Trans. of the Royal Society from 1879, vol. i. of Thomson and Tal' i's Nat. Phil. (1883) or Scientific Papers, vol. ii.

2. These explanations, together with other remarks, are to be found in the abstracts of G. H. Darwin's memoirs in Proc. Roy. Soc., 1880.
than on $T'$, and that of the anti-moon on $T'$ is greater than on $T$. The result of these forces is clearly a pair of forces acting on the earth in the direction TM, T'M'. These forces cause a couple about the axis in the equator, which lies in the same meridian as the moon and anti-moon and in the equator and the ecliptic. But the couple is curved arrows at L'L'. If the effects of this couple be compounded with the existing rotation of the earth according to the principle of action and reaction, then the earth is forced to move northwards to approach M'. Hence, supposing the moon to move in the ecliptic, the inclination of the earth's axis to the ecliptic diminishes, or the obliquity increases. Next the forces TM, T'M' clearly produce precession, as in the simple case. This precession is the one recognized by the earth's polar axis, which tends to retard the diurnal rotation.

This general explanation remains a fair representation of the state of the case so long as the different harmonic constituents of the precession are not different from the different modes of retardation; and this is the case so long as the viscosity is not great. The rigorous result for a viscous planet shows that in general the obliquity is constant, and does not vary with the period of rotation of the planet, the obliquity increases, and vice versa. Hence, zero obliquity is only dynamically stable when the period of rotation of the satellite is less than two periods of the planet's rotation.

It is possible, by similar considerations, to obtain some insight into the effect which tidal friction must have on the planet of the lunar orbit, but as the subject is somewhat complex we shall pass over this tied in with the necessary, but not the said explanation. It must suffice to say that in general the inclination of the lunar orbit must diminish. Now let us consider the reposition of a satellite in the precessional motion of the moon, which has a periodic time which is long compared with the period of rotation of the planet; and suppose that frictional tides are raised in the planet. The major axis of the tidal spheroid is now perpendicular to the axis of the satellite, and the TIDE

Earth and Moon Subject of Investigation.

The Moon.

The Earth and Lunar Orbit.

The Theory of Plastic Sufficient Lapse of Solids.

The Theory of Sufficient Lapse of Solids. 1

Distortion of Plastic Planet.

87.—Cosmogonic Speculations Founded on Tidal Friction.

§ 57. History of the Earth and Moon.—We shall not attempt to discuss the mathematical methods by which the complete history of a planet, attended by one or more satellites, is to be traced from the laws indicated in the preceding sections show that there is such a problem, and that it may be solved, and we refer to G. H. Darwin's paper entitled "The Earth and the Moon," 1879. It may be interesting, however, to give the various results of the investigation of a sketch of the possible evolution of the earth and moon, followed by remarks on the other planetary systems and on the solar system as a whole.

We begin with a planet not very much more than 8,000 m. in diameter, and probably partly solid, partly fluid, and partly gaseous. It is rotating about an axis inclined at about 11° or 12° to the normal equator. Suppose that this planet is subject to forces of rotation, which is revolving about the sun with a period not much shorter than our present year. The rapidity of the planet's rotation causes so great a compression of its figure that it cannot continue to exist in an ellipsoidal form with stability; or else it is so nearly unstable that complete instability is induced by the solar tides. The planet then separates into two masses, the larger of which becomes the earth, and the smaller mass becomes more or less conglomérated and finally fused into a spheroid, perhaps in consequence of impacts between its constituent meteorites, which were once part of the prævalent planet. Up to this point we have not attempted to define the mode of separation, or to say whether the moon was initially a chain of asteroids. An investigation of the conditions of instability in such a case surpasses the powers of the mathematician. We have now the earth and moon nearly in contact with one another, and rotating nearly as though they were one body, and the solar tide, which was the subject of dynamic investigation. As the two masses are not rigid, the attraction of each does not act upon the other; and they do not move rigorously with the same periodic time, each raises a tide in the other. Also the sun raises tides in both. In consequence of the frictional resistance to these tidal motions, such a system is dynamically unstable. If the moon and moved orbitally a little faster than the earth rotated, she must have fallen back into the earth; thus the existence of the moon compels us to believe that the equilibrium broke down by the moon revolving orbitally a little slower than the earth, and the increase of the tangential motion of the moon system the moon was conglomérated into a spheroidal form, and acquired a rotation about an axis nearly parallel to that of the earth.

The axial rotation of the moon is retarded by the attraction of the earth on the tides raised in the moon, and this retardation takes place at a far greater rate than the similar retardation of the earth of the rotation. As soon as the moon rotates around its axis with the angular velocity with which she revolves in her orbit, the position of her axis of rotation (parallel with the earth's axis) becomes dynamically unstable. The obliquity of the lunar equator to the plane of the moon's orbit increases a maximum, and then diminishes. Meanwhile the lunar axial rotation is being reduced towards identity with the orbit rotation. Finally, her equator is nearly coincident with the plane of the orbit, and the tides cease. By the history of the rates into a permanent ellipiticity of the lunar equator, causes her always to show the same face to the earth. All the must have taken place early in the history of the earth, to which we now return. At first the moon is identical with the day, and as both these increase in length the lunar orbit will retain its circular form until the month is equal to 1° days. From that time the orbit begins to eccentric, and the eccentricity increases thereafter up to its present magnitude. The plane of the lunar orbit is at first practically identical with the earth's equator, but as the moon recedes from the earth less of the perigees are visible to the observer on the earth, and they shall not attempt to trace the complex changes by which the plane of the lunar orbit is affected. It must suffice to say that the present small inclination of the lunar orbit to the ecliptic accords with the supposed neglect.

As soon as the earth rotates with twice the angular velocity with which the moon revolves in her orbit, a new instability sets in. The moon is then about twelve of our present hours, and the day above six such hours in length. The inclination of the equator to the ecliptic now begins to increase and continues to do so until finally it reached its present value of 23°. All these changes continue, and no new phase now supervenes, and at length we have the system in its present configuration. The minimum time in which the changes from first to last can have taken place is 54,000,000 years. There are other collateral results which must arise from a supposed principle of possibility of the history of the earth's moon, and for this course of evolution the earth's mass must have suffered a screwing motion, so that the solar regions have allowed a little from west to east relatively to the earth-equator. This affords a possible explanation of the north and south trend of our great continents. The whole of this argument reposes on the imperfection of solids and on the adhesion of the moon to its original place as a cause. Thus of changes of the kind here discussed must be going on, and must have gone on in the past. And for this history of the earth and moon to be true throughout, it is necessary that there should not be an intrinsic gravity, and that there is not enough matter diffused through space materially to resist the motions of the moon and effects of the sun, of 54,000,000 years. It seems hardly too much to say that, given these two postulates, and the existence of a

1 See criticism, by Noll, Genesis of Moon (Melbourne, 1885); also Nature (Feb. 18, 1886).
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The primeval planet such as that above described, a system would necessarily be developed which would bear a strong resemblance to its own. The long period of the moon was deferred until a late epoch in the history of the terrestrial mass, the mass of the moon relatively to the earth would be likely to differ from the mass of other satellites which may have their planet in the solar system, and this must be almost completed before the genesis of the satellite, tidal friction will thereafter be the great cause of change in the system; and thus the hypothesis that it is the sole cause of change will give an apparent explanation of the motion of the terrestrial satellite at any subsequent time. We have already seen that the theory that tidal friction has been the ruling power in the evolution of the earth, and moon co-ordinates the present motions of the two bodies. If our hypothesis is correct, then it would be impossible for the separate existence as a satellite; and the initial configuration of the two bodies is such that we are led to believe that the moon is a primeval earth detached by rapid rotation or other causes.

Let us now turn to the other planetary sub-systems. The satellites of the larger planets revolve with short periodic times; for the smallness of their masses would have prevented tidal friction from being a very efficient cause of change in the dimensions of their orbits, and the largeness of the planet’s masses would have caused them to proceed slowly in their evolution. The satellites of Mars present one of the most remarkable features in the solar system, for, whereas Mars rotates in 24h. 37m., Deimos has a period of 30h. 18m., and Phobos of only 7h. 39m.

The theory of tidal friction would explain the shortness of the period of one of these of Phobos and their ellipticity of the rotation of the planet, or the that the dimensions of their own orbits have been much changed.

We may say, that given the tidal friction on a contracting planetary mass, we have been led to assign a cause for the observed distribution of satellites in the solar system, and this again has itself afforded an explanation of how it happened that the moon so originated that the tidal friction of the lunar tides in the earth should have been able to exercise so large an influence. We have endeavoured not only to set forth the influence which tidal friction may have, and probably has had in the history of the system, if sufficient time be granted, but also to point out what effects it cannot have produced. These investigations afford no grounds for the rejection of theories more recently proposed; but, on the other hand, an elimination of explanations of considerable importance. Tidal friction is a cause of change of which Laplace’s theory took no account; and, although the discovery of radio-activity and the consequent remarkable advances in physics throw grave doubt on all such arguments, and we believe that it is still beyond our powers to assign definite numerical limits to the age of the solar system.

Laplace (Principes de la Mécanique Céleste; vol. ii. (1910) Capture Theory) rejects the applicability of tidal friction to the cosmogony of the solar system, and argues that the satellites were primitively wandering bodies and were captured by the planet. This position has been considered by Dr See to be a necessary result of the presence in space of a resisting medium; but the present writer does not feel convinced by the arguments adduced.

(G. H. D.)

TIDORE or Tidor, an island of the Malay Archipelago, off the W. coast of Halmahera, S. of Ternate. It is nearly circular and has an area of about 30 sq. m. Several quiescent volcanic peaks, reaching 750 ft., occupy most of the island, and are covered with forests. The capital, Tidore, on the east coast, is a walled town and a seat of a sultan tributary to the Dutch in

1 A Review of this and of cognate subjects is contained in G. H. Darwin’s presidential address to the Brit. Assoc. in 1905.

2 Thomson and Tait’s Nat. Phil., &c. E; Nature (Jan. 27, 1887); Wolf, Théories cosmogoniques (1886).

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and of a Dutch controleur (commissioner or agent). By an agreement of 1879 the sultan exercises authority over some parts of Halmahera, the Papuan Islands, the western half of New Guinea and the islands in Godlind Gulf. The sultanate is included in the residency of Teine (Ternate). The population of Malaita, Tana and Malakula in religion, is about 8000. They live by agriculture (cotton, tobacco, nutmegs, etc.) and fishing.

**TIECK, JOHANN LUDWIG** (1772–1833), German poet, novelist and critic, was born in Berlin on the 31st of May 1773, his father being a rope-maker. He was educated at the Friedrich-Werdensche Gymnasium, and at the universities of Halle, Göttingen and Erlangen. At Göttingen Shakespeare and the Elizabethan drama were the chief subjects of his study. In 1794 he returned to Berlin, resolved to make a living by his pen. He contributed to a number of periodicals (1795–1798) to the series of Straußfelder, published by the bookseller C. F. Nicolai and originally edited by J. K. A. Musius, and wrote *Abdallah* (1796) and a novel in letters, *William Lovell* (3 vols. 1795–1796). These works are, however, immature and sensational in tone. Tieck’s transition to romanticism is to be seen in the series of plays and stories published under the title *Volksmärchen von Peter Lehrbrec* (3 vols. 1797), a collection which contains the admirable fairy-tale *Der blonde Eckbert*, and the witty dramatic satire on Berlin literary taste, *Der Bildner* (1797). Tieck’s friendship with W. H. Hackenroeder (1777–1798), he planned the novel *Franz Sternbolds Wanderungen* (vols. i–ii. 1798), which, with Hackenroeder’s *Hersenergis- sungen* (1798), was the first expression of the romantic enthusiasm for old German art. In 1798 Tieck married and in the following year settled in Jena, where he, the two brothers Schlegel and Novalis were the leaders of the new Romantic school. His writings between 1798 and 1804 include the satirical drama, *Prinz Zerzub* (1799), and *Romantische Dichtungen* (2 vols. 1799–1800). The latter contains Tieck’s most ambitious poetic experiments, like *Leichte Übung in die Natur* (1799) and *Leben und Tod des kleinen Rotkäppchens*, which were followed in 1804 by the remarkable “comedy” in two parts, *Kaiser Oktavius*. These dramas, in which Tieck’s poetic powers are to be seen at their best, are typical plays of the first Romantic school; although formless, and destitute of dramatic qualities, they show the influence of both Calderon and Shakespeare. *Kaiser Oktavius* is a poetic glorification of the middle ages.

In 1801 Tieck went to Dresden, then lived for a time near Frankfort-on-the-Oder, and spent many months in Italy. In 1803 he published a translation of *Menandros*, and the following year, a translation of *Phantasus*. In this collection he published the stories *Der Kunen- burg, Die Elfen, Der Pokal*, and the dramatic fairy tale, *Fortuna*. In 1817 Tieck visited England in order to collect materials for a work on Shakespeare (unfortunately never finished) and in 1819 he settled permanently in Dresden; from 1825 on he was literary adviser to the Court Theatre, and his semi-public readings from the dramatic poets gave him a wide popularity which extended far beyond the Saxon capital. The new series of short stories which he began to publish in 1822 also won him a wide popularity. Notable among these are *Die Gemälde, Die Reisenden, Die Verlobung, Des Lebens Überfluss*. More ambitious and on a wider canvas are the historical or semi-historical novels, *Dichter- leben* (1826), *Der Aufruhr in den Cevennen* (1826, unfinished), *Der Tod des Dichters* (1834); *Der junge Tischlermeister* (1836; but begun in 1811) is an excellent story written under the influence of Goethe’s *Wilhelm Meister*; *Vittoria Accorambona* (1840), in the style of the French Romanticism, shows a falling off. In later years Tieck carried on a varied literary activity as critic (Dramaturgische Blätter, 2 vols. 1825–1826; Kritische Schriften, 2 vols., 1848; he also edited the translation of Shakespeare by A. W. Schlegel, who was assisted by Tieck’s daughter Dorothea (1799–1841) and by Graf Wolf Heinrich Baudissin (1789–1858); Shakespeare’s *Vorschule* (2 vols., 1825–1826); the works of H. von Kleist (1826) and of J. M. R. Lenz (1828). In 1841 Friedrich Wilhelm IV. of Prussia invited him to Berlin where he enjoyed a pension for his remaining years. He died on the 28th of April 1853.

Tieck’s importance lay rather in the readiness with which he adapted himself to the new ideas which arose at the close of the 18th century, than in any conspicuous originality or genius. His importance as an immediate force in German poetry is restricted to his early period. In later years it was as the helpful friend and adviser of others, or as the well-read critic of wide sympathies, that Tieck distinguished himself.

Tieck’s *Schriften* appeared in 20 vols. (1828–1846), and his *Gesammelte Werke* in 12 (1822–1854). Nachgelassene Schriften were published in 2 vols. in 1855. There are several modern editions—*Ausgewählte Werke* by H. Wehl (8 vols., 1886–1888); by J. Minor (in Kirschner’s *Deutsche Nationalliteratur*, 144, 2 vols., 1883); by G. Kies (with an excellent biography, 3 vols., 1892), and G. Wittkowski (4 vols., 1903). *The Elves and The Cabinet* were translated by Carlyle in *German Romance* (1827), *The Pictures* and *The Betrothal* by Bishop Thirlwall (1829). A translation of *Vittoria Accorambona* was published in 1845. Tieck’s *Letters* have not yet been collected, but *Briefe an Tieck* were published in 4 vols. by K. von Hostel in 1864. See for Tieck’s earlier life R. Köpke, *Ludwig Tieck* (1851), and *Tieck: Erinnerungen* (2 vols., 1871); also A. Stern, *Ludwig Tieck in Dresden* (Zur Literatur der Gegenwart, 1876); J. Minor, *Tieck als Nationaldichter* (1884); B. Steiner, *L. Tieck und die Volkskabare* (1893); H. Rautenstrauch, *Tieck als Dramaturg* (1897); W. Miessler, *Tiecks Lyrik* (1902).

**TIEDEMANN, FRIEDRICH** (1781–1861), German anatomist and physiologist, eldest son of Dietrich Tiedemann (1748–1803), a philosopher and psychologist of considerable repute, was born at Cassel on the 23rd of August 1781. He graduated in medicine at Marburg in 1804, but soon abandoned practice. He devoted himself to the study of natural science, and, betaking himself to Paris, became an ardent follower of Baron Cuvier. On his return to Germany he maintained the claims of patient and sober anatomical research against the prevalent speculations of the school of Lorenz Oken, whose foremost antagonist he was long reckoned. His remarkable studies of the development of the human brain, as correlated with his father’s studies on the development of intelligence, deserve mention. He spent most of his life as professor of anatomy and physiology at Heidelberg, a position to which he was appointed in 1816, after having filled the chair of anatomy and zoology for ten years at Landsluth, and died at Munich on the 22nd of January 1861.

**Tiel, a town in the province of Gelderland, Holland, on the right bank of the Waal (here crossed by a pontoon bridge), 25 m. by rail west of Nijmegen. Pop. (1900), 10,788. It possesses fine streets and open places, but of its fortifications the Kleiberg Gate (1647) alone remains. The principal buildings are St. Martin’s church (15th century), the town hall, court-house and the historical castle of the family of van Arkel. In 1892 a harbour was built, but the shipping of Tiel is now chiefly confined to craft for inland navigation. It carries on a flourishing trade, especially in fruit, and is an important market for horses and cattle. It also manufactures agricultural implements and makes fine flour.

Five miles W.N.W. of Tiel is the small town of Buren, which contains some interesting old houses and is an important market for horses. Buren was the seat of an independent lordship which is mentioned as early as 1152. In later times it was held in fief, first from the dukes of Brabant, then from the dukes of Gelderland. In 1492 the emperor Charles V. raised it to a countship, and in 1551 it passed by marriage to Prince William of Orange Nassau. The title is now sometimes used by the royal family of the Netherlands when travelling inconspicuously. The castle was destroyed in the beginning of the 19th century, and the site of it is now marked by the park on the west side of the town. It contained not less than 170 apartments and was memorable for the imprisonment within its walls of Arnold duke of Gelderland (d. 1473), and as the birthplace of Philip William of Orange in 1544.
TIELE—TIEPOLO

TIELE, CORNELIS PETRUS (1830-1902), Dutch theologian and scholar, was born at Leiden on the 16th of December 1830. He was educated at Amsterdam, first studying at the Atheneum Illustre, as the communal high school of the capital was then named, and afterwards at the seminary of the Remonstrant Brotherhood. He was destined for the pastorate in his own brotherhood. After steadily, declining for a considerable period, this had increased its influence in the second half of the 19th century by winning the interests of the author, in the History of Methodists, which had caused many of the liberal clergy among the Lutherans and Calvinists to go over to the Remonstrants. Tiele certainly had liberal religious views himself, which he early enunciated from the pulpit, as Remonstrant pastor of Moor-drecht (1853) and at Rotterdam (1856). Upon the removal of the seminary of the brotherhood from Amsterdam to Leiden in 1873, Tiele was appointed one of its leading professors. In 1877 followed his appointment at the university of Leiden as professor of the history of religions, a chair specially created for him. Of his many learned works, the Verkeerdeschis van de egyptische en mesopotamische Godsdiensten (1872), and the Geschiedenis van den Godsdienst (1876; new ed. 1891), have been translated into English, the former by James Ballingall (1887-1882), the latter by J. Estlin Carpenter (1877) under the title "Outlines of the History of Religion" (French translation, 1885; German translation, 1893). A French translation of the Comparative History was published in 1882. Other works by Tiele are: De Godsdienst van Zarathustra, van het Ontstaan in Bokhri, tot den Val van het Oud-Persische Rijk (1864) a work now embodied, but much enlarged and improved by the latest research. In 1881 he published the History of Religions (vol. ii, part ii, Amsterdam, 1901), a part which appeared only a short time before the author's death; De Vrucht der Assyrialogie voor de vergelijkende geschiedenis der Godsdiensten (1877; German ed., 1878); Babylonisch-assyrische Geschiede (two parts, Leipzig, 1886-1888); Western Asia, according to the most Recent Discoveries (London, 1894). He was also the writer of the article "Religions" in the 9th edition of the Ency. Brit. A volume of Tiele's sermons appeared in 1865, and a collection of his poems in 1863. He also edited (1866) the poems of Petrus Augustus de Géneset. Tiele was best known for his Outlines by his Outlines and the Gifford Lectures "On the Elements of the Science of Religion," appearing in 1866-1868 at Edinburgh University. They appeared simultaneously in Dutch at Amsterdam, in English in London and Edinburgh (1897-1899, 2 vols.). Edinburgh University in 1900 conferred upon Tiele the degree of D.D. honoris causa, an honour bestowed upon him previously by the universities of Dublin and Bologna. He was also a fellow of at least fifteen learned societies in Holland, Belgium, France, Germany, Italy, Great Britain and the United States. He died on the 11th of January 1902. In 1901 he had resigned his professorship at Leiden University. Tiele's zeal and power for work were as extraordinary as his vast knowledge of ancient languages, peoples and religions, upon which his researches, according to F. Max Müller, have shed a new and vivid light. With Abraham Kuenen and J. H. Scholten, amongst others, he founded the "Leiden School" of modern theology. From 1867 he assisted A. Kuenen, A. D. Loman and L. W. Rauwenhoven editing the Theologisch Tijdschrift.

His brother PIETER ANTON TIELE (1834-1888) acted for many years as the librarian of Utrecht University, and distinguished himself by his bibliographical studies, more especially by his several works on the history of colonization in Asia. Among these the most noteworthy are: De Opkomst van het nederlandsch Genoot in Oost-Indië (1886); De Vestiging der Portugeseen, in Indie (1875), and other books on the early Portuguese colonization in the Malay Archipelago.

TIENSTINS, the largest commercial city in Chih-li, the metropolitan province of China. Pop. (1907), about 750,000. It is situated at the junction of the Peiho and the Hun-ho, which is connected by the grand Canal with the Yangtze-kiang. It is a prefectural city, and has, since the conclusion of the foreign treaties, become the residence of the viceroy of the province during a great portion of the year. The town is built on a vast alluvial plain, which extends from the mountains beyond Peking to the sea, and through which the Peiho runs a circuitous course, making the distance by water from Tientsin to the coast about 70 m. as against 30 m. by railway.

The appearance of the city has greatly changed since the Boxer rising in 1900. After the event of the city, which measured about three-quarters of a mile each way, were razed, wide streets were made, the course of the river straightened, electric lighting and tramways introduced and a good water service supplied. Among the public buildings are a university (in which instruction is given in western learning) and an arsenal. There are several cotton mills and important rice and salt markets. The city has always been a great commercial depot; a wharf nearly two miles long affords ample facilities for vessels able to cross the bar of the Peiho, over which there is a depth of water varying from 9 to 12 ft.

In 1907 the imports amounted to 22,500,000 taels (a tael in 1907 averaged 38.30d.); viz. foreign imports 61,200,000, native imports of 17,500,000 taels. In 1907 the value of foreign trade was about 7,250,000. Valuable cargoes of tea are landed here for carriage overland, via Kalgan and Khiakhta, to Siberia. During the winter months the river is frozen. Here the Peiho and the Kiangyin, which is brought by the canal to the east of Tientsin; its output in 1883 was 181,099 tons and in 1904 28,926 tons.

The importance of Tientsin has been enhanced by the railways connecting it with Peking on the one hand and with Shanghai, Kwan and Manchuria on the other. The British concession, in which the trade centres, is situated on the right bank of the river Peiho both for the native city, and occupies some 200 acres. It is held on a lease in perpetuity granted by the Chinese government to the British Crown, which sublets plots to private owners in the same way as is done at Hankow. The local management is entrusted to a local company, the Tientsin and Peking Railway (1899) which obtains a dividend out of the receipts of the railway. Besides the British concession the French, Germans, Russians, Japanese, Austrians, Italians and Belgians have separate settlements, five miles in all, the river front being governed by foreign powers.

In 1853 Tientsin was besieged by an army of T'ai-p'ing rebels, which had been detached from the main force at Nanking for the capture of Peking. The defences of Tientsin, however, saved the capital, and the rebels were forced to retreat. Five years later Lord Elgin, accompanied by the representative of France, steamed up the Peiho, after having forced the barriers at Taku, and took possession of the city. Here the French treaty was signed. But in 1860, in consequence of the treacherous attack made on the British plenipotentiary the preceding year at Taku, the city and suburbs were occupied by an allied British and French force. Afterward the Russians were held here by the Chinese. The last open port. On the establishment of Roman Catholic orphanages some years later the pretensions of the priests so irritated the people that on the occurrence of an epidemic in the schools in the year 1870 they attacked the French and Russian establishments and murdered twenty-one of the foreign inmates, besides numbers of their native followers. The Chinese government suppressed the riot, paid 180,000 in compensation and sent a representative to Europe to apologize for the outbreak.

During the period 1874-1894, when Li Hung-Chang was viceroy of Chih-li and ex efficio superintendent of trade, he made Tientsin into a centre for the control of his empire's foreign trade and naval education. As a consequence the city became the chief focus of enterprise and foreign progress. Having arrogated to himself the right of judicial control of the foreign policy of the nation, Li's yamen became the scene of many important negotiations, and attracted distinguished visitors from all parts of the globe. The loss of prestige consequent on the Japanese War brought about the collapse of this position, which he had so skilfully created. Both the foreign concessions and the native city suffered severely during the hostilities resulting from the Boxer movement in June-July, 1900. (See CHINA: History § B.)

TIEPOLO, GIOVANNI BATTISTA (1692-1768), Italian painter, was born at Venice, and acquired the rudiments of his art from Gregorio Lazzarini, and probably from Piazzetta, though the decisive influence on the formation of his style was the study of Paolo Veronese's sumptuous pictures. When hardly out of his teens he developed an extraordinary facility of brushwork, and proved himself, as a fresco-painter, a colourist of the first
order, though this early mastery of technique made him frequently neglect form and composition. The more solid qualities of Paolo Veronese—depth of thought and balance of design—are frequently wanting in his work, but he approaches the earlier master in richness of colour and in the management of difficult effects of lighting. He decorated many Venetian churches and palaces with ceilings and frescoes full of turbulent movement and rich colour, extending his operations to the near cities of the mainland and to Bergamo (Colleoni Chapel) and Milan (ceiling at Palazzo Chierici). In 1750 he proceeded to Würzburg to paint the magnificent ceilings and frescoes at the archbishop's palace. From 1753 to about 1759 he worked again at Venice and in the cities of north-east Italy, until he was summoned to Madrid by Charles III. to paint some frescoes for the royal palace. He died at Madrid in 1766. He was the last important figure in Venetian art, and at the same time the initiator of the baroque period.

Tiepolo's altarpieces and easel pictures show more clearly even than his frescoes how deeply he was imbued with the spirit of Paolo Veronese, for in these smaller works he paid more attention to the balance of composition, whilst retaining the luminosity of his colour harmonies. The majority of his works, both in fresco and in oils, are to be found in Venice in the churches of S. Aloise, SS. Apostoli, Gesuati, SS. Giovanni e Paolo, in the Scalzi, and the Scuola del Carmine, the Academy, and the Palazzi Labia, Rezzonico, and Quirini-Stampaia, and the Doge's Palace. Besides the cities already mentioned, Padua, Udine, Pordenone and Vicenza boast of fine examples of his work. At the National Gallery are two altarpieces, for altarpieces, and the Marriage of Marie de Médicis. Two versions of "Christ and the Adulteress" are in the collection of Dr L. Richter. Other easel pictures by Tiepolo are at the Louvre, and at the Berlin and Munich galleries. His paintings in Madrid belong to the closing years of his life and show signs of waning power. Tiepolo also executed some notable work with the etching-needle, the list comprising some fifty plates. His two sons, Giovanni Domenico (about 1725-1804) and Lorenzo, did not attain to his excellence.


TIENEY, GEORGE (1761-1830), English Whig politician, was born at Gibraltar on the 20th of March 1761, being the son of a wealthy Irish merchant of London, who was living there as prize agent. He was sent to Eton and Peterhouse, Cambridge, where he took the degree of LL.B. in 1784, and was called to the bar; but he abandoned law and plunged into politics. He contested Colchester in 1788, when both candidates received the same votes, but Tieney was declared elected. He was, however, defeated in 1790. He sat for Southwark from 1796 to 1806, and then represented in turn Athlone (1806-1807), Bandon (1807-1812), Appleby (1812-1818), and Knaresborough (1818-1830). When Fox seceded from the House of Commons, Tieney became a prominent opponent of Pitt's policy. In 1797 Wilberforce noted in his diary that Tieney's conduct was "truly Jacobinical"; and in May 1798 Pitt accused him of want of patriotism. A duel ensued at Putney Heath on Sunday, the 27th of May 1798; but neither combatant was injured. In 1803 Tieney, partly because peace had been ratified with France and partly because Pitt was out of office, joined the ministry of Addington as treasurer of the navy, and was created a privy councilor; but this alienated many of his supporters among the middle classes, and offended most of the influential Whigs. On the death of Fox he joined (1806) the Grenville ministry as president of the board of control, with a seat in the cabinet, and thus brought himself once more into line with the Whigs. After the death of George Ponsonby in 1817 Tieney became the recognized leader of the opposition in the House of Commons. It was Ponsonby's ministry he was master of the mint, and when Lord Goderich succeeded to the lead Tieney was admitted to the cabinet; but he was already suffering from ill-health and died suddenly at Savile Row, London, on the 25th of January 1819.

Tieeny was a shrewd man of the world, with a natural aptitude for business. His powers of sarcasm were a cause of terror to his adversaries, and his presence in debate, even when his arguments were felicitous, and his choice of language was the theme of constant admiration. Lord Lytton, in his poem of St Stephen's, alludes to "Tieeny's airy tear," and praises his "light and yet vigorous" attack, in which he inferred, "with a placid smile," a fatal wound on his opponent.

TIERRA DEL FUEGO, an archipelago at the southern extremity of South America, from which it is separated by Magellan Strait, at the First Narrows and other points scarcely a mile wide. The group lies between 52° 40' and 55° 59' S. and 63° 30' and 74° 30' W. stretching nearly in a line with the Patagonic Andes for 400 m. N.W. and S.E., between Capes Pillar (Desolation Island) and Horn, and for about 270 m. W. and E. from Cape Pillar to Catherine Point on the north of the main island of Tierra del Fuego. Southwards it tapers to 120 m. between Capes Horn and San Diego, east of which extends Staten Island, which terminates in Cape St John. The boundary between A and C has once been settled in such a manner that Argentina holds that part of the main island of Tierra del Fuego which is situated east of the meridian of Cape Espiritu Santo, the frontier striking the north shore of Beagle Channel about its centre; and Chile holds the western part of the main island and the other numerous islands to the west and to the south of Beagle Channel. The Argentine side is known as the Territory of Tierra del Fuego (including Staten Island), and the Chilean forms part of the Territory of Magallanes. Although on ordinary maps this region presents to the eye a hopelessly confused chaos of islands and fjord-like inlets, it is nevertheless clearly disposed in three main sections: (1) the main island; (2) the islands to the south, from which it is separated by Beagle Channel; (3) the islands to the west, marked off from those to the south by the Brecknock Peninsula.

Knowledge of these lands increased considerably during the later years of the 19th century, and their reputation for dreariness has been favourably modified. The climate in the eastern and southern regions is not so rigorous as was believed, there are no barren lands, the soil is fertile and can support fruitful industries, and the aborigines are far from being so dangerous as they were once considered to be. The greater part of the main island of Tierra del Fuego is formed by the continuation of the Tertiary beds of the Patagonian tableland cut by the transversal depression of Magellan Strait and by the low land extending from Useless Bay on the west to San Sebastian Bay on the east, of so recent origin that there exist still some salt lakes, this depression being represented in the old charts as an inter-oceanic passage for small boats. Although in 1880 numerous prospectors discovered extensive deposits of alluvial gold, its exploitation was not generally successful, and farms took the place of mines. By the end of the 19th century 200 square miles had been occupied by cattle and sheep on the Argentine side, and about the same extent on the Chilian; and the cattle industry proved very profitable.

The undulating tableland has an average height of 300 ft. above the sea, and its climate, however cold in winter—in 1892 and 1893 the temperature reached 12-6° F.—allows of the cultivation of barley, oats and occasionally potatoes, which, however, grow better south of Beagle Channel; there are more lakes and rivers, and more broken, being drained by the Silva and Grande, among smaller rivers, the Grande being navigable in some parts by small craft. To the west and south-west the general character of the land changes; the hills and larger ranges extend to Cape Horn, and its depth reaches 700 ft. To the south of the lake rises the south-eastern prolongation of the Cordillera of the Andes, with ridges of a uniform height of 3500 ft., in which predominates crystalline schists which are less broken than the mountains to the north, but the slopes collapse and the uniformity, such as Mt Sarmiento (7200 ft.), Mt Darwin, of which two peaks have been measured (6201 and 7054 ft.), and Mt Olivia (4524 ft.), Sarmiento, the culminating point of
The archipelago, was generally supposed to be volcanic, but it presents such extremely precipitous flanks that John Ball considered it most likely to be a mole, a great force of the axis of the Andean chain during the long ages that preceded the great volcanic outbursts that have covered the framework of the South America.

Martin Conway, who ascended it, ascertained that it was a volcano. This is altogether a region with numerous snow-clad summits and glaciers descending down to the sea. Deep valleys, which seem to be only the precursor channels and the floor of the large extinct igneous lakes, have been dissected, and alluvial gold is washed principally at Sloggett Bay. These regions, as they become more known, may even invite the attention of tourists by their sublime scenery. Stanley Island to the east of Tierra del Fuego has been settled by the Argentine government; there are a prison and lighthouse at St John Harbour, and a first-class permanent meteorological and magnetic station.

The dissection of the archipelago to the south of Beagle Channel includes the islands of Hoste, Navarin, Gordon, Londonderry Stewart, Wollaston and numerous islets, disposed in triangular form with the mainland and Isla Grande de Tierra del Fuego being the vertex of Cape Horn. At its west end Beagle Channel takes the name of Darwin Sound, which leads to the Pacific at the Londonderry and Stewart Islands. Partial exploration in this region was conducted by Dr. Darwin and Capt. John Byron in 1801. The foundations of the southern islands are granite and basic volcanic rocks. The western group of islands, demarcated by Brecknock Peninsula, includes Clarence Island and Captain Cook's Desolation Land, with Darwin Island and several small islets. Desolation Land was supposed by Cook to form a continuous mass stretching from the western entrance of Magellan Strait to Cockburn Channel, but it actually consists of several islands. Small islands separated from each other by very narrow channels, flowing among these islands have shown that several of the larger islands are cut by channels which separate them into smaller parts, while elsewhere the low valleys which unite the mountains and hills are the result of postglacial depressions that have filled part of the former channels, these islands being the summits of an old continuous half-submerged mountain chain. At Dawson Island the Chilian government has established settlements, and a Roman Catholic mission has carried on work among the Alakaluf Indians.

Climate.—At Ushuaia ten years' meteorological observations have shown a mean annual temperature of 42.84° F., with a winter mean of 42.2° F., and they confirm the observations of Charles Darwin that tolerably mild winters (as a whole, apart from the extremes of cold already indicated) are followed by cool summers, both seasons being accompanied by overcast skies, constant and sudden changes from calm to a gale. Philip Parker Snow (1855), while living in the same winds (prevailing throughout the year) endangers the navigation of the intricate inland channels. The precipitation during ten years at Ushuaia has been 29.80 inches. Beagle Sound, forming the southern seaward islands, under the influence of the prevalent westerly and south-westerly winds, it is very much heavier, and reaches 59 in. at Staten Island.

Flora.—In the main island of Tierra del Fuego, the low-lying plains with their rich growth of tall herbage are frequented by the rhea, guanaco and other animals common to the adjoining mainland. In the southern and western islands the fauna is restricted mainly to coatis, rats, bats, mice, the sea otter, the penguin and other aquatic birds, and various cetaceans in the surrounding waters.

Inhabitants.—To the three geographical divisions correspond three well-marked ethnical groups—the Onas of the main island, the Yagans (Yahgens) of the south and the Alakalufs of the west. With the settlement of the main island, which is now sometimes called Charles Darwin, having taken place, the Onas of Patagonia, the Onas tribe has become fairly known. Their origin, like that of the other groups, is obscure. Undoubtedly among these Indians are many that recall some Patagonian types; if so, it seems almost as if the same species have been driven, in what they pertain to one of the races that in earlier times existed in Patagonia. Their language is closely allied to that called Old Tehuelche; it is a hard, slow-spoken speech, not at all resembling the soft, rapidly-spoken language of the Yagans, which has many points of similarity with that of the Alakalufs. The isolation of the Onas is peculiarly marked, inasmuch as they are an insular people, living upon the flesh of the guanaco, and using only tussock-roots and wild celery for vegetable food. Their skill in and necessary to the chase influence their whole mode of life; "their moral code is based upon the chase. A man who has not suffered a serious injury to his stock is considered a disgrace, though certain legends are preserved. They have maintained their stock untainted, and have withstood the influence of the white man to a remarkable degree (for example, they use no spiritual drink); their scanty gold has never been subject to any other form of currency, or even to a medium of exchange, but is always kept in a bush or under a rock, 'the food,' they venture naked in small canoes into the treacherous seas; their life is a constant battle with starvation and a rude climate, and their characters have become rude and low in consequence. They have no higher social unit than the family. On the authority of Charles Darwin they have been held by many to be cannibals, but they are not, although those suffering from incurable ailments are sometimes killed for their meat. Although tall and on the Negritos of the eastern hemisphere (4 ft. 10 in. to 5 ft. 4 in.), the Yagans present in some respects a more debased type—characteristic of the same genus—prominent zygomatic arches, large gum lips, flat nose, loose wrinkle on the back of the neck. They have been considered coarse black unskirted hair, and head and chest disproportionately large compared with the extremely slender and outwardly curved body. The Yagans are of considerable size, and have about 30,000 words, although the numerals stop at five, already a compound form, and although the same word expresses both hand and foot. It is argued that it was not a human language in this total are compounds. Comparatively little is known about the Alakalufs. They have a reputation for treachery, and for absurdities on shipwrecked ships. They are hunters both on land and on the water, using the bow and arrow like the Onas, and building canoes often of considerable size.

The aborigines are decreasing rapidly in the whole archipelago, and the Roman Bishop Thomas Bridges, who, as missionary first and then as farmer, resided thirty years there, calculated the population to be 10,000 when he arrived, towards the close of the 19th century it was estimated to be little more than 1000.

Tierra del Fuego was discovered by Fernández de Magellan in 1520, when he sailed through the strait named after him, and called this region the "Land of Fire," either from now extinct volcanic flames, or from the fires kindled by the natives along parts of his course. In 1578 Sir Francis Drake first sighted the point which in 1616 was named Cape Horn (anglicized Horn) by the Dutch navigators Jacob Lemaire and Willem Cornelis Schouten (1615-1617), and which the Dutch navigators A. de Bille (1624) and B. de Lace (1643) circumnavigated the archipelago, which was afterwards visited at intervals by Captain Sir John Narborough (1670), M. de Gennes and the Sieur Friger (1666), Commodore John Byron (1764), Samuel膀 (1768), and Philip Parker Snow (1813-1836). The latter expedition (Voyage of the "Beagle") was accompanied by Charles Darwin, then a young man. To these admirable surveys is due most of the present geographical and historical knowledge of the archipelago. Subsequently the work of exploration was continued by Dumont d'Urville (1837), Charles Wilkes (1839), Parker Snow (1852), various later travellers, a selection of whose works are quoted below, and British, American and Roman Catholic missionaries and settlers.

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1 Notes of a Naturalist in South America (London, 1887).
2 Dr Chavanne, Diploma Temps et Regenverhaligkeiten Argen
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TIETJENS


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Made into a decision, Tiffany, the firm having the principal address in London, was 1877), (Stockholm, 1895), xxi.; K. Skottsberg, Vegetationsbilder aus Feuerland, &c., parts iii. and iv. in G. Karsten and J. Schenck's Vegetationsbilder (Jena, 1906); R. Crawshaw, The Birds of Tierra del Fuego (London, 1907).

TIETJENS, THÉRÈSE JOHANNE ALEXANDRA (1831-1877), Hungarian soprano vocalist, was born at Hamburg on the 17th of July 1831. Her voice was trained at Hamburg, where she soon made a success. She left in 1849 as Lucretia Borgia in Donizetti's opera. Thence she proceeded to Frankfort and Vienna. She sang for the first time in London in 1858, appearing as Valentine in Les Huguenots. Her success was so great that for the rest of her life she made England her home, and soon gained as brilliant a reputation in concert and oratorio work as she had already won upon the stage. Her voice was a dramatic soprano of magnificent quality, and her powers as an actress were supreme. Her most famous parts were Fidelio, Medea (in Cherubini's opera) and Donna Anna (in Don Giovanni). She died in London on the 3rd of October 1877, having enjoyed as much success with the English people as much by her private virtues as by her artistic gifts.

TIPPANY, CHARLES LEWIS (1812-1902). American jeweler, was born at Killingly, Connecticut, on the 15th of February 1812. At fifteen he became a clerk in his father's store, but removed to New York City in 1837, and with John B. Young opened a fancy goods store. In 1847 the firm began to manufacture gold jewelry, and in 1858, when the political unrest in Europe caused great depreciation in the price of precious stones, Tiffany invested heavily in diamonds, which were sold at a Test price a few years later. The firm became Tiffany, Young & Ellis in 1851 and was reorganized as Tiffany & Co. (Mr. Young and Mr. Ellis retiring) in 1853. In 1851 the firm had established the sterling silver standard of 925 fine, subsequently adopted by other jewelers; and in the same year had founded a branch house in Paris. In 1858 Tiffany bought the unused portion of the Atlantic telegraph cable which he made into cane handles or sold in sections. At the beginning of the Civil War, foreseeing that the jewelry business would suffer, he turned most of his capital to the manufacture of swords, medals and similar war material. In 1868 the company was incorporated, and branches were established in London and at Genova. Tiffany made a specialty of importing historic gems, jewelry and art works, and in 1857 bought some of the crown jewels of France, paying for them about half a million dollars. He was made a chevalier of the Legion of Honour in 1878. He died in New York on the 18th of February 1902.

TIPPANY, LOUIS COMFORT (1848- ), American artist, son of Charles L. Tiffany, was born in New York City, on the 18th of February 1848. He was a pupil of George Inness and of Samuel Coleman, New York, and of Léon Bailly, Paris. He became a member of the Society of American Artists, 1880, of the National Academy of Design (1880), of the American Water Color Society, and of the Société Nationale des Beaux Arts, Paris. He travelled extensively in Europe, and painted in oil and water-colour, but subsequently devoted himself to decorative glass work. He became president and art director of the Tiffany Glass and Decorating Co., and produced a "Favellite" glass, of unusual beauty of colour.

TIPPANY, a city and the county-seat of Seneca county, Ohio, U.S.A., on the Sandusky river, about 40 m. S.S.E. of Toledo. Pop. (1900, 18,904, of whom 1,804 were foreign born. (Last census), 11,894. Tiffany is served by the Baltimore & Ohio, the Cleveland, Cincinnati, Chicago & St. Louis and the Pennsylvania railways, and by an electric line to Fostoria, about 12 m. west. It is the seat of an Ursuline College for girls, founded in 1863 and incorporated with power to confer degrees in 1878; and of Heidelberg University (Reformed Church), founded in 1859, incorporated as Heidelberg College in 1851 and reincorporated under its present name in 1890. The Heidelberg Theological Seminary was conducted here from 1850 to 1907, not removed to Warrenton. There are a Roman Catholic college and a Norwegian Lutheran College, Collegeville, Pennsylvania, to form the Central Theological Seminary of the Reformed Church in the United States, which in 1908 was removed to Dayton, Ohio. In Tiffin are the St Francis Home (1869), and the National Orphans' Home (1897). The city had 87 factories in 1905, of which 54-2% were owned by individuals, and the value of the factory products was $2,434,502. Tiffin was settled in 1817, incorporated as a town in 1835, and chartered as a city in 1850, when the village of Ft. Balli, on the opposite side of the Sandusky, was consolidated with it. It was named in honour of Edward Tiffin (1766-1829), a native of Carlisle, England, who emigrated to the United States. He graduated at the University of Pennsylvania in 1789, removed in 1796 to Chillicothe, Ohio, where he practised medicine and was a local Methodist preacher. He was speaker of the House of Representatives of the Northwest Territory in 1799, president (1802) of the convention which framed the first constitution of Ohio, the first governor of the state (1803-1807), a Democratic member of the United States Senate in 1807-1809, first commissioner of the United States General Land Office in 1813-1814, and surveyor-general of public lands north-west of the Ohio River in 1814-1829.

TIFLIS, a government of Russian Transcaucasia, occupying the eastern portion of the great valley which stretches between the main Caucasus range and the Armenian highlands, from the Meskes Mountains eastward, and extending up into the higher regions on both north and south. The district of Akhalkalik lies actually on the Armenian highlands. The government is rich in minerals, but only copper is extracted, at Alaverdi and Akhtal; petroleum and other mineral springs are abundant. The government is drained by the Kura and its tributaries (Lyakhka, Aragva, Yora and Alazan), all of whose waters are largely used for irrigation; but in the lower parts of the valley there are extensive waterless steppes, Shirak and Karayaz, on the left bank of the Kura, which are chiefly inhabited by nomad Tatars. The area of the government is 15,601 sq. m. (17,140 with the Zakataly district), and the estimated population in 1906 was 1,681,600. The government is divided into nine districts, the chief towns of which are Tiflis, Akhalkalaki, Akhalkalikh, Dushet, Gori, Signakhi and Telav. Agriculture is the principal occupation. Good soil is produced, especially in the province of Akhalkalak, the Black Sea and the Black Sea bight, and the grains are carried on the steppes. About one-fourth of the area is under forest. The natives exhibit remarkable skill in the manufacture of leather and metallic goods, felt, woollen stuffs (e.g. carpets and shawls) and gold embroidery.

TIFLIS, a town of Russian Caucasus, capital of the government of the same name and of the governor-generalship of Caucasus, picturesquely situated (44° 48' E., 41° 42' N.) at the foot of bare high mountains, on both banks of the river Kura, 300 ft. above the Black Sea. It is connected by rail with Poti and Batum (217 m.) on the Black Sea, with Baku on the Caspian (432 m.), with Kars (187 m.) and Tiflis (189 m.) and Petrovsk, with the railway system of European Russia, which it joins at Beslan, near Vladikavkaz. Omnibuses also run regularly across the main range to Vladikavkaz, which by this route is only 133 m. distant. The best in summer is excessive (mean, 73.4° F.), owing to the confined position; but the surrounding hills (1500 to 2400 ft.) shelter the town effectively from the cold winds of winter (mean, 34.7°). A large square, cathedrals, handsome streets, gardens, bridges, many fine buildings—among them the grand-ducal palace, the opera-house and the museum—mark the seat of an important national university. In the departmental offices, there are evidence of Western civilization. Among the modern public buildings are the Hall of Fame (1885), the Caucasian Museum, a
cathedral of the Catholic Greek Church, and a curiositario museum. The chief of the older edifices is the (Sion) cathedral, which traces back its origin to the 3rd century. Other churches date from the 14th and 15th centuries, the Armenian cathedral of Van from 1480, and the Catholic church from the 14th century. At Tiflis are the Caucasian branch of the Russian Geographical Society, an astronomical and a physical observatory, a botanical garden and museum, and a public library. There are cotton and silk factories, tanneries, soap-works and brick-works. The artisans of Tiflis are renowned as silversmiths, gunsmiths and sword-makers. Tiflis is the chief centre for the export of raw silk and silken goods, raw cotton, cottons, woollens, boots, tobacco, wine, carpets, and dried fruits from Persia and Transcaucasia, while manufactured wares are imported from Russia.

The city has considerably developed, and had in 1897, 160,645 inhabitants, as compared with 104,024 in 1883. They include Georgians, Russians, Germans, Persians and Tatars.

In the old division of Tiflis three distinct towns were included—Tiflis, Kala (the fort) and Isni; subsequently Tiflis seems to have been known as Aulahar. Kala and Isni possessed citadels; that of the former contained the church of St Nicholas and a royal palace; that of the latter the church of the Holy Virgin and the residence of the archimandrite. The town is now divided into Russian quarters: the Russian (the finest of all), the German, the Armenian, and that in which are congregated Jews, Mahomedans and the mass of Orientals.

The Georgian annals put the foundation of Tiflis back to A.D. 379. In the later half of the 5th century the chieftain of Georgia, Wakhlong, Gurgashan, transferred his capital from Mtskhet to the warm springs of Tphlis, where he erected several churches and a fortress. In 570 the Persians took the place and made it the residence of their rulers, but retained it only for ten years. Tiflis suffered successive plunderings and devastations at the hands of the Greeks in 626, of one of the commanders of the Caliph Omar in 731, of the Khazars in 828, and of the Arabs in 851. The Georgians, however, always managed to return to it and to keep it in their permanent possession. In the course of the succeeding centuries Tiflis fell repeatedly into Persian hands; and it was plundered by the Mongol conqueror Tamerlane towards the end of the 14th century. Afterwards the Turks seized it several times, and towards the end of the 17th century the Lesghians attacked it. In 1705, when the shah of Persia plundered Tiflis, Russia sent troops to its protection, and the Russian occupation became permanent in 1799.

Perhaps one of the fullest accounts of Tiflis is contained in Brossot's edition of the Description géographique de la Géorgie (St Petersburg, 1842), by the illegitimate son of Wakhlong VI., king of Georgia (q.v.), who became a pensioner of Peter the Great.

TIGELLINUS, SOPHONIUS, minister and favourite of the emperor Nero, was a native of Agrigentum, of humble origin and possibly of Greek descent. During the reign of Caligula he was banished (A.D. 39) for adultery with the emperor's sisters, but recalled by Claudius (41). Having inherited a fortune, he bought land in Apulia and Calabria and devoted himself to breeding race-horses. In this manner he gained the favour of Nero, whom he aided and abetted in his vices and cruelties. In 63 he was promoted to the pretorship of the praetorian guards. In 64 he made himself notorious for the orgies arranged by him in the Basin of Agrippa, and was suspected of incendiarity in connexion with the great fire, which, after having subsided, broke out afresh in his Aemilian gardens. In 65, during the investigation into the abortive conspiracy of Piso, he and Poppaea formed a kind of imperial privy council. In 67 he accompanied Nero on his tour in Greece. When the emperor's downfall appeared imminent, Tigellinus deserted him, and with Nymphophilus Sabinus brought about the defection of the praetorians. Under Galba he was obliged to give up his command, but managed to save his life by lavishing presents upon Vinius, the favourite of Galba, and his daughter. Otho on his accession (69) determined to remove one so universally detested by the people. While in the baths at Sinussa, Tigellinus received the news that he must die, and, having vainly endeavoured to gain a respite, cut his throat.

TIGELLINUS—TIGER

See Tacitus, Annals, xiv., xv., xvi.; Hist. i. 72; Dio Cassius lix. 23, liii. 13, 15, 27, lixii. 12, 21, lixiv. 3; Suetonius, Galba, 15; Plutarch, Galba, Other; ancient authorities quoted by Mayor on Juvenal, i. 135; B. W. Henderson, Life and Principate of the Emperor NERO (1893).

TIGER (Felis tigris), an animal only rivalled by the lion in size, strength and ferocity among the cat-like beasts of prey (see Carnivora). Almost everything that is stated in the article Lion concerning the structure of the skeleton, teeth and claws of that animal will apply equally well to the tiger, the difference between the two lying mainly in the skin and its coverings. A tiger's skull may, however, always be distinguished from that of a lion by the circumstance that the nasal bones extend higher on the forehead than the maxillae, instead of stopping on nearly the same line. Although examples of both species present considerable variations in size, it is ascertained that the length of the largest-sized Bengal tiger may exceed that of any lion. Much larger specimens are recorded, but 10 feet from the tip of the nose to the end of the tail is no unusual length for a large male tiger. The female is somewhat smaller and has a lighter and narrower head. The tiger has no mane, but in old males the hair on the cheeks is rather long and spreading. The ground-colour of the upper and outer parts of the head, body, limbs and tail is bright rufous fawn; and these parts are beautifully marked with transverse stripes of a dark, almost black colour. The markings vary much in different individuals, and even on the two sides of the same individual. The under-parts of the body, the inside of the limbs, the cheeks and a large spot over each eye are nearly white. The tigers which inhabit hotter regions, as Bengal and the south Asiatic islands, have shorter and smoother hair, and are more richly coloured and distinctly striped than those of northern China and Siberia, in which the fur is longer, softer and lighter-coloured. The Siberian tiger is F. tigris mongolica, and the Persian F. tigris virga. Black and white phases have been recorded, but they are rare. The tiger is exclusively Asiatic, but has a very wide range in that continent, having been found in almost all suitable localities south of a line drawn from the river Euphrates, passing along the southern shores of the Caspian and Sea of Aral by Lake Balkal to the Sea of Okhotsk. Its most northern range is the territory of the Amur, its most southern the islands of Sumatra, Java and BAli. Westward it reaches to Turkish Georgia and eastward to the island of Sakhalin. It is absent, however, from the great elevated plateau of Central Asia, nor does it inhabit Ceylon, Borneo or the other islands of the Indo-Malay Archipelago, except those named. The principal food of the tiger in India is cattle, deer, wild hog and peafowl, and occasionally human beings. The regular "man-eater" is generally an old tiger whose vigour is past, and whose teeth are worn and defective; it takes up its abode in
the neighbourhood of a village, the population of which it finds an easier prey than wild animals. Though chiefly affecting grassy plains or swamps, tigers are also found in forests, and seem to be fond of haunting the neighbourhood of old ruins. As a rule, they do not climb trees; but when pressed by fear, or during an inundation, they have been known to do so. They take to the water readily and are good swimmers. The tigers of the Sundarbans (Ganges delta) continually swim from one island to the other to change their hunting grounds for deer. The following extract from Sir J. Fayer's "Royal Tiger of Bengal" (1875) may complete this notice of the tiger's habits.

The Tigress gives birth to from two to five, even six cubs; but three is a frequent number. She is most affectionate and attached to her young, and will defend her cubs against her youth with the most watchful solicitude. They remain with her until nearly full-grown, or about the second year, when they are able to kill for themselves and look after their own food. As soon as they begin to require other food than her milk, she kills for them, teaching them to do so for themselves by practising on small animals, such as deer and young pigs. When they are about three years old and have become too large for her to carry them, and are too strong to be held, they are driven away from her. The young tigers are more destructive than the old. They will kill three or four cubs at a time, while the older and more experienced rarely kill more than one, and this at intervals of from three or four days to a week. For this purpose the tiger will leave its retreat in the dense jungle, proceed to the neighbourhood of a village or gowrie, where cattle feed, and during the night steal on and strike down a bullock, drag it into a secluded place, and then remain near the "murrie" or "kill," for several days, until it has eaten it, when it will proceed in search of a further supply, and, having found good hunting ground in the vicinity of a village or in the course of its rovages, will devour one or two cows or buffaloes a week. It is very fond of the ordinary domestic cattle, which in the plains of India are generally weak, half-starved, undersized creatures. One of these is easily struck down and carried or dragged off. The smaller buffaloes are also easily disposed of, but the buffalo bulls, and especially the wild ones, are formidable antagonists, and have often been known to beat the tiger off, and even to wound him seriously. (W. H. F.; R. L. *)

TIGER-CAT, typically *Felis tigrina*, an American wild cat ranging from Mexico, on the east of the Andes to Paraguay and the central forest region of Argentina. Together the head and body measure something over 30 in., of which the tail counts for a third. The fur is grizzly grey, with black spots that do not form chains. The name is also applied to the Ocelot (*P. tigrina*), and often used of any small striped or spotted wild cat, either from the western or eastern hemisphere.

TIGER-FLOWER, known botanically as *Tigridia*, a genus of bulbous plants (natural order Iridaceae), native in Mexico, Central America, Peru and Chile. They have long narrow plicate-veined leaves springing from the bulb and a stem bearing two or three scattered smaller leaves and above a few flowers emerging from a spathe. The flowers are spotted (whence the name tiger-flower or tiger-iris) and have free segments springing from a tube; the three large outer segments are concavely spreading, the three inner are much smaller and more erect. *T. pavonia* (Flower of Tigris) has large flowers with a golden orange, white or yellow ground colour.

TIGHE, MARY (1772-1816), Irish poet, daughter of the Rev. William Tighe, who was born on the 9th of October 1772. In 1793 she contracted what proved to be an unhappy marriage with her cousin, Henry Tighe, of Woodstock, Co. Wicklow. She died on the 24th of March 1810, at Woodstock, Co. Kilkenny, and was buried at Inistioge. Mrs Tighe was the author of a poem of unusual merit, *Psyche or the Legend of Love*, printed privately in 1803 and published posthumously in 1811 with some other poems. It is founded on the story as told by Apuleius, and is written in the Spenserian stanza. The poem had many admirers, and high praise is awarded it in a contemporary notice in the *Quarterly Review* (May 1811).

TIGLATH-PILESER I, the son of Assur-ris-isi, ascended the throne c. 1120 B.C., and was one of the greatest of Assyrian conquerors. His first campaign was against the Moschi who had occupied certain Assyrian districts on the Upper Euphrates; then he overran Commagen and eastern Cappadocia, and drove the Hittites from the Assyrian province of Subharti north-east of Malatia. In a subsequent campaign the Assyrian forces penetrated into the Kurdish mountains south of Lake Van and then turned westward, Malatia submitting to the invader. In his fifth year Tiglath-Pilesar attacked Comana in Cappadocia, and placed a record of his victories engraved on copper plates in a fortress he built to secure his Cilician conquests. The Aramaeans of north Syria were the next to be attacked, and he thrice made his way as far as the sources of the Tigris. The command of the high road to the Mediterranean was secured by the possession of Cilicia and Pamphylia. Tiglath-Pilesar crossed the Tigris, and held the fortress of Birt Marduk, by which he compelled his enemy to submit. In the following year the Assyrians penetrated into the Syrian states, and compelled the kings of Damascus and Arpad to surrender. Tiglath-Pilesar then turned south to Tarsus, and was called to Damascus by a message from the King of Arpad, and the party who had fled thither from the Assyrian invaders. In the fall of this year Tiglath-Pilesar died, and was succeeded by his son Esarhaddon.

TIGLATH-PILESER II, or III., son of Hadad-nirari II., appears to have reigned from about 930 to 930 B.C., but nothing is known about him.

TIGLATH-PILESER III. or IV., was a successful general who was over the Assyrian throne on the 73th of Lykar 745 B.C., after the fall of the older dynasty, and changed his name of Pulu to that of the famous conqueror of earlier times. In Babylonia, however, he continued to be known as Pulu. He was a man of great ability, both military and administrative, and initiated a new system of policy in Assyria which he aimed at making the head of a centralized empire, bound together by a bureaucracy who derived their power from the king. The empire was supported by a standing army and an elaborate system of finance. The first task of Tiglath-Pilesar was to reduce the Aramaean tribes to order, and so win the gratitude of the Babylonian town of Nisibin. The army at the junction of the Euphrates and the Tigris was thereby sent to the eastern frontiers of the kingdom by a campaign which extended into the remotest parts of Media. Next came the defeat of a northern coalition headed by Sar-duris of Ararat, no fewer than 72,050 of the enemy being captured along with the city of Arpad, where the Assyrian king received the homage of various Syrian princes. Arpad revolted soon afterwards, but after a siege was taken in 740 B.C. The following year Azariah of Judah appears among the enemies of Tiglath-Pilesar, who had overthrown his Hamathite allies and annexed the nineteen districts of Hamath. The conquered peoples were now transported to distant parts of the empire. In 737 B.C. Tiglath-Pilesar again marched into Media, and in 735 he invaded Ararat and wasted the country round the capital Van to a distance of 450 miles. In 734 B.C. he was called to the help of Yahu-khaz (Ahaz) of Judah, who had been attacked by Pekah of Israel and Rezon (Rasun) of Damascus. Rezon, defeated in battle, fled to his capital which was at once invested by the Assyrians, while with another portion of his army Tiglath-Pilesar ravaged Syria and overran the kingdom of Samaria. Ammon, Moab, Edom and the queen of Sheba sent tribute, and Teima in northern Arabia was prized by the Assyrian troops. In 732 B.C. Damascus fell; Rezon was put to death, and an Assyrian viceroy appointed in his stead. Tyre also was made tributary. The next year Tiglath-Pilesar entered Babylonia, but it was not until 729 B.C. that the Chaldaean prince Uzin-zer (Chinzirus) was driven from Babylon and Tiglath-Pilesar acknowledged as its legitimate ruler. In the early part of Tebet 727 B.C. he died, after having built two palaces, one at Nineveh, the other at Calah.

See P. Rost, *Die Keilschrifttexte Tigl-Pileser III. (1893)*; also *Babylonia and Assyria, § v. History* ("Second Assyrian Empire"); and authorities quoted in § viii. Chronology.
TIGRANES—TIGRIS

TIGRANES, or Dikran, king of Armenia (c. 95-52 B.C.). Armenia had by the conquests of Alexander the Great become a province of the Macedonian Empire; but it was never thoroughly subjected to the foreign rule. A Persian family, that of Hydarnes, one of the associates of Darius Hystaspis, which possessed large domains in Armenia and had been invested with the satrapy for several generations, was dominant in the country, and assumed the royal title in defiance of the Seleucids. Antiochus III. The Great put an end to this dynasty (about 212 B.C. and divided the kingdom between his two grandsons, testing their loyalty and ability to govern. Later, he subdivided it among his younger sons, and assumed the title of king of kings. The new king was subjected to a number of Persian origin, the district of Sophene in the west (on the Euphrates and the sources of the Tigris) to Zariades, the eastern part, called Armenia Major (round the lake of Van) to Artaxias. After the battle of Magnesia (190) both remained independent; Artaxias conquered the valley of the Araxes, where he founded his new capital Artaxata ("town of Artaxias," said to be built by the advice of Hannibal, Strabo xii. 528; Plut. Lec. 37). He was defeated and taken prisoner by Antiochus IV. Epiphanes in 165 (Appian, Syr. 45, 66), but soon became independent again in the troubles of Mithradates, his death (cf. Diod. xxi. 274); and his successors extended their power even farther against Media and the districts on the Kur. But from 140 the Parthians became the dominant power east of the Tigris. King Artavasdes of Armenia was attacked by Mithradates II. The Great about 105 B.C. (Justin xii. 2). He had to give his son Tigranes (b. 140 B.C. according to Lucian, Macrobr. 15; by Appian, Syr. 48, he is called "son of Tigranes"); if that is correct, he probably was the nephew of Artavasdes) as hostage to the Parthians, and he obtained his freedom only by ceding seventy valleys bordering on Media (Strabo xi. 524 cf. xvii. 321). During his first war with Rome, Mithradates was supported by Tigranes, although he abstained from interfering openly. But he meanwhile began war with the Parthians, whose empire was weakened after the death of Mithradates II. (about 88) by internal dissensions and invasions of the Scythians. Tigranes reconquered the valleys which he had ceded, and laid waste a great part of Media, down to Ecbatana (Isidor. Charac. 6), and the districts of Nineveh and Arbela; the kings of Artaxata, Gordyene (the country of the Carduchi, now Bohtan), Ardabene (the former Assyria) and Orsoene (Edessa) became his vassals, who attended him like slaves wherever he went; northern Mesopotamia also was taken from the Parthian Empire (Strabo xi. 529, 747; Plut. Lec. 32). In 83 he invaded Syria, defeated the last successors of Seleucus and occupied Cilicia, of which the eastern parts still belonged to the Seleucids (Justin xi. 13; Appian, Syr. 48; Plut. Lec. 14, 21). In 81 he was in battle with Mithradates and Sulla and he did not interfere, but after the death of Sulla (78) he occupied Cappadocia again and expelled King Ariobarzanes I., the vassal of the Romans (Appian, Mihr. 67; Strabo xii. 539). During the next years wars are mentioned in Syria, when the princes Cleopatra Selene attempted to establishe herself in the Seleucid rule, but was besieged in Acco and afterwards killed (Joseph. Ant. xiii. 16, 4; Strabo xvi. 749), and in Cilicia, where he destroyed the Greek town of Soli (Plut. Pompeu. 28; Dio Cass. xvi. 37). Tigranes now had become "king of kings" and the mightiest monarch of Asia. So he built a new royal city, Tigranocerta, on the borders of Armenia and Mesopotamia, between Mt. Masius and the Tigris, where he accumulated all his wealth and to which he transplanted the inhabitants of twelve Greek towns of Cappadocia, Cilicia and Syria (Plut. Lec. 21, 26; Appian, Mihr. 67; Strabo xi. 522, 532, 539; Plin. vi. 26 seq.; for the situation, which is much disputed, cf. Tac. Ann. xiv. 24, xv. 5, ed. Furneaux). He also transplanted many Arabic tribes into Mesopotamia (Plut. Lec. 21; Plin. vi. 142). But the Romans could not tolerate encroachment upon their sphere of power, and in 69 Lucullus invaded Armenia. Tigranes was beaten at Tigranocerta on the 6th of October 69, and again near Artaxata in September 68. The recall of Lucullus gave some respite to the two kings, who even invaded Asia Minor again. But meanwhile a son of Tigranes and Cleopatra, called Tigranes, like his father, rebelled against him (as the old man had already killed two of his sons, he had reason enough to be afraid for his life) and found refuge with the Parthian king Phraates III., whose daughter he married and who sent him back with an army (Appian, Mihr. 104; Plut. Pompeu. 33; Dio Cass. xxxvi. 21). The old king now gave up all hope of resistance; he put a price on the head of Mithradates, and when Pompey advanced into Armenia and united with the younger Tigranes, he surrendered himself to the Roman general (66 n.c.). Pompey now changed his policy; he received the old Tigranes graciously and gave him back his diadem, while he treated the son very coolly and soon made him prisoner. The younger Tigranes was led in triumph into Rome, where he found his death when he tried to escape from his confinement by the intrigues of P. Clodius in 58 (Dio Cass. 38, 30). The father after his defeat ruled about ten years longer over Armenia, as vassal of the Romans. He died about 56, and was succeeded by his son Artavasdes. (See also Mithra- datcs.)

TIGRIS, a northern province of Abyssinia; one of the principal divisions of the country, the others being Amhara or Gondar in the centre and Shoah in the south. The seat of power of Tigris has been often a more powerful potentate than the nominal emperor. Tigris contains the town of Axum (q.v.), capital of the ancient Ethiopic Empire. Adua (Adowa, q.v.) is the capital of the province. (See Abyssinia.)

Tigrina, the dialect spoken in Tigré and Lasta, is nearer the ancient Geez than is Amharic, the official and more widely diffused language of Abyssinia. See J. Schröber, Manuel de la langue tigris (Vienne, 1887-1893); and L. de Vito, Grammatica della lingua tigrina (Rome, 1895).

TIGRIS (Old Persian Tigr, Diklat of the cuneiform inscriptions, Hiddekel of the Old Testament, Diglath of the Targum, Digla of the Arabs), a great river of western Asia, rising from two principal sources. The more western of these is about 15 m. S. of Lake Uegulik (Cholchis of the ancients), at an altitude of 550 ft., some 2 or 3 m. only from the channel of the Euphrates, which here forms a peninsula by a great bend (38° 40' N., approximately 30° 20' E.). The eastern source, which joins the main stream at Til (37° 45' N., 41° 46' E.), is itself divided into two branches, or rather it may be said to consist of a network of small streams, the most northerly of which has its origin in about 38° 40' N. to the west of Lake Van, and close to the headwaters of the Murad Su, the eastern branch of the Euphrates, where the most easterly point is situated in a region about 42° 30' E., southward of the same lake. The two sources together drain the region south as the Euphrates drains the region north of the Taurus mountains. After the junction of the two branches the river pursues a winding course, generally south-east, for about 800 m. to the point of union with the Euphrates at Garmat Ali, whence it is known as the Shatt-el-Arab until it emptied into the Persian Gulf some 70 m. lower down. For some five or six centuries before 1908-1909 the junction with the Euphrates was at Kokan, some 70 m. to the west of Garmat Ali. On the western side there are no tributaries at the present day. As late as 1858, however, the Arabian geographers mention a tributary, the Tharthar, navigable in flood time, which flowed from the Jahgah branch of the Khabur, a tributary of the Euphrates, to the Tigris. Ormsby, in 1853, also reported a river, the Asas Amir, as coming down from the Sinjar hills and joining the Tigris near Kal-iat Shergat, about 35° 30' N.; but this seems now to be a dry bed. On the eastern side of the river, on the other hand, there are several important tributaries descending from the Persian
mountains; the Kabur, a little north of 37° N., navigable for rafts; the Great Zab, at 36° N., just below Nimrud, the ancient Calah; the Little Zab, about 35° 15' N.; the 'Adhem at 34° N. and the very large and important Diyalu, a little below Bagdad, at 33° 15' N.

The course of the Tigris is much shorter than that of the Euphrates, about 1,500 m., as compared with 1,800 m., but its volume of water is greater, at least in its lower course. At Bagdad it has an average breadth of about 200 yards and a current in flood time of about 41 ft. per sec., navigable for almost all kinds of boats except above the mouth of the Great Zab, about 30 m. south of Mosul, at which point navigation is blocked by two ancient dams, erected, apparently, to control the river for the Assyrian city of Calah, the ruins of which are still visible and which they conceive to be the work of that mythical hero. Were it not for these dam steemers might reach Mosul itself, at an elevation of 345 ft. above the Persian Gulf. All the great lines of communication of the English and Turkish, furnish an inadequate service between Basra and Bagdad, but there is no steam navigation on the river above the latter city. Small sailing craft navigate upwards as far as Samarra; above this all navigation is downward, and by raft. For rafts the river is navigable from Diarbekir and is termed by the natives "the cheap camelier." The rafts used are the so-called keelless, of wood supported on inflated skins, which are broken up at Bagdad, the wood sold and the skins carried back by caravans.

Near the source of the Tigris, at Arghanna-Ma'den, are copper mines, and at Hamshahr is a large iron. Bagdad and its vicinity are important for some distance, occur sulphurous and bituminous springs. There are also in that neighbourhood famous marble quarries. This part of the river's course, the ancient Assyria, is also a rich agricultural region.

From a little above the confluence of the Great Zab downward, the banks of the river are absolutely uninhabited, and the river flows through a desert until Tekr is reached. Beginning shortly below Tekrit there are indications of considerable civilization, both for the purpose of irrigating country remote from the river, and also for shortening the course of the river for navigation. In ancient times the country on both sides of the river was occupied by tribes so situated below this point, the waters of the Tigris were under thorough control, and it and its lower tributaries, the 'Adhem and the Diyalu, were made, by means of huge canals, to furnish great water-ways for commerce. While it and its smaller branches flow through the maritime plains of the Persian Gulf, and these canals are the best known, and probably the greatest, was the Nahrawan, which, leaving the Tigris, on its eastern side, above Samarra, over 100 m. north of Bagdad, rejoined it below Kut-el-Amarah, equal distance to the south. None of these canals is serviceable at the present time, and few carry water in any part of their course, even in flood time.

A little south of Samarra the stony plateau of Mesopotamia ends, and the alluvial plain of Irak, ancient Babylonia, begins. Here the palm groves begin also, and from this point on is a little beyond Bagdad the shores of the river are well cultivated. At the point just above Bagdad the Tigris seems to have lost the maritime face and bed of the river, and be lower than that of the Euphrates, so that the canals run from the latter to the former stream. At Bagdad the Tigris and Euphrates are less than 35 m. apart, then they run side by side, the Tigris being eastward of and a little north of the Euphrates; at Shat-el-Hai they are separated by almost 100 m. From Bagdad downward, the course of the Tigris is peculiarly serene and shifting. The mud brought down by it, estimated to 7190 lb. an hour at Bagdad, is not deposited in marshes to form alluvium, as in the case of the Euphrates, but although in flood time the river becomes at places an inland sea, rendering navigation extremely difficult and uncertain, the bulk of the mud is deposited in banks, shoals and islands in the stream of the river, and is finally carried out into the Persian Gulf. At Kut-el-Amarah, approximately half way from Bagdad to Korna, the bed of the Tigris is higher than that of the Euphrates, and according from the former to the latter, its waters flow into the Euphrates and not vice versa.

Shortly below Kut-el-Amarah all traces of ancient canalization on the Tigris are lost; it would appear as though the great plain of the region, now largely under water at flood time, constituted an inland sea. On the west side, however, there are the remains of some canals or channels, some still carrying water, one of which, the Shat-el-Hai, is said to have been navigable for munitions during the Tigris at Kut-el-Amarah, and emptying into the Euphrates at Nasireh, is still navigable. Indeed, in the time of the caliphate this was the channel of the Tigris, and on its banks stood the important city of Aiwa, much more recently the great city of Lagash stood by on its banks. In the time of the Sasanian kings, however, as at the present time, the Tigris occupied a more easterly course. Indeed, the lower course of the Tigris, leaving the Tigris at Kut-el-Amarah, and emptying into the Euphrates at Nasireh, has been subject to change. Below the Shatt-el-Hai the country on both sides of the river is practically a swamp, except where the palm groves have formed land.

The Tigris begins to rise about the middle of November and is highest in May and June, and lowest in September and October. The principal towns on its banks are Diarbekir (anc. Amida), on the western branch; Bitlis, on the eastern branch; Mosul; Tekrit, a town dating from Persian days, said to have been founded by Shapur I. son of Ardashir I., formerly important, but now relatively insignificant; Samarra, also called Samira, the capital of the caliphate from A.D. 827 to 892, a place of pilgrimage of the Shia Moslems, containing magnificent tombs of two of their Imams the tenth and eleventh, with another much venerated shrine of the twelfth, as well as some interesting ruins; and Bagdad. While the Tigris never played the same rôle historically as the Euphrates, numerous remains of antiquity are to be seen along its course. Cuneiform inscriptions and bas-reliefs have been found at the sources of both the western and eastern Tigris, as well as at various points on the cliffs along the upper course of both branches. Opposite Mosul are the ruins of ancient Nineveh, the last capital of Assyria, and 20 m. below that the ruins of Calah, the second capital; while 35 m. farther south, on the opposite bank, lies Kal'at-Shergat, the ancient Assur, the original name-place and capital of the Assyrian Empire. A little south of Samarra are found remains of the Median Wall, which stretched south-west towards the Euphrates near Sahlawych, marking the edge of the Babylonian alluvial plain. In this neighbourhood also stood the ancient Opis. At Bagdad, besides the memorials of the caliphate, may be seen a few remains of the old Babylonian city of Bagdadu, and a dozen miles southward, on the eastern bank of the river, stands Tukah, the modern town of Teesup, the two are connected by a causeway that recedes in a river, on the lowest part of the river, the low mound remains of ancient Seleucia.

See W. F. Ainsworth, Researches in Assyria (1838); R. F. Chesney, The Euphrates Expedition (1888); G. Le Strange, "Description of Mesopotamia and Bagdad" (Journal of the R. A. S. 1892); E. Sachau, Am Euphrat und Tigris (1900). (J. P. P.)

TILBURG, a town in the province of north Brabant, Holland, and a junction station 13½ m. by rail E. by S. of Breda. A steam tramway connects it northwards with Waalwijk. Pop. (1905), 49,317. Tilburg has risen into importance since the separation of Belgium from Holland as one of the chief industrial centres of the south. It has Roman Catholic and Protestant churches, a synagogue, a cloth hall, a higher-burgher school, an art and music school, and a Roman Catholic seminary. The woollen manufacture is the chief industry, besides which there are leather, soap, oil and tobacco factories, as well as breweries, tanneries and iron foundries.

TILBURY DOCKS, on the north shore of the Thames, in the county of Essex, England. They lie opposite Gravesend 25 m. below London Bridge and about the same distance from the Nore, being thus within the port of London. They were constructed by the South Essex and Thames Iron Works Company, and were later owned by the London & India Docks Company. The docks are four in number, having, with tidal basin and entrance locks, a total area of 74 acres. The depth of water in the tidal basin is 25 ft. at low tide and 44 ft. at high tide. The length of quayage is about 2½ m., and there is extensive warehousing as well as accommodation for passengers, as the largest passenger steamers trading with the Port of London lie here. Railway communication is provided by the London, Tilbury & Southend line, and there is direct connexion for goods traffic with all the northern lines.

TILDEN, SAMUEL JONES (1814–1886), American statesman, was born at New Lebanon, New York, on the 9th of February 1814. In 1834 he entered Yale University, but soon withdrew on account of ill health, and later studied in the University of the City of New York. He was admitted to the bar in 1841, and rose rapidly to the front rank. In the financial troubles between 1850 and 1860 it is said that more than half the railways north of the Ohio river and between the Hudson and the Missouri rivers were at some time his clients. In spite of his activity at the bar, Tilden maintained an interest in politics, serving in the State legislature in 1846 and in the state constitutional conventions of 1846 and 1867. In 1848, largely on account of his personal attachment to Martin Van Buren, he participated in the revolt
of the "Barnburner" or free-soil faction of the New York Democrats, and in 1855 was the candidate of the "softshell," or anti-slavery, faction for attorney-general of the state. During the Civil War, although he opposed several of the war measures of President Lincoln's administration, he gave the Union cause his heartfelt support. In 1866 Tilden became chairman of the Democratic state committee, and soon came into conflict with the notorious "Tweed ring" of New York City. As the "ring" could be destroyed only by removing the corrupt judges who were its tools, Tilden, after entering the Assembly in 1872 to promote the cause of reform, took a leading part in their impeachment. By analysing the bank accounts of certain members of the "ring," he obtained legal proof of the principle on which the spoils had been divided. His fame as a reformer brought him to the governor's chair in 1874, and he at once gave his attention to a second set of plunderers—the "canal ring," made up of members of both parties who had been systematically robbing the state through the maladministration of its canals—and succeeded in breaking them up. In 1876 the Democrats nominated him for the presidency, the Republicans nominating Rutherford B. Hayes of Ohio. The result was the disputed election of 1876, when two sets of returns were sent to Washington from the states of Florida, Louisiana, South Carolina and Oregon. As the Federal Constitution contained no provision for settling a dispute of this kind the two houses of Congress agreed to the appointment of an extra-constitutional body, the "Electoral Commission" (q.v.) which decided all the contests in favour of the Republican candidates. Tilden counselled his followers to abide quietly by the result. In 1878 the New York Tribune (Republican) published a series of telegraphic despatches in cipher, accompanied by translations, by which it attempted to prove that during the crisis following the election Tilden had been negotiating for the purchase of the electoral votes of South Carolina and Florida. Tilden denied emphatically all knowledge of such despatches, and appeared voluntarily before a Congressional sub-committee in New York City to clear himself of the charge. The attempts to implicate him in corrupt transactions were not successful; but his political opponents endeavoured to make capital in subsequent campaigns, out of the "Cipher Despatches." The remainder of his life was spent in retirement at his country home, Greystone, near Yonkers, New York, where he died on the 4th of August 1886. Of his fortune (estimated at $5,000,000) approximately $4,000,000 was bequeathed for the establishment and maintenance of a "free public library and reading-room in the City of New York"; but, as the will was successfully contested by relatives, only about $2,000,000 of the bequest was applied to its original purpose; in 1893 the Tilden Trust was combined with the Astor and Lenox libraries to form the New York Public Library.

See the Writings and Speeches of Samuel J. Tilden (2 vols., New York, 1885) and Letters and Literary Memorials of Samuel J. Tilden (2 vols., New York, 1908), both edited by John Bigelow; also Bigelow's Life of Samuel J. Tilden (2 vols., New York, 1895); and E. Haworth's The Hayes-Tilden Disputed Presidential Election of 1876 (Cleveland, 1906).

TILE (O. Eng. tile, Fr. tuile, connected with Lat. tegula), the name given to flat slabs of baked clay or other material used for a great variety of architectural purposes, such as covering roofs, floors and walls.

1. Roofing Tiles. In the most important temples of ancient Greece the roof was covered with tiles of white marble, fitted together in the most perfect way so as to exclude the rain. In most cases as in the Athenian Parthenon and the existing temple of Aegina the tiles were large slabs of marble, with a flange along each side over which joint tiles (αργυρία) were accurately fitted (see A. in fig. 1). In the temple of Apollo at Bassae, though the main building was of limestone, the roof was covered with very beautiful tiles of Parian marble, which are especially mentioned by Pausanias as being one of the chief beauties of the temple. Some of these were found by Mr Cockerell during his excavations at Bassae early in the 19th century. In design they resemble the other examples mentioned above, but are peculiar in having a joint piece worked out of the same slab of marble as the adjacent tiles (see B in fig. 1) at great additional cost of material and labour, in order to secure a more perfect fit. Fig. 2 shows the

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**Fig. 1.** Examples of roofing tiles from Greek Temples.
A, B, Marble tiles from Aegina; D, Sketch showing method of jointing at the lower edge. A, B, showing two methods of working the E, Longitudinal section of a clay joint-tile. C, C, Clay tiles from Olympia. F, Joint-tile with peg to fix it.

**Fig. 2.** Perspective sketch showing the arrangement of tiles B in fig. 1, at Bassae.
A, B, Dowels to fix the joint-tiles. C, Tilting piece. a, a, Flat surface of tiles.

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1 In Egypt and Assyria temples and palaces were mostly roofed with stone, while inferior buildings had flat roofs covered with beaten clay (see also Terra Cotta).
3 Marble tiles are said to have been first made by Byzas of Naxos about 620 B.C.; see Pausanias v. 10, 2.
TILE

edge of the next tile and the joints were covered with a semi-circular joint tile (imbrex). Rows of terra-cotta antefixae were set along the eaves of the roof, and were often moulded with very beautiful reliefs. In localities which supply laminated stone, such as Gloucestershire and Hampshire in Britain, the Romans often roofed their buildings with stone tiles fastened

brick-clay exists. In some places pan-tiles are still used and have a very picturesque effect; but they are liable to let in the rain, as they cannot be securely nailed or well bedded in mortar. In Gloucestershire, Yorkshire, north-east Lancashire and other counties of England, stone tiles are still employed, but are rapidly going out of use, as they require very strong roof timbers to support them, and the great extension of railways has made the common purple slates cheap in nearly every district. The green slates of the Lake District are now extensively used for this purpose, often with excellent effect.

Some of the mosques and palaces of Persia are roofed with the most magnificent, enamelled, lustred tiles, decorated with elaborate painting, so that they shine like gold in the sun. They were specially used from the 13th century to the 18th. In style and manufacture the finest of them resemble the frieze shown in fig. 5.

2. Wall Tiles.—These are partly described under MURAL DECORATION (p. 446). In most oriental countries tiles were used in the most magnificent way throughout the middle ages especially in Constantinople, Broussa, Damascus, Cairo, Moorish Spain, and in the chief towns of Persia. Fig. 4 shows a fine example from a mosque in Damascus. From the 11th to the 16th century a special kind of lustred tiles was largely employed for dadoes, friezes and other wall surfaces, being frequently made in large slabs, modelled boldly in relief with sentences from sacred books or the names and dates of reigning caliphs. The whole was picked out in various, usually dark or turquoise blue, on a ground of cream-white enamel, and in the last firing minute ornaments in copper lustre were added over the whole design, giving the utmost splendour of effect (see fig. 5). Great skill and taste are shown by the way in which the delicate painted enrichments are made to contrast with the bold decoration in relief. These lustred tiles sometimes line the prayer-niche in houses and mosques; in such cases the slabs usually have a conventional representation of the kaaba at Mecca, with a lamp hanging in front of it and a border of sentences from the Koran. The mosques of Persia are specially rich in this method of decoration.

The Victoria and Albert Museum, London, contains many fine examples of the early as well as of the later sorts, like those shown in fig. 4.
magnificent examples existing at Natenz, Seljuk, Tabriz, Isfahan and other places. Indian tile-work is specially described in the article KASHMIR.

Stamped Spanish tile decoration in its earliest form was an imitation of mosaic, whereof enameled tile of various colors being arranged in geometrical patterns, or combined with glass or stone for the purpose. In the 14th and 15th centuries this process was supplanted by one in which the variously shaped and colored sections of tile were separated by means of narrow bands of the same material, enameled in white and disposed in various combinations of geometrical interlacing. Of this kind are the bulk of the Alhambra tiles. But the tediousness of the process gave rise, about 1450, to what is known as the cuerda seca (or "dry cord") method, in which narrow fillets at the edges of the separating interlacings were first stamped. After the tiles were fired, these being fired (thus forming a "dry cord" or line) formed shallow compartments which were in turn filled with colored enamel, white being used for the interlacings themselves. The process was much in vogue in Andalusia and Castile until about 1550, when there arose the method de cuenca in which the parts of the design to receive different coloured enamels were stamped, slightly concave (cuenca—a bowl or socket), their edges alone being left in relief. This process lasted until about the commencement of the 18th century.

At Manises, Paterna and elsewhere in Valencia, soon after the middle of the 14th century there commenced an extensive production of white enameled tiles painted with designs in blue (more rarely in lustre and manganese) for wall and pavement decoration. This manufacture continued throughout the 15th century and produced some of the finest freestanding tile designs that are known to-day. The motifs included figure compositions, animals, plants, coats of arms, &c., drawn with great skill and facility. Most of these tiles are to be found in old houses in the city and province of Valencia.

In Catalonia, in the 16th century, blue and white painted tiles were produced in imitation of those of Valencia. For the most highly finished of these stencils were employed to block out the designs. Polychrome painting upon tiles in the Italian manner was introduced into Spain by Niculoso Francisco of Pisa, who settled at Seville (1503-1508) and executed altar-pieces and architectural details in tile work. This imported Italian style was much affected for armorial decoration.

In the 16th and 17th centuries tiles of a coarse kind of majolica were used for wall decoration in southern Spain; some rich examples still exist at Seville. These were the work of Italian potters who had settled in Spain.

LITERATURE.—A. Van de Put, Hispano-Moresque Ware of the XVIth Century (1904); G. J. de Osma, Apuntes sobre cerámica morisca: textos y documentos valencianos, No. 1 (1906), and Los Letreros ornamentales en la cerámica morisca del siglo XV, in the review Cultura española, No. II., 1906); J. Font y Guma, Rijolos valencianos y catalanas (1905); J. Gestoso y Perez, Historia de los barro virdiados sevillanos (1904).

3. Floor Tiles.—After the development of painted and lustred tiles in Spain and Italy for the decoration of wall surfaces, they were also introduced, during the latter part of the 15th and the first part of the 16th centuries, as pavements, especially in the chapels of the famous cathedrals of those countries. Comparatively few examples of these pavements now exist, as the majolica enamel was too soft to stand the wear of the feet of worshippers. The earliest known pavement of this type is that in the church of San Giovanna Carbonara in Naples, which is dated, approximately, 1440. The tiles, square and hexagonal in shape, are coated with white enamel and are painted chiefly in dark blue, with touches of green and purple. The British Museum, the Louvre and other museums have secured odd examples of these tiles. It seems probable from the technical methods of the work that it was produced by a Spanish or even a Moorish hand. It is well known that Moorish tile-makers did travel both into Italy and into France to embellish the palaces of great nobles or the chapels they founded. There is the well-known instance of the Moorish potter, Jean de Valence, who, in 1354, was brought to France by Jean de Berry to make tiles for the adornment of his ducal palace at Poitiers. One of the most important of these early majolica pavements is that made for the Convent of San Paolo at Parma, now in the museum of that town, which was probably laid down in 1482. One of the south chapels in the church of S. Maria del Popolo in Rome has a very fine pavement of painted tiles, executed probably at Forli, about 1460, for Cardinal della Rovere (Julius II.), whose arms—a oak tree—are repeated over and over again among the rich decorations. A still more magnificent tile floor, in the uppermost of Raphael's Vatican loggie, is mentioned in the article DELLA ROBBIA, where also are described the exquisite, enameled tiles which Luca della Robbia made as a border for the tomb of Bishop Federighi at Fiesole near Florence. Fine examples of tile pavements of 1486 exist in the basilica of S. Petronio at Bologna. The chapel of St Catherine at Siena and the church of S. Sebastiano at Venice have majolica pavements of about 1510. Fig. 6 shows an example of about this date from

**Fig. 6.—Majolica Paving Tiles from Siena, made in 1509.**

The Petrucci Palace in Siena, now in the Victoria and Albert Museum. In the early part of the 16th century majolica tiles from Spain were occasionally imported into England. At the south-east of the mayor's chapel at Bristol there exists, though much worn, a fine pavement of Spanish tiles dating from about 1520. Others have been found in London, at Newington Butts, and in other places.

Long before the southern nations of Europe were introducing their painted majolica tile pavements, a much more practical type of flooring tile was in use in Germany, France and England; of these the English encaustic tile pavements, dating from the early years of the 13th century to the end of the 16th century, are particularly important and beautiful. These Northern peoples had no knowledge of enamels and colours such as was possessed by the contemporary tile-makers of Moorish Spain or of Italy, and they were confined to the native red-brick earths and white pipeclays for their materials. The method of decoration was as simple and homely as the materials. Slabs of ordinary red-brick clay freed from pebbles, but not from grit or sand, were shaped by pressing cakes of clay into a mould of wood or baked clay, carved in such fashion that when the clay was just hard and dry enough to be removed from the mould the important elements of the design were formed as sunk cells divided by broad raised outlines. While this red tile was still soft and plastic, a thickish paste of pipeclay or other light-burning clay was poured into the cells and allowed to stiffen.
When the whole had dried sufficiently the surface was scraped level, with a thin sharp tool, with the result that the tile appeared with a kind of close-knit design, the cloisons or boundaries of the cells being, of course, the upstanding ridges of the moulded red tile. Over the surface of the tile finely powdered galena (native sulphide of lead) was freely dusted, and the whole was fired at one operation with the resulting production of a tile or tiles bearing a yellowish white pattern relieved against red or chocolate, and glazed with a natural lead glaze, which was much harder and better adapted to resist wear than the majolica glazes of Spain or Italy. The origin of this type of pavement tile is still obscure; one idea is that they were a development of the Roman Mosaic pavement, for, in examples discovered at Lambeth, and at Lambeth and the Abbey Church of Westminster, in which the tiles were of great variety of form and size, and, instead of the patterns being wholly inlaid in the tiles themselves, the design is, to a large extent, produced by the outlines of the individual pieces, which, in the later examples, are cut to the forms required to be represented, including the subject of the "Temptation of Adam and Eve," trees, lions, &c., the tesserae being also enriched with what may be more strictly called encaustic decoration. The more probable origin of this method of work seems, however, to be a development of the pavement tiles with simple incised designs which were made in the northern parts of England, in the Rhine Valley and in Flanders. Most interesting examples of these incised tiles are to be found in the cathedral of St Omer, which are known to be of the 12th century, and it seems impossible to resist the conclusion that such incised work forms the starting-point of the English encaustic tile-makers. A similar piece of work exists in Canterbury Cathedral, where we have stone tiles engraved with pictorial designs, the sunk parts being filled with a dark cement—this pavement also belongs to the 12th century.

Four styles of decoration are found on medieval Gothic tiles (1) incised (2) raised (3) inlaid (4) slip-painted. It is to the third of these groups—the inlaid—that the name of "encaustic" tiles had been particularly given. The manufacture of medieval Gothic tiles was apparently the secret of certain religious houses in England, belonging either to the Benedictine or the Cistercian Orders. The earliest date at which we have tangible proof of the existence of this art is 1237, in which year it was ordered that the king's little chapel at Westminster should be paved with "painted tile": "mandatum est etc., quod Parvum capellam apud Westm. regina piceta decenter pavocti faciatis," Rot. Claus. 27, Henry III. M. 10, A.D. 1237-38. During the 14th century, tiles were used in the church of the Abbey of Westminster, and, in the 15th century, a pavement of this kind was exposed in the chapter-house of Westminster, which is to view a tile pavement in good preservation which, though it can hardly be the pavement in question, is evidently of contemporary manufacture.

The finest and most artistic of these early English tiles were those found in Chertsey Abbey in Surrey. They were found in a very fragmentary condition on the Abbey site, but have been to a great extent pieced together by Mr. H. H. Shurlock. Practically all the tiles that have been recovered are now in the British Museum (a number of them were formerly in the architectural museum at Westminster). They constitute a remarkable series of illustrations from the English romance of Sir Tristram and of events in the history of Richard Coeur-de-Lion (see Hobson's Catalogue of English Pottery in the British Museum, pl. ii.). Mention should also be made of the tile pavement discovered at the abbey of Halesowen in south Staffordshire. Many of these tiles are of very similar design to those of Chertsey, while some appear to have been made from the same moulds. From the evidence of inscriptions it would appear that this pavement was laid down in the latter part of the 13th century.

Combinations of tiles forming a cross were frequently used as mortuary slabs; an example is in Worcester Cathedral in situ, whilst detached component tiles of similar slabs are to be found in other ancient churches.

Encaustic tiles are almost exclusively used for pavements, but an interesting instance of their employment for wall decoration occurs in the Abbey Church of Great Malvern, where these tiles have probably been originally used to form a reredos, and bear designs representing Gothic architecture in perspective, have introduced into them the sacred monogram "I.H.S.," the crowned monogram of "Maria," the symbols of the Passion, the Royal Arms and other devices. This example is also interesting as bearing the date of its manufacture on the margin "Anno R. R. H. VI. XXXVJ," that is the thirty-sixth year of the reign of Henry VI. (1457-1458).

Kilns for tile-burning have been found at Bawsey, near Lynn, Norfolk; Malvern, containing some 15th-century tiles; Repton; Farringdon Street, London; and Great Saredon, in Staffordshire, with tiles of the 16th century.

LITERATURE.—John Gough Nicholls, Examples of Encaustic Tiles (1845); Henry Shaw, Specimens of Tile Pavements (1848); T. Oldham, Ancient Irish Pavement Tiles; Frank Renaud, The Use and Teachings of Ancient Encaustic Tiles; Lancashire and Cheshire Antiquarian Society, vol. ix.; W. W. Pocock's article in The Surrey Archaeological Collections (1868); J. R. Holiday on "Halesowen Tiles," in Transactions of the Birmingham and Midland Institute (1871); Mr. J. C. Medcalf, Shurlock. Tiles from Chertsey Abbey (1895); Major Heales, F.S.A., The Chertsey Tiles (1886); W. Burgess, in The Builder (July 24, 1858).

With the downfall of the monasteries in the reign of Henry VIII. the making of encaustic tiles in England appears to have come to an end, and for nearly two centuries foreign tiles were imported from Germany, the Netherlands, Italy and Spain, or workmen from those countries must have practised their art here. There are in evidence the well-known glazed tiles in the British Museum which, if made in England at all, were obtained from America. The use of encaustic tiles, however, continued until the 17th century, and many of the tiles used in the house of Sir Nicholas Bacon (c. 1500-1579) are obviously the work of an Italian majolist, whether they were made in Italy or in England. Increasing intercourse with the Netherlands brought into this country and, during the 17th century into the American colonies, the famous Delft tiles, painted either in blue, or in blue and manganese purple, on a tin enamel ground like that of the contemporary Delft pottery. From the 16th century onwards every country in Europe continued to make tiles by methods strictly analogous with their contemporary pottery (see CERAMICS). Thus we have in Italy and Spain, throughout the 17th and 18th centuries, wall tiles in the style of the debased Italian majolica; in Germany a continuation of the ancient German stove tiles, either glazed with green, brown or black glaze, or bearing painted designs in the crude colours characteristic of the contemporary German pottery; in France there were, first, the painted tile pavements of Massicot Abaquesne of Rouen (1542-1557), and later the decorative tiles produced at Rouen, Nevers, Marseilles and elsewhere, always in the style of the current pottery of the same centuries, and painted for decoration of fireplaces and for use as wall panels formed a considerable part of the output of the Dutch factories. Wherever imitations of Delftware were made, in England, Germany or the north of France, the manufacture of similar tiles naturally followed; and at Lambeth, Liverpool and Bristol, the chief centres of this industry in England, large quantities of tiles were made, especially during the 18th century. The tiles produced at Lambeth and Bristol factories were invariably painted after the manner of their Dutch prototypes, but during the latter half of the 18th century Liverpool became famous for its printed tiles, in which designs, mostly in black, transferred from engraved copper plates, took the place of hand-painting. Fine examples of all these 18th-century English tiles are to be found in the British Museum; the Guildhall Museum; the Victoria and Albert Museum, London; and in the museums at Liverpool and Bristol.

During the 17th and 18th centuries the old painted and
decorated pavement tiles seemed to have been entirely replaced by the common buff or red terra-cotta "quarries" so largely used in farmhouse kitchens, dairies, &c., and it is to the painted tiles for walls and fireplaces that we have to look for the progress of the art.

The modern revival of tile-making in Europe dates from about 1830, when Samuel Wright, a potter of Shelton, near Stoke-upon-Trent, was granted a patent for the manufacture of tiles by mechanical means. His patent was extended for fourteen years, and in 1844 was purchased, in equal shares, by Herbert Minton—head of the famous firm of Minton, of Stoke-upon-Trent—and Fleming St John, of Worcester. In 1848 the firm of Minton acquired the sole right of the patent, and many of their designs were produced by such famous architects as Pugin, Gilbert Scott, Street, &c., so that between 1850 and 1880 encaustic tiles had a great vogue for pavement work not only in England, but in all civilized countries, and fine examples of the rich encaustic pavements made at Minton's, Maw's, or Godwin's of Hereford, are to be found in many of the restored cathedrals and churches of this period.

Side by side with the revival of this ancient process, there was developed an essentially modern process of manufacturing by compressing pulverized clay in metal dies under a screw press. This was the outgrowth of a patent granted to Richard Prosser in 1840, and worked out and perfected at the works of Minton at Stoke-upon-Trent. The advantages of this method of manufacture consist in (a) greater rapidity in execution than can be effected by the greater mechanical, and (b) the greater mechanical accuracy of the finished tile due to the steel dies used in shaping the tile and to the diminished contraction in drying and firing. This essentially modern method of tile-making is really an outcome of the methods introduced in the manufacture of English earthenware (see Ceramics), and it has not only been extensively developed in England, but has been adopted, practically without modification, in all the leading countries of Europe and in the United States.

The manufacture of tiles by the compression of powdered clay rendered possible the introduction of many varieties—plain, inlaid, embossed and incised. The designs in these cases, though generally based on old work, are so different, especially in mechanical finish, that they form a class of tiles entirely distinct from old work. Economically, and for all practical purposes, they afford a style such as the world has never before seen, but, like many modern productions—perfect in execution and finish—they lack the spontaneity and artistic charm of the work of bygone days.

Since the middle of the 19th century artist-potters in many countries have gone back to the ancient methods of production for highly painted tiles, and, in this connexion, productions of Deck in France, William de Morgan and Pilkington’s in England, mark a distinct departure from contemporary modern work.

The extended use of tiles for interior decoration has created a large trade in these articles, either for wall or floor decoration. Among the most important firms engaged in this branch of the ceramic industry must be mentioned Minton’s, Hollins & Co., Maw & Co., and Pilkington’s in England; Villeroy & Boch in Germany; Utschneider & Co. in France; Boch Frères in Belgium; Thoofit & Labouhere at Delft, Holland; and the American Encaustic Tile Co., in the United States.

Literature.—Besides the works mentioned in connexion with special sections in the text a good deal of information about tiles in general, and modern tiles in particular, will be found in Furnival, Leadless Decorative Tiles, &c.; L. L. Jewitt, Ceramic Art of Great Britain; see also Porter, Geschichte der europäischen Fliesen-Keramik.

(T. B.*

TILLEMONT, Sébastien Le Nain de (1637-1698), French ecclesiastical historian, was born in Paris on the 30th of November 1637. His father, a wealthy member of the legal class, being a devoted Jansenist, the boy was brought up in the little schools of Port Royal. Here his bent towards historical study was warmly encouraged, and in 1660 he was made a tutor in the seminary of Buzenval, Jansenist bishop of Beauvais. Ten years later he came back to Paris, and was eventually persuaded (1676) to enter the priesthood, and become a chaplain at Port Royal. In 1679 the storm of persecution drove him to settle on his family estate of Tillemont, between Montreuil and Vincennes. There he spent the remainder of his life, dying on the 10th of January 1698. He was buried at Port Royal; in 1711, on the desecration of the cemetery, his remains were transferred to the church of St André des Arcs in Paris.

From the age of twenty he was at work on his two great books—the Mémoires pour servir à l'histoire ecclésiastique des six premiers siècles, and the Histoire des empereurs de l'Empire Romain, during the same period. Both works began to appear during his lifetime—the Histoire in 1690, the Mémoires in 1693—but in neither case was the publication...
finished till long after his death. To his modesty Bossuet bears witness, when he told him to stand up sometimes, and not be always on his knees before a critic. Gibbon vouches for his learning, when (in the 47th chapter, On the erudition, veracity, diligence, and scrupulous minuteness.) There is a full account of his life in the 4th volume of Sainte-Beuve's Port Royal.

TILLEY, Sir Samuel Leonard (1618-1690), Canadian statesman, was born at Gagetown, New Brunswick, on the 28th of May 1618, the son of Samuel Tilley, an American Loyalist, who had settled in St. John in 1783. In 1850 he was elected to the local legislature as a Liberal representative of St. John. He soon became prominent from his opposition to the liquor traffic, and in 1853 persuaded the assembly to pass a prohibitory law, which proved a failure, and was repealed. From 1860 to March 1865 he was premier of the province, and was prominent in organizing the conference on the union of the maritime provinces, which met at Charlottetown in 1864, and which soon widened into a discussion of Canadian federation. In 1856 he was defeated in a general election on the federation question, but returned to power in 1866, partly through an intrigue of the colonial office. From 1868 till November 1873 he held various portfolios in the Dominion cabinet; from 1873 to 1878 he was lieutenant-governor of New Brunswick, but in 1878 was again elected as member for St. John, and entered the Conservative cabinet as minister of finance. Later in 1878 he introduced and carried through parliament the "national policy" of protection, on which issue the election of 1878 had been won. The tariff so introduced became the basis of Canadian financial policy. In October 1883 ill health forced him to retire from the cabinet, and he was again appointed lieutenant-governor of New Brunswick, which position he held till 1893. He died on the 25th of June 1896. In 1879 he was created K.C.M.G. His kind and honourable private character was admitted by all; his political merits are judged differently by advocates and opponents of the policy of protection which he introduced, but of his financial ability and grasp of detail there is no doubt.

His Life, by James Hannay (1907), forms one of the "Makers of Canada" series.

TILLODONTIA, a group of mammals of uncertain position, typified by Tillemium from the Middle Eocene of Wyoming,

and perhaps including Esthonyx from the Lower Eocene of the same district, and other genera from the same horizon in both North America and Europe. In Tillemium the skull is decidedly rodent-like, with an elongated cranial and a short facial portion, and a small brain-cavity; the jugal bone occupying the middle of the zygomatic arch. The dentition, of which the formula is $i, I, c, I, p, I, m, I$, also approximates to the rodent type, the canines being minute and functionless, and the first pair of incisors large and chisel-like. On these and other grounds it has been suggested that Tillemium (of which the greater part of the skeleton is known) indicates the ancestral form of the Rodentia. Professor Max Weber considers, that such a view has but little justification. Relationship with the Ungulata and Carnivora has also been suggested; if there be any with the latter, it must have been with the most primitive forms, as the plantigrade feet are furnished with five toes carrying long pointed claws.

(From Marsh.)

Skull of Tillemium fodiens. (1 nat. size.)

Possibly Platychroerm richardsoni, from the Lower Eocene London Clay, belongs to the group. (R. L. *)

TILLOTON, John (1630-1694), English archbishop, was the son of a Puritan clothier in Sowerby, Yorkshire, where he was born in October 1630. He entered as a pensioner of Clare Hall, Cambridge, in 1647, graduated in 1650 and was made fellow of his college in 1651. In 1656 he became tutor to the son of Edmond Prideaux, attorney-general to Cromwell. About 1661 he was ordained without subscription by T. Sydserf, a Scottish bishop. Tillotton was present at the Savoy Conference in 1661, and renounced the Presbyterian creed in the preamble to the Act of Uniformity in 1662. Shortly afterwards, he became curate of Cheshunt, Herts, and in June 1663, rector of Kedington, Suffolk. He now devoted himself to an exact study of biblical and patristic writers, especially Basil and Chrysostom. The result of this reading, and of the influence of John Wilkins, master of Trinity College, Cambridge, was seen in the general tone of his preaching, which was practical rather than theological. He was a man of the world as well as a divine, and in his sermons he exhibited a tact which enabled him at once to win the ear of his audience. In 1664 he became precentor of Lincoln's Inn. The same year he married Elizabeth French, a niece of Oliver Cromwell; and he also became Tuesday lecturer at St Lawrence, Jewry. Tillotton employed his controversial weapons with some skill against atheism and popery. In 1663 he published a characteristic sermon on "The Wisdom of being Religious," and in 1666 replied to John Sergeant's Sure Footing in Christianity by a pamphlet on the "Rule of Faith." The same year he received the degree of D.D. In 1670 he became prebendary and in 1672 dean of Canterbury. In 1675 he edited John Wilkins's Principles of Natural Religion, completing what was left unfinished of it, and in 1682 his Sermons. Along with Burnet, Tillotton attended Lord Russell on the scaffold in 1683. He afterwards enjoyed the friendship of Lady Russell, and it was partly through her that he obtained so much influence with Princess Anne, who followed his advice in regard to the settlement of the crown on William of Orange. He possessed the special confidence of William and Mary, and was made clerk of the closet to the king in March 1689. It was chiefly through his advice that the king appointed an ecclesiastical commission for the reconciliation of the Dissenters. In August of this year he was appointed by the chapter of his cathedral preacher at Lincoln's Inn. The same year he married Elizabeth of Canterbury during the suspension of Sancroft. He was also about the same time named dean of St Paul's. Soon afterwards he was elected to succeed Sancroft; but accepted the promotion with extreme reluctance, and it was deferred from time to time, at his request, till April 1691. In 1693 he published four lectures on the Socinian controversy. His attempts to reform certain abuses of the Church, especially that of clerical non-residence, awakened much ill-will, and of this the Jacobites took advantage, pursuing him to the end of his life with insult and reproach. He died on the 22nd of November 1696.

For his manuscript sermons Tillotton's widow received 2500 guineas. Ralph Barker edited some 250 of them together with the "Rule of Faith" (1695-1704). In 1752 an edition appeared in 3 vols., with Life by Thomas Birch, compiled from Tillotton's sermons, theological papers, and letters. Various selections from his sermons and works have been published separately, e.g. by G. W. Weldon in 1886.

TILLY, Johann Tserclaes, Count of (1550-1632), general of the Catholic League in the Thirty Years' War, was born in 1559 at the chateau of Tilly in Braissant. He was destined for the priesthood and received a strict Jesuit education. But, preferring the career of a soldier, he entered Span's infantry and foot regiment about 1574 as a volunteer, and in the course of several campaigns rose to the command of a company. This being reduced, he again became a simple pikeman, and as such he took part in the famous siege of Antwerp by Parma, whose army afforded the best training in the art of war then obtainable. He distinguished himself by his bravery, and the duke of Lorraine gave him the governorship of Dun and Villefranche, which he held from 1590 to 1594. Henry IV. made tempting
offers, which were refused, to induce him to enter the service of France. Somewhat later he left the Spanish service for that of Austria to fight against the Turks. In 1602 he became colonel in the imperial army, and raised a regiment of Walloon infantry, which he commanded in the assault on Budapest, receiving a severe wound. In 1604 he was made general of artillery, and handled his new force with conspicuous success; the campaign of this year showed Tilly as a soldier of great capacity, and in 1605 he was made a field-marshall. His part in the dissensions in Austria, which preluded the 'Thirty Years' War, was marked by unswerving loyalty and devotion to the emperor and the Catholic religion. In 1610 he left the service of the emperor to enter that of Maximilian, duke of Bavaria, the head of the Catholic League. It was not, however, until 1620 that he became lieutenant-general to Maximilian and commander-in-chief of the field forces.

With the great victory of the Weisser Berg near Prague (1622) the new army and its leader became celebrated throughout Germany, and the long and weary campaigns against Christian, Mansfeld and the Protestant princes of the north-west established their reputation. The chief battles were Wimpfen (1622), Stadtlohn (1623), Wiesloch (1622), Höchst (1622), the last being a great victory for the Catholic forces, and winning for Tilly the title of count, which was given by the emperor himself (1622). The military operations of the Thirty Years' War will be found described under that heading. With the intervention of the King of Denmark, the struggle entered upon a new phase, and on the 26th of May, Tilly, after a four-days' stay at Wallenstadt, appeared on the scene, though it was the army of the League which won the great success of the war at Lutter-am-Barenberge (1626). Throughout these arduous campaigns Tilly had other than military difficulties with which to contend. The military superiority of his veterans, trained as they were to their own ideal of "a ragged soldier and a bright musket," may be held to explain his victories over superior numbers, but the energy which he displayed in the midst of political difficulties was not less conspicuous than his leadership and strategy. On two occasions, at least, he was thwarted by orders from the League; once the Protestants were allowed to escape into Holland, once the army of Wallenstein was left to its own resources in the presence of the enemy. That the League achieved the successes which it actually did, was to the credit of Tilly and his men rather than to any action of the allied princes. It may be that Tilly cannot be considered as great a soldier as Wallenstein; it should, however, be borne in mind that the League army never possessed the prestige of an imperial force: that Tilly was repeatedly thwarted by political considerations, and that, even so, the hardest part of the task was achieved by the League and its allies.

The defeat of King Christian was soon followed by the intervention of Gustavus Adolphus, a great captain at the head of the finest troops in Europe. But Tilly was the best general of the old school; the League troops were trained after the Spanish model, and the opening stages of the campaign did not display any marked superiority of the Swedes. At this time Tilly was commander of the imperial forces as well as of his own army. The first great contest was for the possession of Magdeburg (1631). After one of the fiercest struggles of the war, the town was taken by storm on the 20th of March, and the sack which followed was accompanied with every sort of atrocity. For this the old general has been held responsible, yet it was rather the magnitude of the catastrophe than its special cruelties which made it the most striking example of military barbarity in modern history. Tilly's personal exertions saved the cathedral and other religious buildings from pillage and fire. Four months later Tilly and Gustavus, the representatives of the old and the new art of war, met in the battle of Breitenfeld (q.v.). The victory of Gustavus was complete, though the imperial general, severely wounded as he was, managed to draw off his men in good order. A few more months of campaigning brought the two armies to the Lech, where Gustavus was again victorious, and Tilly received a mortal wound. He died on the 30th of April 1632, in Ingolstadt, and was buried in the church at Altenmünster in Bavaria.


**TILSIT,** a town of Germany, in the Prussian province of East Prussia, situated on the left bank of the Memel or Niemen, here crossed by an iron railway bridge, 57 m. S.E. of Memel and 72 N.E. of Königsberg by rail. Pop. (1905), 37,148. The town has a number of handsome modern buildings, including a town hall, a post office, law courts, and a large hospital. It contains four Protestant churches, among them the German church, with a handsome steeple, and the curious circular Lithuanian church, a Roman Catholic church, a Jewish synagogue and a classical school (*Gymnasium*). The manufactures include machinery, chemicals, soap, leather, shoes, glass and other articles, and there are iron-foundries, breweries, and steam flour and saw-mills. Tilsit carries on trade in timber, grain, hemp, flax, herrings and coal; but its trade with Russia, at one time considerable, has fallen off since the construction of the railway from Königsberg to Kovno. The river is navigable for the whole of the town, and steamboat communication with Königsberg, Memel and Kovno.

Tilsit, which received civic rights in 1552, grew up around a castle of the Teutonic order, known as "the Schaulauer Haus," founded in 1288. It owes most of its interest to the peace signed here in July 1807, the Peace of Tilsit, by which the emperors Alexander and Napoleon on a raft moored in the Memel. This treaty, which constituted the kingdom of Westphalia and the duchy of Warsaw, registers the nadir of Prussia's humiliation under Napoleon. The poet Max von Schenkendorf (1784–1817) was born at Tilsit.


**TIMAEUS** (c. 345-c. 295 B.C.), Greek historian, was born at Tauromenium in Sicily. Driven out by Agathocles, he migrated to Athens, where he studied rhetoric under a pupil of Isocrates and lived for fifty years. During the reign of Hiero II. he returned to Sicily (probably to Syracuse), where he died. While at Athens he completed his great historical work. The *Histories*, in at least 38 (Bury says 33) books, was divided into unequal sections, containing the history of Italy and Sicily in early times; of Sicily alone; of Sicily and Greece; of the cities and kings of Syria (unless the text of Suidas is corrupt); the lives of Agathocles and Tychrus, king of Ephesus. The chronological sketch ("Ολυμπιουσικά, the victors at Olympia) perhaps formed an appendix to the larger work. Timaeus was bitterly attacked by other historians, especially by Polybius, and indeed his unfairness towards his predecessors, which was attributed to his being a disciple of Isocrates ("fault-finder," though some authorities render this "old woman," in allusion to his fondness for trivial details), is preferable to the rationalistic interpretation under which it had become the fashion to disguise them. Timaeus also devoted much attention to chronology, and introduced the system of reckoning by Olympiads, with which he compared the years of the Attic archons, the Spartan ephors, and the priestesses of Argos. This system, although not adopted in everyday life, was afterwards generally used by the Greek historians. Although a pupil of Isocrates and a disciple of Isocrates, Timaeus is a representative of the Asiatic style of Hegesias of

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TIMANThES—TIMBER

Mognesia rather than of the Attic (see Norden, Griech. Kunstprosa i. 186). Both Démyus of Halicarnassus and the pseudo-Plutarch regarded him as a model of "frigidity" (Syrupus), although the latter admits that in other respects he is a competent writer. Cicero, who was a diligent reader of Timaeus, expresses a far more favourable opinion, specially commending his copiousness of matter and variety of expression. Timaeus was one of the chief authorities used by Trogus Pompeius, Diodorus Siculus and Plutarch in his life of Timoleon.

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TIMANThES, of Cythnos or Sicyon, a Greek painter of the 4th century B.C. The most celebrated of his works was a picture representing the sacrifice of Iphigienia, in which he finely depicted the emotions of those who took part in the sacrifice; but despairing of rendering the grief of Agamemnon, he represented him expressing his joy at seeing his face. A painting discovered at Pompeii, and now in the Museum at Naples, has been regarded as a copy or echo of this painting (Helbig, Wandgemälde Campaniens, No. 1304).

TIMARU, a seaport of Geraldine county, New Zealand, on the E. coast of South Island, 100 m. S.W. of Christchurch by rail. Pop. (1906), 7015. The slight inward sweep of the coast forms the Canterbury Bight, and the shore-line northward from Timaru is called the Ninety-mile Beach. The harbour is formed by breakwaters enclosing a space of 50 acres. Chief exports are wool, flour and frozen meat, and the industries are in connexion with these. Opals are found in the district. The Anglican church of St Mary is built of Oamaru and bluestone, with a roof of kauri wood. Caroline Bay, to the north, is a bathing resort. The volcanic soil is highly fertile. Timaru is the chief town in South Canterbury district, and the seat of the supreme and district courts. A branch railway traverses the inland agricultural district.

TIMBER, the term given to wood cut and shaped for building purposes, or growing wood suitable for such purposes; in English law the tenant for life may not cut such trees (see Wood). The word occurs in all the early Latin, Greek, and Gothic languages, meaning originally material to be used for building purposes; in the case of Ger. zimmer, and Du. timmer, both meaning "room," the word has been transferred to the structures made of this material. The root is seen in Gr. ἔξω, to build, and Lat. domus, house.

The wood used in building is obtained from trees of the class known to botanists as exogens, or those trees which grow larger by the addition each year of a layer of new wood on their outer surface. A transverse section of a tree of this class shows it to consist of three distinct parts: the pith or medulla, the wood, made up of annual rings or layers, and the bark. The pith is in the centre of the tree and around it the wood is disposed in approximately concentric rings; that part near the pith is hard and close in grain, and from its position is termed heart-wood. The sap-wood is made up of the outer layers or rings, and these are softer than the heart and generally more open grain. Each annual ring is made up of two parts—an inner soft portion light in colour, and a hard, dark-coloured outer portion. The inner portion is formed early in the season and is termed "spring wood," the darker part being called "autumn wood." The medullary rays extend radially from the centre of the tree to the bark at right angles to the grain of the wood, and serve during life to bind the whole together as well as to convey nourishment from one part of the tree to another. The greatest care should be exercised in the selection of trees for felling. If the tree is too young the proportion of sap-wood is large, and the heart-wood is not so hard as that of a tree of mature age. The wood of an old tree, on the other hand, has lost a great part of its toughness, and is of bad colour, brittle and often predisposed to decay. In trees that have arrived at a mature age the heart-wood is in its largest proportion and the sap-wood is firm and elastic; and the timber from such trees is of the strongest, toughest and most durable character. The age at which the northern pine and Norway fir arrive at maturity is between seventy and one hundred years. The larch, elm and ash should be felled when the trees are between the ages of fifty and one hundred years. The oak should be about one hundred years old when it is cut. The best time of the year for felling timber is in midsummer or midwinter, when the sap of the tree is at rest; it is not desirable to cut timber in the spring or autumn. By some authorities it is considered a good plan to remove the bark in the early spring and fell the tree in the ensuing winter.

As soon as possible after felling, logs should be converted by sawing into scantlings, sizes for, if the log is left to dry or season, it is liable on shrinking to split. The usual method is to saw a log into planks or boards by cutting it into slices longitudinally as shown in fig. 1; this is called bastard sawing, and is the most economical method, but, as will be seen in the diagram, the quality of the boards will vary very much, some consisting almost entirely of sap-wood cut at a tangent to the annual rings such as a, b, c, whilst the centre boards contain the heart-wood cut in the best way at right angles across the annual rings as d, e, f. For oak and other hard woods another method of conversion is often adopted, called quarter sawing. The log is first cut into quarters and then sawn diagonally (fig. 2). In oak this develops the beautiful silver grain by cutting longitudinally through the medullary rays. Timber is now generally sawn into marketable sizes in the country of its growth, and shipped as scantling timber.

Definitions and sizes are given below of the most usual forms of sawn timber:

A log is the trunk of a tree with the bark removed and branches lopped.

A balk is a log hewn or sawn to a square section, and varying in size from 11 to 18 in. square.

Planks are parallel-sided pieces of timber from 2 to 6 in. thick, 11 or more ins. wide, and from 8 to 21 ft. long.

Deats are similar pieces 9 in. wide, and 2 to 4 in. thick.

Battens are similar pieces, but not more than 7 in. wide. Pieces of planks, deals and battens under 8 ft. long are called ends. Many of the soft woods, such as pine and fir, are sold by the standard. The standard of measurement most in use is the St Petersburg standard, which contains 145-cubic ft. or 720 lineal ft. of 11 in. by 3 in.

A load of sawn or hewn timber contains 50 cub. ft., and a load of unhewn timber 40 cubic ft.

A square is a superficial measurement, used chiefly for boarding, and contains 100 sq. ft.
TIMBER

Norwegian timber is stencilled with the shipper's initials in blue letters painted on the ends. Swedish timber is stencilled with red letters on the devices, the inferior qualities in blue. Russian timber is stencilled on the sides near the middle. By stencilling is meant that the distinguishing letters are roughly cut in with a gouge. Russian timber is dry-stamped or hammer-branded on the ends. American (Canadian) timber is stencilled in black and white. United States timber is marked with red chalk on the sides.

To fit timber for use in building construction the superfluous sap and moisture contained in the green wood must be evaporated, either by natural or artificial means. During this process the wood shrinks considerably, and unless much care and attention are given to the drying wood it will warp and shake sufficiently to unfit it for practical uses. After the log is converted into scantlings, or 'lumber,' as it is termed in America, it is stacked in the timber yard under covered sheds with open sides to enable it to 'season.' The wood is carefully piled in tiers or courses, with strips of wood about an inch thick between each layer, so as to allow of the free circulation of air all round each piece. This is the natural and best method of seasoning, and timber treated in this way is more durable than that seasoned by artificial methods; the time taken, however, is much longer. For joiners' work the drying of the wood is often hastened by stacking the timber in well-ventilated rooms kept at a temperature of from 80° to 100° F. The time taken in seasoning wood by this desiccating process is not more than that required in a natural method. Where it is convenient, timber is sometimes treated with a water seasoning process which enables it to be more easily dried. The wood is placed in a running stream and so tied or chained down as to be entirely submerged. The water enters the pores of the wood (which should be placed with the butt end pointing up stream) and dissolves and forces out the sap. After about two weeks in this position it is taken out and stacked in open sheds to be dried in the natural way, or treated by warm air in special chambers. Steaming and boiling are sometimes resorted to, but even these methods, while they may be expedient, are not to the same extent, as the timber deteriorates under such treatment, and the cost of the process is in many cases prohibitive. When wood is required to be bent, however, this is often the method that is adopted, to soften the material, so as to allow it to be bent easily. The time allowed in the English government dockyards for the natural process of seasoning for hard woods such as oak is, for pieces 24 in. sq. and upwards, 26 months; from 16 in. to 20 in. sq., 18 months; from 8 in. to 12 in. sq., 10 months; from 4 in. to 8 in. sq., 6 months. Soft woods are allowed half these periods. When the wood is in such a state as to "dry season," it is allowed for the length of time is given. Planks are allowed from a half to two-thirds of the above time, according to their thickness.

Deals with coarse annual rings (i.e. coarse grain) should be rejected for good work, as also those with wane or naturally bevelled edges. The wide annual rings show that the tree was grown too quickly, probably in marshy ground. Timber with wane edges has a large proportion of sapwood, and is cut either from a small tree or from the outer portion of a large one, the wane edge being obviously due to irregularities in the surface of the tree. "Cup shake" is a natural splitting in the wood, and is found in Swedish and American timber. Scandinavian timber is supposed to be caused in severe weather by the freezing of the ascending sap. "Heart shake" is often found in old trees and extends from the pith or heart of the tree towards the circumference. When there are fissures radiating in several directions it is called "star shake." "Upsets" are the result of some crushing force or violent shock to the bark or log. Foxeye timber is tinged with a brownish or blackish discoloration and is similar to that found in the walnut. "Downdecay," similarly, is a spotted or speckled stain denoting decay in certain varieties of timber, such as beech and some kinds of oak.

The primary causes of decay in timber are the presence of sap, exposure to conditions alternately wet and dry, and want of efficient ventilation, especially if accompanied by a warm air. The moist atmosphere of damp timber is conducive when in black and dry ventilated, but some varieties last an indefinite period when kept continually under water. When, on the other hand, the wood becomes alternately wet and dry, "wet rot" results. The wood affected shrivels up and becomes reduced after a time to a fine brown powder. It is only by actual contact that wet rot affects the surrounding good timber. If the decayed portion be cut out the remainder of the wood will be unaffected.

"Dry rot," which usually attacks the sap-wood, generally starts in a warm damp unventilated place, and if the conditions are favorable, will readily spread and attack other parts of the ground. The spores are visible to the naked eye, some microscopic. The spores from the fungi on the decayed wood float in the air and alight on any adjacent timber, infecting this with the same condition. In damp or wet weather the fungus will find a way through brickwork, concrete and similar material, in order to reach woodwork that may be on the other side. Damp-ness in buildings is the greatest predisposing cause of dry rot, and it is under these conditions that it spreads most quickly, the fungus soon drying when exposed to the fresh air.

There will be little danger of the decay of timber used in the construction of ordinary buildings if care has been taken, in the first place, to have it well seasoned, and, in the second, to ensure its being well ventilated when fixed in position. There are, however, several preservative processes to which timber may be subjected when it is to be fixed in positions which favour its decay (see also DRY ROT). In creosoting, which was invented by J. B. Bouchier and patented by him in 1832, the timber is treated by soaking it in creosote by boiling the wood in the hot oil for several hours, but the better way is to place the seasoned timber in an iron chamber in which a partial vacuum is created by exhausting the air. The creosote is then forced into the wood by a pressure of from 200 lb. to the sq. in., according to the size of the timber. In warm weather the pressure need not be so great as in winter. The whole process only occupies from two to three hours. Soft woods take up from 10 to 20 lb. of the fluid. Hard woods are not usually treated by this process. Kyan's process, patented in 1832, consists in impregnating the timber with corrosive sublimate which, acting on the albumen in the wood, converts it into an insoluble substance. Boucherie, a Frenchman, originated a system in which the sap is expelled from the timber under pressure, and a strong solution of copper sulphate is then injected at the end of the wood. In Boucherie's process the timber is dried, and made carbonate of copper is injected. In Burnett's process a solution of zinc chloride is forced into the pores of the wood. A new process of preserving timber by means of steam heat has been tried and seems to be effectual. The timber is placed in a chamber which is then heated to a high pressure (200 lb. to the sq. in.). The heat and pressure together exert a chemical action upon the sap, which becomes insoluble and itself preserves the wood from decay.

Posts that are to be fixed in the ground should have their buried ends either charred or else well tarred. External woodwork may be protected by painting or oiling.

The timber used in building is obtained from trees which may be classed under two heads: (1) Coniferous or needle-leaved trees; (2) the non-coniferous or broad-leaved trees. Varieties. Coniferous Trees.—This class includes most of the soft woods which furnish timber for the framing and constructional portions of nearly all building work. They are also used for the finishing joinery of the ordinary class of building. The numerous varieties of pine which are used more extensively than any other kind of wood are included in this class.

The northern pine (Pinus sylvestris) has a number of other names and may be referred to under any of the following: Scotch fir, red deal, red fir, yellow deal, yellow fir, Baltic pine, Baltic fir, Norway pine, Scotch pine, white pine, North American pine, and often gets a name from the port of shipment, such as Memel fir, Danzig fir, Riga fir, and so on. The colour of the wood of the different growths of northern pine varies considerably, the general characteristics being a light reddish yellow colour. The annual rings are well defined, each ring consisting of a hard and a soft portion, respectively dark and light in colour. No medullary rays are present. The wood is rather heavy, soft, and flexible, elastic, easy to work, and is used by the carpenter for internal and external constructional work, and by the joiner for his fittings. Tar, pitch and turpentine are obtained from the wood of this tree, the yields being nearly one in twenty per cent.

The white fir, or Norway spruce (Abies excelsa), is exported from Russia, Sweden and Norway, where it grows in enormous quantity. The wood is obtained from the trunk of the tree, which has a slender trunk to a height of from 80 to 100 ft. Like the northern pine, it is called by several names, such as "spruce," "white deal," "white wood," "Norwegian fir." The colour of the cut wood is a very light yellowish or brownish white, the hard parts of the
annual rings being of a darker shade. A characteristic feature is the large number of annual rings; knots are almost absent, and the wood is easy to work, but rather inferior in all respects to the northern pine. Its weight per cubic foot averages about 33 lb.

The red pine (Pinus resinosa or P. rubra) is also known as "Canadian pine," is a native of the northern parts of North America, where the tree attains a height of 60 or 70 ft. with a diameter of from 12 to 30 in. It weighs about 36 lb to the cubic foot. In Canada it is called Norway pine and "red pine," and in the United States it is known as "black pine." It is distinguished by yellow or red, of fine grain, and works to a smooth lustrous surface remarkably free from knots.

For joiners' work, however, it is well adapted, and glue adheres strongly to it, though nails do not hold well. It cuts about 30 lb per cu. ft.

The Kauri pine (Dacrydium australis) is a native of New Zealand. It grows to a height of from 80 to 140 ft., with a straight stem 4 to 8 ft. in diameter. The wood is a light yellowish brown in colour, fine grained, and very hard, the annual rings are marked by a dark line. It is strong, elastic and resinous. A cubic foot weighs about 35 to 40 lb.

The pitch pine (Pinus rigida) is a native of Canada and is common throughout the eastern United States and the Pacific States of America. It is remarkable for the large quantity of resin it contains, the weight of the wood, which is about 48 lb per cu. ft., and the strong red markings of the surface. It attains a height of about 100 ft., but the average height is about 80 ft.

The larch is the most beautiful variety known in Great Britain. Its diameter attains about 6 ft., and it weighs about 56 lb per cu. ft. or less.

Of the elm (Ulmus) there are five common varieties, the two most extensively used being the tough-leaved elm (Ulmus campestris), which is grown in large quantities in England and North America, and the smooth-leaved yew elm (Ulmus glabra). The colour of the wood is brown; it is hard, heavy, strong and very tough, and when wet is easily bored. It is not very liable to warp and shake, and is porous and usually cross-grained.

The pines of old London Bridge were of elm, and after six centuries of immersion were little decayed. The wood is not much used in building operations. It weighs about 40 lb per cu. ft.

The common ash (Fraxinus excelsior) is a native of Europe and Northern Asia, and is grown extensively in Great Britain. Its ornamental light brown, sometimes with a greenish tint, with the annual rings of darker colour. The wood is very tough and strong, and superior to most wood in elasticity; and it weighs about 45 to 55 lb per cu. ft.

Birch (Fagus sylvatica) grows in the temperate districts of Europe. The wood is heavy, strong and hard; white to light reddish-brown in colour; and durable if kept either dry or wet; is porous and works easily; it weighs about 40 to 50 lb per cu. ft. The red beech (Fagus purpurea) is found in China and in North America.

Sycamore (Acer pseudo-platanus), sometimes mistakenly called the plane tree, is common in Germany and Britain and in the eastern states of America. The wood is very tough and strong, and is used for ornamental joinery. Itattains a height of about 60 ft., and weights less than 40 lb per cu. ft.

Teak (Tectona grandis) is a native of southern India and Burma. It grows rapidly to a great height, often exceeding 150 ft., with a straight trunk and spreading branches. Teak wood is straight in the grain, and is not readily split, and it has the nature of being able to resist the attacks of insects and to preserve iron, nails and fastenings. It weighs from 45 to 56 lb per cu. ft.

Mahogany (Swietenia mahogani) is a native of the West Indies and Central America, the best-known varieties being Cuban or Spanish and Honduras. The Spanish wood has a darker colour and richer figure than the Honduras, and is therefore preferred for ornamental joinery. The colour of mahogany is reddish brown, and in the Cuban wood the pores are often filled with a white chalky substance which is usually absent in the Honduras variety; the latter, however, may be obtained in larger sizes, and is straighter in the grain, and easily worked. It weighs about 45 to 56 lb per cu. ft.

Greenheart (Neobalanus radicans) is a very heavy, hard and durable wood, used in ornamental joinery, being more used by the cabinet and joiner than the carpenter. It weighs about 56 lb to the cubic ft., and the Honduras variety about 36 lb.

Basswood (Tilia americana) is common to Canada and in the United States. It is soft and easy to work, and of even texture and straight grain. It may be obtained in wide boards, and this is fitted for use in large panels. It weighs about 30 lb per cu. ft.

There are several varieties of maple growing in Canada and the United States, but the one in most common use is the sugar maple, also called rock maple, which grows freely in the districts around the Great Lakes. The wood is fine-grained, frequently with a beautiful wavy figure, yellowish white to light brown in colour; it is light and easy to work, and is used in ornamental joinery, particularly for curved work.

The numerous tests of the strength of timber which have been made by various authorities from time to time vary so much, both as regards the conditions under which they were carried out and the results obtained, that no general rule can be given as to the strength of different kinds of wood. The American strength tests are not comparable with those of European counties, and the results of the American strength tests are not comparable with those of the older European strength tests.

Recently, the American Society of Civil Engineers has been conducting tests of the strength of timber. These tests have been conducted in a manner that is comparable with the European strength tests.

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in America, Professor J. B. Johnson made a large number of tests for the Forest Department of the Board of Agriculture of the United States between 1891 and 1895. More than 300 trees were cut down and experimented with, the species under test embracing ten different kinds of pine and five different varieties of hard-wood trees. Records were made as to the nature of the soil and climate where the trees were grown; their conditions of growth, their age and size, and the season of felling. As in the tests made by Bauschinger, the percentage of moisture contained in the wood was very carefully observed, and it was found that this wood species has a very great influence upon the resisting power of the wood, the strength increasing with the dryness of the material up to 3 or 4% of moisture, at which point the greatest strength of the wood is reached. Wood in such a dry condition, however, is never found in actual practice, timber in an ordinary well-warmed and well-ventilated situation probably containing at least 10%.

One general conclusion arrived at both by Bauschinger and Johnson was that the strength is much affected by the specific gravity of the timber. In all cases the strength increases proportionately with the density of the wood. A more substantial and physical characteristic of the hard woods of Western Australia was completed for the government of Western Australia by G. A. Julius in 1907. This work was carried out in a most thorough manner, and as many as 16,000 tests were made, the conditions of test being based upon those laid down by Johnson. The results serve to show the great value of Australian timbers, and the comparisons made with the typical timbers of many other countries emphasize the fact that the Australian woods are equal to any in the world for hardness, strength and durability. For use under special conditions a wood suitable to the particular requirements must be selected. The following is a list of the best timbers for different situations: for general construction, spruce and pine of the different varieties; for heavy constructions, pitch pine, oak (preferably of English growth), teak, jarrah; for constructions immersed in water, Baltic pine, elm, oak, teak, jarrah; for very dry situations, spruce, pines, mahogany, teak, birch, sycamore.

There are no regulations in England limiting the working stresses that may safely be placed upon timber, although in some districts the least sizes that may be used for timbers in roofs and floors are specified. In some European and other countries, however, the safe working stresses of timber used for constructional purposes are defined. The building by-laws of the municipality of Johannesburg and the Acts of the Legislative Assembly contain the following table:

<table>
<thead>
<tr>
<th>Safe Working Stresses for Timber. In tons per square inch.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardwood.</td>
</tr>
<tr>
<td>Fir and Pine.</td>
</tr>
</tbody>
</table>

Note.—The compressive stress are for short struts and columns where the length does not exceed for timber 15 times the least transverse dimension, and where the ends are fixed. Where the ratio of the length to the least transverse dimension is higher, the load per square inch shall be proportionately reduced. No part of timber shall exceed in length 30 times its least transverse dimension.


**Timber-Line — Timbuktu**

In physical geography, the line of elevation above sea-level above which trees do not grow. In any hilly locality, which is not of too high latitude to allow of trees growing near the sea-level, this line is generally clearly marked. It varies not only with general but also with local conditions of climate, just as does the snow-line.

**Timber-Wolf (Canis occidentalis), or grey wolf, an American species, or, perhaps, a geographical race of the European C. lupus (see Wolf).** The length of good specimens is about 64 in., of which the tail forms nearly a quarter, and the range of colour is from black to white. Cattle ranchers and shepherds have established a war of extermination against this wolf and their efforts have been several times interrupted by a bounty fixed by the government. The reward was at one time $10 on wolf-scallips. In Montana in 1901 during a month in the saddle an observer saw no wolves, which have become so scarce that the occupation of the professional wolf-hunter is almost gone. These animals are, however, far from being exterminated, the "bad lands" forming an absolutely secure refuge.

**Timbrel or Tarret (the taf of the ancient Hebrews, the deff of Islam, the adufe of the Moors of Spain), the principal musical instrument of percussion of the Israelites, identical with the tambourine.** The word timbal is used in the Old Testament in both its plural and singular forms; it was the name of a vessel containing a set of bells or small gongs fixed at intervals in hoops. The Israelites learnt to use the timbrel during their sojourn in Egypt, and it has been suggested that as the Egyptians used it to scare away their evil spirit Typhon, the word taf is derived from the latter. The tabret or timbrel was a favourite instrument of the women, and was used with dances, as by Miriam, to accompany songs of victory, or with the harp at banquets and processions; it was one of the instruments used by King David and his musicians when he danced before the Ark. It was also used in the valley of Hinnom at the sacrificial rites, when human victims were "passed through the fire" to Moloch.

(K. S.)

**Timbs, John (1801-1875), English antiquary, was born in Clerkenwell, London, on the 17th of August 1801. He was educated at a private school at Hemel Hempstead, and in his sixteenth year apprenticed to a druggist and printer at Dorking. He had early shown literary capacity, and when nineteen began to write for the Monthly Magazine. A year later he became secretary to Sir Richard Phillips, its proprietor, and permanently adopted literature as a profession. He was successively editor of the Mirror of Literature, the Harlequin, the Literary World, and sub-editor of the Illustrated London News. He was also founder and first editor of Year-Book of Science and Art. His published works amounted to more than one hundred and fifty volumes. In 1834 he was elected a fellow of the Society of Antiquaries. He died in London on the 6th of March 1875.**

**Timbuktu (French spelling Tombouctou), chief town of the territory of Timbuktu, French West Africa, 9 m. N. of the main stream of the Niger in 16° N. and 5° W.**

Timbuktu lies on a terrace formed by the southern scarps of the Sahara, about 800 ft. above sea-level, and overlooking a chain of dunes or marshy hollows, fringed here and there with a few mimosas and palm trees, and surrounded sandy wastes. These dunes, which are flooded every three or four years, convert the lowland tracts between the terrace and the main stream into a labyrinth of channels and backwaters, mark the bed of a navigable creek which formerly branched from the Niger northwards to the foot of the scarps, and which in 1640 inundated a low-lying quarter of the city. It is conjectured that the main stream followed this course before it took its present easterly curve to Burrum, where it divides southwards to the coasts, and finally joins the foregoing remote period of Wadi Messuara from the Tuat oases south of Algeria, although the rough levels taken by the topographer Less and other maps are uncertain whether the flow of waters to this delta is from the north or north-west. In any case Timbuktu has been left, so to say, high and dry by the general process of desiccation going on throughout the Saharan region.

Timbuktu has been described as "the meeting point of the camel and the canoe," "the port of the Sahara in the Sudan," and (more correctly) "the port of the Sudan in the Sahara." It is a great "exchange" for the produce of North Africa and
that of the rich countries south and west of the Niger. It was
formerly a much larger place than it was found to be at the time
of its occupation by the French in 1893–1894. Extensive ruins
exist north and west of the present town. The great mosque
which at one time stood in the centre of the town now lies near
the well, an outbuilding, where its high but slightly east tower
forms a striking landmark. The mosque of Sidi Yaia (in
the centre of the town) and that of Sankoré in the north-east also
possess prominent towers. Two forts, built by the French
and placed, one on the northern the other (Fort Bonnier) on
the southern side of the town, protect the roads to the desert and
the river respectively. Whereas in 1893 the town was little more
than a vast ruin, under French protection the inhabitants,
relieved from the fear of Tuareg oppression, set about repairing
and rebuilding their houses; trade revived; new streets were
broadened; European schools, churches and other establishments
were opened.

The industries of Timbuktu—cotton-weaving, earthenware,
leather-work and embroidery—are of subordinate importance,
and the great bulk of the people are occupied exclusively with
trade. The whole traffic of the surrounding lands converges on
Timbuktu, which has a transit trade estimated at over £500,000
per annum. Considerable quantities of British and German
fabrics, hardware, beads, &c., are conveyed across the Sahara
from Mogador (Morocco), while two great caravans of 3000 or
4000 camels are yearly charged with salt from the Taduni
district, salt being an important item in the Niger caravan trade.
The imports via the Sahara average about £50,000 annually,
and by way of Senegal goods of equal value are received.
From the south come cereals, gold, wax, ivory and coarse native
cotton goods, now brought to Kabara (the port of Timbuktu)
by steamers plying on the upper Niger. Cowries, the former
currency (2500 = 5 francs), have been generally replaced by
French money. It is proposed to connect the city with the
Niger by a canal.

Timbuktu, which possesses some valuable Arabic manuscripts
—notably the Tarik es-Sudan, a 17th-century history of the
Sudan written by Abderrahman Sadi of Timbuktu—and is
a centre of Moslem teaching, is a converging point of the chief
west Sudanese and Saharan races—Arabs or Arabized Berbers
to the west; Songhio in the immediate vicinity, and thence
south-eastwards along the Niger; Ireghenaten or "mixed"
Tuareg southwards across the Niger as far as the Hombori Hills
and in the fertile Llibbako plains beyond them; Fula, Mandingo,
and Bambara in and about the city; and Imoshagh (Tuareg)
belonging to the Aweilmedien confederacy mainly to the north
and west.

The local administration—preserved under French rule—
is in the hands of an hereditary kahia, a kind of mayor, descended
from one of the Runa families (see below). The kahia, during
the greater part of the 19th century, was more or less under
the control of the powerful Bakhai (Bacay) family, who, as
"sheriffs" and marabouts, were revered throughout the western
Sahara.

History.—The history of Timbuktu is intimately connected
with that of the city of Jenne and the Songhoi Empire. The
Songhio (q.v.) are a negro race reported to have come to the Niger
country from the Nile valley. In the 8th century they made
themselves masters of a considerable tract of country within
the bend of the Niger, and built the city of Gao (q.v.) 200 m.
in a direct line S.S.E. of Timbuktu, making it their capital. In
the 11th century they were converted to Islam. Besides Gao,
the Songhio founded Jenne (q.v.), which early attained consider-
able commercial importance. Meantime (11th century) a
settlement had been made at Timbuktu by Tuareg. Perceiving
the advantages for trade with the north offered by this desert
rendezvous, the merchants of Jenne sent agents thither (12th
century), and Timbuktu shortly afterwards became known to
the inhabitants of the Sahara and Barbary as the best market
in which to dispose of their salt and other goods, and also for
the purchase of the many commodities of the western Sudan.
In the 12th or 13th century Timbuktu fell under the power
of the Mandingo kings of Melle or Mali, a country lying west and
south of Jenne. Its fame as a mart for gold and salt spread to
Europe; "Timboutch" being marked on a Catalan map dated
1523, and in 1525 had been visited by the famous traveller Ibn
Batuta. In 1434 the Tuareg made themselves masters of the
city, which in 1460 was captured by the Songhoi king Sunni Ali.
In the days of Sunni's successor Askia (1494–1529), who com-
pleted the conquest of Melle begun by Sunni Ali, the Songhoi
empire reached its highest development, and Timbuktu rose
to great splendour. The "university" of Sankoré became a chief
centre of Mahomedan culture for the peoples of the western
Sudan. One of the sheiks of Sankoré, Ahmad Baba, was among
the most learned of Moslems. Some of his writings are still
existed. The riches of Timbuktu. The eminence of El
Mansur, sultan of Morocco, who, in 1590, sent an army across
the Sahara under an "Andalusian" Moor (that is, a Moor
descended from those expelled from Spain), which captured
Timbuktu (1591) and completely broke up the Songhoi empire.
The Moors made Timbuktu their capital city. For about twenty
years after the conquest the pasha who ruled at Timbuktu was
nominated from Morocco, but the distance of the Niger countries
from Marrakesh enabled this vast viceroyalty to throw off all
allegiance to the sultan of Morocco.

The Tuareg Moors, known as Rumas after El Mansur's musketeers,
who maintained a tradition of their own, and provided by
them, the negro tribes. By the end of the 18th century two hundred years
of oppression had reduced Timbuktu to comparative desolation and
poverty. By this time the whole country was in a state of
anarchy, and in 1800 the Tuareg swooped down from the desert
and captured the place. They were in turn (1813) dispossessed
by the Fula, who in 1840 gave place to the Tukulor, led by El
Haj Omar, the first great opponent of the extension of French
influence in the Niger bend. When the French reached Tim-
buktu in December 1893 they found that the town had again
fallen beneath the rule of the Tuareg. The townsmen, instead
of the time from the decay of the Ruma power being at the
mercy of all comers, were content to pay tribute to each in turn
and sometimes to more than one simultaneously, for which they
indemnified themselves by peaceful intervals of trade
whenever the land routes were open and the upper and lower
reaches of the Niger clear of pirates. But at times even the short
tract separating the town from Kabara was so beset with
marauders that it bore the ominous name of "Ur-immaness," that is,
"The (God) hears not." Little wonder then that the townsmen,
weary of the constant and internecine strife of their Fula and Tuareg
masters, freely opened their gates to the French as soon as Liet. Boiteux reached Kabara in command of a small flotilla.

The occupation of the town, against orders, was a daring
exploit of a handful of marines. The force which "garrisoned"
Timbuktu consisted of but seven Europeans and twelve Sene-
galese, a somewhat larger body being left with the gunboats at
Kabara. On the 28th of December the Tuareg attacked the
boat party, killing Naval Ensign Aube, another officer, and
eighteen black sailors. Colonel T. P. E. Bonnier, who was at
the time a prisoner in the town, marched to the relief of Boiteux
and entered Timbuktu without opposition on the 10th of January
1894. Leaving part of his force in the town the colonel set out
with about 100 men to chastise the nomads. In the night of the
14th–15th January his camp was surprised and the colonel
and nearly all his men perished. The enemy did not follow
up their victory, and within a short period French rule was
firmly established in Timbuktu.

Apart from some Christian captives, the place was reached
during the 19th century, previous to its capture by the French,
by four Europeans—Major Gordon Laing from Tippoli (1820),
who was murdered by order of the Fula; René Caillée from
the south (1828), Heinrich Barth from Central Sudan (1855) and
Oskar Lenz from Morocco (1880). (In 1893 the French authori-
ties placed commemoratve tablets on the houses occupied by

1Tim-Buktu in Arabic may stand for "the well of Buktu," in
the Songhio tongue the word means a hollow.
the four men during their stay in Timbuktu. The tablets bear simply the name of the explore and the date of his visit.) In 1895
Felix Dubois made a stay of some duration in the town, investi-
gating its history and that of the surrounding country. In 1904
Timbuktu became part of the colony of Upper Senegal and Niger.

The British connexion with Timbuktu may be briefly stated.
British explorer, Dr. E. J. P. du Chaillu, visited the town in 1868

and the inclination of its orbit to the equator, so that it becomes
necessary to introduce an imaginary mean sun moving in the
equator with uniform velocity. The equation of time is the
difference between apparent (or true) solar time and mean
solar time. The latter is that shown by clocks and watches used
for ordinary purposes. Mean time is converted into apparent
time by applying the equation of time with its proper sign, as
given in the Annual Almanac, during a universal day for every
day at noon. As the equation varies from day to day, it is
necessary to take this into account, if the apparent time is
required for any moment different from noon. The ephemerides
also give the sidereal time at mean noon, from which it is easy
to find the sidereal time at any moment, as 24 hours of mean
solar time are equal to 24° 36' 56.55' of sidereal time. About
the 21st of March each year a sidereal clock agrees with a mean
time clock, but it gains on the latter 3° 56.5' every day, so that
in the course of a year it has gained a whole day. For a place
not on the meridian of Greenwich, the sidereal time at noon
must be corrected by the addition or subtraction of 9° 8.5'6"
for each hour of longitude, according as the place is west or
east of Greenwich.

While it has for obvious reasons become customary in all
civilized countries to commence the ordinary or civil day at
midnight, astronomers count the day from noon, being
the transit of the mean sun across the meridian, in strict conformity
with the rule as to the beginning of the sidereal day. The hours
of the astronomical day are also counted from 0 to 24.

Determination of Time.—The problem of determining the
exact time at any moment is practically identical with that of
determining the apparent position of any known point on the
celestial sphere with regard to one of the fixed (imaginary) great
circles appertaining to the observer's station, the meridian or the
horizon. The point selected is either the sidereal or one of the
standard stars, the places of which are accurately determined
and given for every tenth day in the modern ephemerides.
The time thus determined furnishes the error of the clock, chronon-
\_meter or watch employed, and a second determination of time after
an interval gives a new value of the error and thereby the
rate of the timekeeper.

The ancient astronomers, although they have left us very
ample information about their dials, water or sand clocks (\_clespydrae),
and similar timekeepers, are very reticent as to the means they
employed in applying this method. Ptolemy, states nothing whatever as to how the time was found when the numer-
ous astronomical phenomena which he records took place;
but Hipparchus, in the only book we possess from his hand,
gives a list of 44 stars scattered over the sky at intervals of
right ascension equal to exactly one hour, so that one or more
of them would be on the meridian at the commencement of
every sidereal hour. H. C. F. C. Schjellerup \(^1\) has shown that
the right ascensions assumed by Hipparchus agree within about
15' or one minute of time with those calculated back to the year
140 B.C. from modern star-places and proper motions. The
accuracy which, it thus appears, could be stated by Hipparchus
in their determinations of time was far beyond what they seem
to have considered necessary, as they only record astronomical
phenomena (e.g. eclipses, occultations) as having occurred
"towards the middle of the third hour," or "about 8½ hours of
the night," without ever giving minutes. \(^2\) The Arabians had a


\(^{2}\) For astronomical purposes the ancients made use of mean-
time horai, \_epotai, horai ephemeridales—which into which
they translated all indications expressed in civil hours of varying length—
\_pse kaupakal, horai temporales. Ptolemy counts the mean day from
noon.
clearer perception of the importance of knowing the accurate
time of phenomena, and in the year 829 we find it stated that at
the commencement of the solar eclipse on the 30th of November
the Tycho's fan of an instrument was observed at the mid 21°, as
observed at Bagdad by Ahmed ibn Abdullah, called Habash. 1 This
seems to be the earliest determination of time by an altitude; and this
method then came into general use among the Arabians, who,
on observing lunar eclipses, never failed to measure the altitude
of some bright star at the beginning and end of the eclipse. In
Europe this method was adopted by Purbach and Regiomontanus
apparently for the first time in 1457 Bernhard Walther, a pupil
of the latter, seems to have been the first to use for scientific
purposes clocks driven by weights: he states that on the 16th of
September he observed the longitude of the planets Mercury,
and immediately attached the weight to a clock having an hour-
wheel with fifty-six teeth; at sunrise one hour and thirty-five
teeth had passed, so that the interval was an hour and thirty-
seven minutes. For nearly two hundred years, until the applica-
tion of the pendulum to clocks became general, astronomers
could place little or no reliance on their clocks, and conse-
quently it was always necessary to fix the moment of an observa-
tion by a simultaneous time determination. For this purpose
Tycho Brahe employed altitudes observed with quadrants; but he
remarks that if the star is too near the meridian the altitude
may be too low, and if too near the horizon the refrac-
tion (which at that time was very imperfectly known) introduces
an element of uncertainty. He sometimes used azimuths, or with
the large "armillary spheres" which played so important a part
among his instruments, he measured hour-angles or distances
from the meridian along the equator. 2 Transits of stars across
the meridian were also observed with the meridian quadrant,
an instrument which is alluded to by Ptolemy and was certainly
in use at the Marâgha (Persia) observatory in the 13th century,
but of which Tycho was the first to make extensive use. But he
very aptly employs the star-planet to determine, after obtaining
the clock error by the methods already described.

In addition to these methods, that of "equal altitudes" was
much in use during the 17th century. That equal distances east
and west of the meridian correspond to equal altitudes had of
course been known as long as sundials had been used; but, now
that quadrants, cross-staves and parallactic rules were commonly
employed for measuring altitudes more accurately, the idea
naturally suggested itself to determine the time of a star's or
the sun's meridian passage by noting the moments when it
reached any particular altitude on both sides of the meridian.
But this plan of an instrument in the same line of thought
was not forgotten, and from the end of the 17th century, when
Römer invented the transit instrument, the observation of
transits across the meridian became the principal means of
determining time at fixed observatories, while the observation
of altitudes, first by portable quadrants, afterwards by reflecting
sextants, and during the 19th century by portable alt-azimuths
or theodolites, has been used on journeys. Since about 1830
the small transit instrument, with what is known as a "broken
teleScope," has been much employed on scientific expeditions,
but dry gemination is necessary in using it, as the difficulty of
getting a perfectly rigid mounting for the prism or mirror
which reflects the rays from the object glass through the axis
to the eyepiece appear to be very great, for strange discrepan-
cies in the results have often been noticed. The gradual develop-
mend of astronomical instruments has been accompanied by
a corresponding development in timekeepers. From being very
untrustworthy, astronomical clocks are now made to great
perfection by the application of the pendulum and by its com-
pliance, while the invention of chronometers has placed a
portable and equally trustworthy timekeeper in the hands of
travellers.

We shall now give a sketch of the principal methods of
determining time.

1 Causin, Le Livre de la grande table Hâkème, p. 100 (Paris, 1804).
2 See his Epistolas astronomicae, p. 73.
circle) is generally found on observation of four or five "clock stars," these being standard stars not near the pole, of which the altitudes may be determined with considerable accuracy, besides observation of a close circumpolar star for finding the error of azimuth and determination of level and collimation error.  

Observing the field, the instruments often find it inconvenient to wait for the meridian transits of one of the few close circumpolar stars given in the ephemerides. In that case they have recourse to what is known as the method of time determination. When the alt-azimuth of a pole star is directed to one of the standard stars near the pole, such as α or δ Ursae Minoris, using whichever is nearest to the meridian at the time. The instrument is set so that the star in a few minutes will cross the middle vertical wire in the field. The spirit-level is in the meantime put on the axis and the inclination of the latter measured. The time of the transit of the star is then observed, after which the instrument is tilted in the south, is turned to a cock wire and the transit of this over all the wires is observed. The level is applied again, and the mean of the two results is used in the reductions. In case the collimation error of the instrument is not accurately known, the instrument should be reversed and another observation of the same kind taken. The observations made in each position of the instrument are separately reduced with an assumed approximate value of the error of collimation, and two equations are thus derived from which the clock error and correction to the assumed collimation error are found. This use of the transit or alt-azimuth out of the meridian throws considerably more work on the observer, but for the meridian alone it does not seem ever never resorted to except when an observer during field operations is pressed for time. The formulae of reduction as developed by Hansen in the Astronomische Nachrichten (xxviii, 113 seq.) are given by Czerny in his Spherical and Practical Astronomy ii. 216 seq. (4th ed., Philadelphia, 1873). The subject has also been treated at great length by Döll in two memoirs: Die Zeitbestimmung mit Hilfe der Durchmusterung im Verticale des Polardreieck (ato, St. Petersburg, 1863 and 1874).

Longitude.—Hitherto we have only spoken of the determination of local time. But in order to compare observations made at different places on the surface of the earth a knowledge of their difference of longitude becomes necessary, as the local time varies proportionally with the longitude, one hour corresponding to 15°. Longitude can be determined either geodetically or astronomically. The first method supposes the earth to be a sphere of known dimensions. Starting from a point of departure of which the latitude has been determined, the azimuth from the meridian (as determined astronomically) and the distance of some other station are measured. This second station then serves as a point of departure to a third, and by repeating this process the longitude and latitude of places at a considerable distance from the original starting-point may be found. Referring for this method to the articles EARTH, FIGURE OF THE, and GEODESY, we shall here only deal with astronomical methods of determining longitude.

The earliest astronomer who determined longitude by astronomic means is said to have been Hipparchus, who chose for the first meridian that of Rhodes, where he observed; but Ptolemy adopted a meridian laid through the "Insulae Fortunatae" as being the farthest known place towards the west. When the voyages of discovery began the peak of Teneriffe was frequently used as a first meridian, until a scientific congress, assembled by Richelieu at Paris in 1630, selected the island of Ferro for this purpose. Although various other meridians (e.g. that of Uarburg and that of San Miguel, one of the Azores, 29° 25' W. of Paris) continued to be used for a long time, that of Ferro received the most recognition. The first meridian of the Xth. Observ., in the field, portable instruments of 1830, was the Greenwich meridian, adopted with the recommendation of a conference held in 1851, and found by Captain Tyndall, in the course of his voyage to the doubtful and tropical regions of the world. Meteorological observations are commenced, with the recommendation of a conference of the British Association of 1852. The Greenwich meridian was adopted by the United States, in 1854, with the recommendation of a conference of 1854. In 1853 four standard meridians were defined to the United States, 76°, 90°, 105°, 120° west of Greenwich, so that clocks showing "Eastern, Central, Mountain, or Pacific time" are exactly five, six, seven or eight hours slower than a Greenwich mean time clock. In Europe Norway, Sweden, Germany, Austro-Hungary, Switzerland and Italy use mid-European time, one hour fast on Greenwich. In South Africa the legal time is two hours fast on Greenwich, &c.

The simplest method for determining difference of longitude consists in observing at the two stations some celestial phenomenon which occurs at the same absolute moment for the whole earth. Hipparchus pointed out how observations of lunar eclipses could be used in this way, and for about fifteen hundred years this was the only method available. When Regiomontanus began to publish his ephemerides towards the end of the 15th century, they furnished other means of determining the longitude. Thus Amerigo Vespucci observed on the 23rd of August 1499, somewhere on the coast of Venezuela, that the moon at 7° 30' p.m. was 17°, at midnight 35° east of Mars; from this he concluded that they must have been in conjunction at 6° 30', whereas the ephemeris announced this to take place at midnight. This gave the longitude of his station as roughly equal to 53 hours west of the prime meridian. This instrumen could, of course, be very imperfect, the longitudes determined were very erroneous. The invention of the telescope early in the 17th century made it possible to observe eclipses of Jupiter's satellites; but there is to a great extent the same drawback attached to these as to lunar eclipses: that it is impossible to observe with sufficient accuracy the moments at which they occur.

Eclipses of the sun and occultations of stars by the moon were also much used for determining longitude before the invention of chronometers and the electric telegraph offered better means for fixing the longitude of observatories. These methods are now hardly ever used except by travellers, as they are very inferior as regards accuracy. For the necessary formulae see Chauvenet's Spherical and Practical Astronomy, i. 518-542 and 550-557.

We now proceed to consider the four methods for finding the longitudes of fixed observatories, viz. by (1) moon calculations, (2) rockets or other signals, (3) transport of chronometers and (4) transmission of time by the electric telegraph.

1. Moon Calculations.—Owing to the rapid orbital motion of the moon, its sidereal proportional motion is different for different meridians. If, therefore, the rate of the moon's change of right ascension is known, it is easy from the observed time of culmination on the meridian to find the sidereal times to be as much as possible independent of instrumental errors, some standard stars nearly or at the parallel of the moon are observed at the two stations; these "moon-culminating stars" are given in the ephemerides in order to secure that both observers take the same stars. As either the preceding or the following limb, not the centre, of the moon is observed, allowance must be made for the time the semi-diameter takes to pass the meridian and for the change of right ascension during this time. This method was proposed by Pigot towards the end of the 18th century, and has been much used; but, though it may be very serviceable on journeys and expeditions to theœ, its use is not recommended in cases where observations cannot be employed, it is not accurate enough for fixed observatories. Errors of four to six seconds of time have frequently been noticed in longitudes obtained by this method from a limited number of observations: e.g. 4-47' in the case of the London observatory.


2 For fixed stations the photographic method first proposed and carried out by Captain Tyndall, at the Cape of Good Hope, was advantageous. A camera of rigid form is set up and some instantaneous moon-exposures are made, after which the camera is left untouched until a few exposures can be made of a couple of bright stars, which are allowed to impress their trails on the plate for 15 or 30 seconds. If the exact local time of each exposure be known, such a plate gives the data necessary for computing the moon's position at the time of each exposure, and hence the Greenwich time and longitude (Mem. Roy. Astr. Soc., 1899, iii. 117).
2. Signals.—In 1671 Picard determined the difference of longitude between Copenhagen and the site of Tycho Brahe's observatory at Helsingør by observing the transit of a star across the meridian from both stations. He placed a telescope on the roof of his observatory in Copenhagen. The stars were observed with an instrument of 9 inches in diameter, which was later increased to 12 inches. The observations were made from the beginning of May to the middle of July. On the first day of May, a star was observed to cross the meridian at 3 p.m. at Copenhagen and at 3:06 a.m. at Helsingør. The difference in time was 100 minutes, so that the longitude of Copenhagen was determined to be 9 degrees west of Helsingør.

3. Use of Rocket Signals.—In 1848, a rocket was launched from the top of the tower of the observatory at Copenhagen. The rocket was equipped with a small灯笼, which was set on fire by a spark produced by a battery. The flame was visible for a distance of 20 miles, and was observed at several observatories in England and France. The rocket signals were used to determine the difference of longitude between Copenhagen and London.

4. Determination of Longitude by Signals.—In 1849, a signal was sent from the western station A at the local time T1, and received at the eastern station B at the local time T2. The difference in time T2 - T1 is the longitude of station A, and is determined by this method. The signal was transmitted by a chronograph, which was a device for measuring time accurately. The chronograph was placed on a platform which could be moved horizontally. The platform was driven by a spring, and the motion of the platform was transmitted to a lever which operated a register. The register was a device for recording the time on a card. The chronograph was operated by a clock, which was set by a signal from the western station. The clock was set by a signal from the eastern station, and the difference in time was taken either by eye or by ear or by the chronograph, but as the observations made with the chronograph were somewhat more accurate than those made by eye and ear, the chronograph should be used in preference to the other methods.

The method of simultaneous registration at both stations of transits of the same star has one advantage. Each transit observed at both stations furnishes a value of the difference of longitude, and the final result is the mean of the two values. In the first method, which necessitates the combination of a series of clock errors determined during the night to form a value of the difference of longitude, the errors are cumulative.

When using this method it is advisable to select the stars in such a manner that only one station at a time is at work, so that the intensity of the current can be readjusted (by means of a rheostat) for the intensity of the current for the other station. When a single station is in use, the intensity of the current is necessary whatever method is employed, as the constancy of the transmission time (z in the above equations) chiefly depends on the constancy of the current. The probable error of a difference of longitude deduced from one star appears to be 3 degrees for eye and ear transit and 0.008 degree for chronograph transit.

Wireless telegraphy was first used in 1869 to determine the longitude of the western station of Altona-Greenwich in England. The signals were sent from Nauen, 32 km from the station, and from 183 km from the latter station. The clock-differences were found to be quite independent of the energy of the electric current in the wireless telegraph. The results made it possible for the first time to determine the longitudes of ships in places where it may be desirable to determine the longitudes of a number of stations at the same time.

The results of a determination of longitude depend to a very great extent on the accuracy of time of the two stations, and great care must therefore be taken to determine the instrumental errors repeatedly during a night's work. But in addition to the uncertainty which enters into the results from the ordinary errors of observation, there is another source of error which becomes of special importance in longitude work, viz., the range of the observer. It is sometimes possible to conceive that one person may hear and then see, while another these sensations take place in the reverse order; and to this possible source of error may be added the sensible time required by observers to analyse and then start to act on the third signal, and this time is referred to the latter for its exact determination. As the chronographic method of observing dispenses with one sense (that of hearing) and merely requires the watching of the star's motion and the pressing of an electric button, it is possible to compensate for the subjective element in the personal errors should in this case be much smaller than when the eye and ear method is employed. And it is a fact that in the former method there have been or occurred errors of between half and a whole second such as have not infrequently appeared in the latter method.

In transit observations generally this personal error does not cause any inconvenience, so long as only one observer is employed at a time, and unless the amount of the error varies with the magnitude of the star (which is often the case); but when absolute time has to be determined, as in longitude work, the full amount of the personal error is received between the times T1 and T2, and the latter is referred to the former for its exact determination. It may be conceived that one observer may hear and then see, while another these sensations take place in the reverse order; and to this possible source of error may be added the sensible time required by observers to analyse and then start to act on the third signal, and this time is referred to the latter for its exact determination. As the chronographic method of observing dispenses with one sense (that of hearing) and merely requires the watching of the star's motion and the pressing of an electric button, it is possible to compensate for the subjective element in the personal errors should in this case be much smaller than when the eye and ear method is employed.

1 Albrecht, Bestimmung von Längendifferenzen mit Hilfe des elektrischen Telegraphen, p. 80 (Leipzig, 1869).

2 Maskelyne had in 1795 noticed that one of his assistants observed transit signals which he considered too slow, and that it was supposed to arise from some wrong method of observing adopted by the assistant, and the matter was not further looked into.
caused by a shifting of the reflector inside the telescope, by means of a rack and pinion, which produced an apparent shifting of the image of the spider lines, unless the eye-piece was very accurately focused for the observer's sight. The simplest and best way to find the equation between two observers is to let one observer work at the completion of a certain number of and the other observe the transits over the remainder, each taking care to refocus the eye-piece for himself in order to avoid the above-mentioned effect. Repsold's equation was reduced to have immediately the equation; and, in order to eliminate errors in the assumed wire-intervals, each observer uses alternately the first and the second half of the wires. In longitude work, the two wires are taken as the basis of a certain number of nights' work exchange stations and commence a new set of observations; the mean of the two results thus obtained should be free from the effect of personal error, provided that the errors of both observers happen to be equal in respect to the same wire. Whichever of the two observers happens to let the observers compare themselves at the beginning, middle and end of the operations, and, if possible, at both the instruments employed. A user—General results are afforded by simultaneous experiments with one of the instruments contrived by C. Wolf, Kaiser and others, by which the absolute personal error of an observer can be determined. Though differing much in detail, these instruments are all constructed on the same artificial star (a lamp shining through a minute hole in a screen mounted on a small carriage moved by clockwork) passes in succession across a number of lines drawn on oiled paper, while an electric contact with the instrument is made at each transit by means of conductors on each line by the carriage passing a number of adjustable contact makers. The currents thus made register the transits automatically on a chronograph, while the operator observes and apprises the carriage by his eye and ear or by chronograph, thus immediately finding his personal error. These contrivances have sometimes been used to educate pupils, there being good examples of them. It is shown that the possible personal error can be generally somewhat diminished through practice. By using Repsold's self-registering micrometer, which enables the observer to follow the motions of the star with a movable vertical wire which automatically registers its passage over coter fixed points in the eyepiece, the effect of personal error is almost completely eliminated. In the determination of the difference of longitude between Fortsdaan and Dresden, the longitude of the station 3° 0', the relative error on the appearances through the eyepiece, and the sum of their personal and instrumental equation was 0.0006 with a probable error of 0.0005.

LITERATURE—Great treatises on spherical astronomy, such as Brünnow's Lehrbuch der sphärischen Astronomie (3rd ed., Berlin, 1871; trans. into English and several other languages) and Chauvenet's Manual, treat very fully of the numerous methods of determining time by combination of altitudes or azimuths of several stars. For telegraphic longitude work see the Publications des kön. preussischen geodätischen Instituts; the Reports of the United States Coast and Geodetic Survey; the A Ccounts of the Great Trigonometrical Survey of India; and Report of the Chief Astronomer, 1905 (Ottawa, 1906), which gives a useful review of recent longitude work in the Pacific and adjacent countries. On personal errors see the Memoire, of the Acad. des Sciences, and "Recherches sur l'équation personelle par M. F. Connessat" in the Trav. de l'observ. de Lyon (1892), vol. ii. (J. L. E. D.)

TIME, STANDARD. Local time is determined by the relation of the meridian of a place to the sun. Noon at any place is defined as the moment when either the true or mean sun passes the meridian of that place, according as apparent or mean time is used. Practically, the use of mean time is now universal, so that we may regard the mean sun as that by which noon is determined. As the earth revolves, all its meridians are brought under the sun in succession. At any instant the earth, rotation time, revolves about the earth, making the circuit in twenty-four hours. It follows that noon, and therefore any other hour of the day, is later by four minutes for every degree of longitude towards the west, so that a watch carried east or west will be found to deviate from local time by an amount proportional to the change of longitude. Before the time of railways this deviation was not productive of inconvenience. But when railway travelling became common, train schedules had to be more exact than those of a mail coach, and the traveller was rapidly carried to places where the local time continually deviated from that shown by his watch. The invention of railways had thus produced a situation in which communication with others of a different longitude was frequent. Thus arose a practice on the part of railways of using the time of some central or important city on its line for all places not too distant, which time would naturally be adopted by the inhabitants of the region through which it passed. For a similar reason, in countries which did not extend through a large fraction of an hour of longitude, it was natural to use the time of the capital throughout all or a large part of its extent. Thus Greenwich time has long been in use throughout England, and all the railways of France are run by Paris time. But inconvenience was still unavoidable in passing from one country to another, or in travelling through long stretches in the same country. The inconvenience was especially felt in the United States, where every railway, and even every long stretch of several great railways, had its own time system. Thus it happened not infrequently that in a single station clocks would be found set to the time of three different meridians, one for the road toward the east, another for the road toward the west, and a third for the meridian of the place, or local use. A device now being generally adopted to do away with this confusion was planned in 1878-1879 by Mr (afterwards Sir) Sandford Fleming, and published in the Journal of the Canadian Institute of Toronto for 1879. On the initiative of this organization, Mr Fleming's proposals were officially communicated to the leading governments of the world with a view of securing an international unification of the method of designating the hour of the day for common use. Naturally connected with the proposal was that of a prime meridian, from which all longitudes should be reckoned. United States invited an international conference, which was held in Washington in 1884, for the purpose of adopting a standard meridian to which longitudes and times should be referred.

Before this conference was called the railway managers of the United States, after long discussion, adopted the system. Its fundamental idea was that twenty-four standard meridians should be established 15° apart in longitude, starting from the meridian of Greenwich and extending round the globe. Then on each meridian the local time would differ from Greenwich time by some entire number of hours. At every point of the globe the time to be adopted for common use was that of the nearest standard meridian. These twenty-four standard meridians would then divide the earth into lines of twenty-four zones, within each of which the time to be adopted would be uniform, but which would change by an hour on passing from one zone into another. The inhabitants of each zone naturally take the time of the zone instead of their local time, the maximum difference between the two being half an hour.

When the system was first established in the United States a delicate legal question arose as to whether the business of banks and courts should be legally adjusted to the new time. This was soon settled by law making the standard time legal within the limits of each zone. A similar system is being adopted in Europe, the standard meridians being those of 15°, 30°, &c., east of Greenwich. France, however, still adheres to Paris time, but Belgium and Holland use Greenwich time, and Switzerland, Italy and central Germany use the time of 15° E., and therefore one hour in advance of that of Greenwich. This is termed mid-European time.

The system we have described is that adopted for the purposes of the railways and of daily life. For scientific and for some international purposes yet other modifications are desirable. An important distinction must be made between the cases in which no inconvenience results that the time be 4 hours behind the hour of the day, and those where no such relation is required. The former is the case in designating acts or occurrences which depend upon our daily routine of rest and wakefulness. But if nothing is necessary except the designation of some moment of absolute time, irrespective of our daily routine of life, then only a single measure for the whole world is necessary. At the Washington Meridian Conference of 1884 it was proposed that Greenwich time should be adopted as a standard for the whole world in all matters of this class, especially in astronomical practice and in cable despatches. But this system does not seem to have been extensively adopted outside of astronomy, the
cultivators of which are most accustomed to the conversion of local into standard or Greenwich time. An unavoidable inconvenience associated with the system is the uncertainty in many cases whether local or Greenwich time is understood. This must be especially the case with magnetic and seismic phenomena, the designation of which should be uniform for the whole earth; at present, however, we cannot invariably expect local observers to convert their observations from local into Greenwich mean time.

Associated with this question is that of the moment when the day should begin, or from which the hours should be counted. This civil day begins at midnight (the beginning of the day at midnight and p.m. (post meridiem, after mid-day), now practically universal in household and ordinary civil life, is impracticable for scientific purposes, where a count of the hours from 0 up to 24 is necessary. In railway schedules the necessity of distinguishing a.m. from p.m. when our civil time is used is found so troublesome that in some countries, especially Italy and Canada, the 24-hour system is used. Hours after noon are there designated as 13, 14, &c., up to midnight, at which moment a new day begins. On the other hand, with some few exceptions, astronomers have always from the immemorial begun their day at noon, and navigators have very generally adopted the same practice, but for a quite different reason. In astronomy the day begins at noon for two reasons of convenience. One is that as the day is fixed by the transit of the sun over the meridian, it is more natural to start the count of the hours from this moment than from that when the sun is on the invisible meridian at midnight. This practice also coincides with that of counting the hours of sidereal time from the transit of the vernal equinox, and leads to the simple rule that the local mean time is equal to the hour angle of the mean sun. The other reason is that, as the astronomer makes most of his observations at night, and often after midnight, it is inconvenient to begin a new day at the latter hour. This consideration is however reversed in day observations, especially those on the sun, but these are few in number.

Navigators began the day at noon because their latitude is determined by observations of the sun, while the longitude is also generally determined during the daytime. Thus, in doing the "day's work" in the log, the position of the ship was always computed for noon. Such being the case, it was found more convenient to begin the count of a new day at this hour, to be continued through the night until the following noon. But the navigator's count of days was one day in advance of that of the astronomers; for example, March the 10th, astronomical time, begins on the 10th day of March at noon, and this count continues until noon of the day following, so that the forenoon of March the 11th, civil time, is still March the 10th, astronomical time. But the navigator begins March the 11th at noon on March the 10th. This difference is worthy of mention because a widespread misapprehension exists that the navigator was forced to count his days from noon owing to the adoption of the same system in the Nautical Almanac. The fact is that the practice of the navigator, like that of the astronomer, was adopted purely for his own convenience, and for the reasons just set forth. It is, however, being changed so as to conform to civil time, but as yet no general law prescribes the change.

At the Meridian Conference of 1884, it was proposed that the practice of beginning the day at midnight should be adopted universally in astronomy and navigation, and that the hours should be counted from that moment in all the nautical and astronomical ephemerides. The question of adopting this system became a subject of international correspondence. The views of the directors of the astronomical ephemerides, so far as elicited, were strongly against the change. The considerations which determined them were the confusion which the change would introduce into the tables and the count of time in the ephemerides, including the relation of sidereal and solar time; the unavoidable doubt as to whether the one or the other system was used in astronomical publications; and the danger of placing in the hands of the navigator an ephemeris in which the hours should have a different meaning from that to which he was accustomed. On the other hand, the reasons of convenience which led to the practice of beginning the day at noon still continued, so that nothing could be shown to counterbalance these drawbacks. Still, in works to be used by the public, especially almanacs and other astronomical annuals, it is necessary to convert astronomical into civil time. This must continue to be done, but offers no difficulty to the authors of such works, who are acquainted with the difference, nor to the public, which has no interest in the ephemerides and measures of time used by the profession of the mathematician.

TIME BARGAINS, a financial or commercial term, is the transfer of ephemerides in securities or commodities which are to be completed at a future date, as opposed to bargains which are settled immediately. (See Market.)

TIMGAD, a ruined city 23 m. S.E. of Batna in the department of Constantine, Algeria. Timgad, the Thamugas of the Romans, was built on the lower slopes of the northern side of the Aures Mountains, and was situated at the intersection of six roads. It was traversed by two main streets, the Cardo Maximus running north and south, and the Decumanus Maximus east and west. The residential part of the town was on a lower level than the capitol and most of the other public buildings. The ruins of the capitol occupy a prominent position in the southwest of the city. Some of the columns of the façade (which are of the Corinthian order and 45 ft. high) have been re-erected. The dimensions of the capitol correspond with those of the Pantheon at Rome. Immediately north of the capitol are the remains of a large market; to the east are the ruins of the forum, basilica and theatre. The auditorium of the theatre, which held nearly 4000 persons, is complete. A little west of the theatre are baths, containing paved and mosaic floors in perfect preservation. Ruins of other and larger thermae are found in all four quarters of the city, those on the north being very extensive. Across the Decumanus Maximus just north-east of the market is the arch of Trajan—still erect, and restored in 1900. The arch is of the Corinthian order, and has three openings, the central one being 11 ft. wide. Each façade has four fluted columns 15 ft. high. The chief material used in building the arch was sandstone. The fluted columns are of fine white limestone and smaller columns are of coloured marble. At the other (eastern) end of the street are the remains of another triumphal arch. West of the capitol are the ruins of a large theatre, which was circular at the circumference, built in the 1st century. There are also remains of six other churches. About 400 yds. south of the city, the walls nearly entire, is a ruined citadel, a quadrangular building 360 ft. by 295 ft., with eight towers. It was built (or rebuilt) by the Byzantine army in the 6th century. Near the northernthermae is the house of the director of the excavations and a museum containing small objects found in the ruins.

 Numerous inscriptions have been found on the ruins, and from them many events in the history of Thamugas have been learnt. In the year A.D. 100 the emperor Trajan gave orders to build a city on the site of a fortified post on the road between Thamugas and Lambaesis. This city, called Colonia Marciana Trajana Thamugas (Marciana in honour of Trajan's sister) appears from the inscriptions to have been completed, as far as the principal buildings were concerned, in seventeen years. A legion of Parthian veterans was stationed in the newly founded city. From the time of its foundation to the 4th century Thamugas seems to have enjoyed a peaceful and prosperous existence. Numerous inscriptions testify to the manner of life of the citizens. In the 3rd century Thamugas became a centre of Christian activity, and in the next century espoused the cause of the Donatists. The city declined in importance after the Vandal invasion in the 5th century, and was found in a ruinous condition by the Byzantine general Solomon, who occupied it A.D. 535. It is believed that the Berbers from the neighbouring mountains destroyed the city, hoping thus to prevent it being used as a stronghold from which to harry them. Thamugas was, however, repeopled, and in the 7th century was a Christian
TIMOCREON-TIMOR

city. After the defeat of Gregory, governor of Africa, by the Arabs in 647, Thamugas passes from history. After centuries of neglect James Bruce, the African traveller, visited the spot (1765), made careful drawings of the monuments and deciphered some of the inscriptions. Bruce was followed, more than a century later (1873), by Sir R. Lambert Playfair, British consul-general at Algiers, and soon afterwards (1875-1876) Professor Masquerey published a report on the state of the ruins. Since 1881 Thamugas has been systematically explored, and the ruins excavated under the direction of the Service des monuments historiques. Among the objects discovered are a series of standard measures—five cavities hollowed out of a stone slab.

Seventeen miles west of Timгад, on the site of the Roman city Lambes (q.v.).

See G. Boeswillwald, R. Cagnat and A. Ballu, Timгад, une cite africaine sous l'epoque romain; and A. Ballu, Guide illustre de Timгад (Paris, 1903).

TIMOCREON, of Ialysus in Rhodes, Greek lyric poet, flourished about 480 B.C. During the Persian wars he had been banished on suspicion of "medism." Themistocles had promised to procure his recall, but was unable to resist the bribes of Timocreon's adversaries and allowed him to remain in exile. Timocreon thereupon attacked him most bitterly (see Plutarch, Thémistocle, 321) and Themistocles, the friend of Thucydides, retorted in an epigram (Anth. Pal. vii. 348). Timocreon was also known as a composer of scolia (drinking-songs) and, according to Suidas, wrote plays in the style of the old comedy. His gluttony and drunkenness were notorious, and he was an athlete of great prowess.

TIMOLEON (c. 411-337 B.C.), of Corinth, Greek statesman and general. As the champion of Greece against Carthage he is closely connected with the history of Sicily, especially Syracuse (q.v.). When his brother Timophanes, whose life he had saved in battle, took possession of the acropolis of Corinth and made himself master of the city, Timoleon, after an ineffectual protest, tacitly acquiesced while the friends who accompanied him put Timophanes to death. Public opinion approved his conduct as patriotic; but the curses of his mother and the indignation of some of his kinsfolk drove him into retirement for twenty years. In 344 envoys came from Syracuse to Corinth, to appeal to the mother-city for relief from the intestine feuds from which the Syracusans and all the Greeks of Sicily were suffering. Carthage too, their old and bitter foe, was intriguing with the local despots. Corinth could not refuse help, though her chief citizens declined the responsibility of attempting to subdue a settled government with a land army. The tumultuous reply of Syracuse, Timoleon, being named by an unknown voice in the popular assembly, was chosen by a unanimous vote to undertake the mission, and set sail for Sicily with a few of the leading citizens of Corinth and a small troop of Greek mercenaries. He eluded a Carthaginian squadron and landed at Tauromenium (Taormina), where he met with a friendly reception. At this time Hicetas, tyrant of Leontini, was master of Syracuse, with the exception of the island of Ortigia, which was occupied by Dionysius, still nominally tyrant. Hicetas was defeated at Adranos, an inland town, and driven back to Syracuse. In 343 Dionysius surrendered Ortigia on condition of being granted a safe conduct to Corinth. Hicetas now received help from Carthage (60,000 men), but ill-success roused mutual suspicion; the Carthaginians abandoned Hicetas, who was besieged in Leontini, and compelled to surrender. Timoleon was thus master of Syracuse. He at once began the work of restoration, bringing new settlers from the mother-city and from Greece generally, and establishing a popular government on the basis of the democratic laws of Diocles. The citadel was razed to the ground, and a court of justice erected on its site. The amphipolos, or priest of Olympian Zeus, who was annually chosen by lot out of three clans, was invested with the chief magistracy. The impress of Timoleon's reforms seems to have lasted to the days of Augustus. Hicetas again induced Carthage to send (340-339) a great army (70,000), which landed at Lilybaeum (Marsala). With a miscellaneous levy of about 12,000 men, most of them mercenaries, Timoleon marched westwards across the island into the neighbourhood of Selinus and won a great and decisive victory on the Crimissus. The general himself led his infantry, and the enemy's discomfiture was completed by a blinding storm of stone which hit the barbarians. The victory gave the Greeks of Sicily many years of peace and safety from Carthage. Carthage made, however, one more effort and despatched some mercenaries to prolong the conflict between Timoleon and the tyrants. But it ended (338) in the defeat of Hicetas, who was taken prisoner and put to death; by a treaty the dominion of Carthage in Sicily was confined to the west of the Halycus (Platani). Timoleon then retired into private life without assuming any title or office, though he remained practically dictator not only at Syracuse, but throughout the island. Notwithstanding the many elements of discord Sicily seems to have been during Timoleon's lifetime tranquil and contented. He became blind some time before his death, but persisted in attending the assembly and giving his opinion, which was usually accepted as a unanimous vote. He was buried at the cost of the citizens of Syracuse, who erected a monument to his memory in their market-place, afterwards surrounded with porticoes, and a gymnasium called Timoleontium.

Lives by Plutarch and Cornelius Nepos; see also Diod, Sic. xvi. 64-65; G. Wachsmuth, Photographic Reconstructions (1860) which contains an exhaustive examination of the authorities; also SICILY: History; and SYRACUSE, with works quoted.

TIMOMACHUS, a Greek painter of the 1st century B.C. He was noted especially for two pictures, one of which represented Ajax during his madness, the other Medea meditating the slaying of her children. Both of these works were remarkable for their power of expression, especially in the face, and so belong to the late phase of Greek art. Of the Medea we may form some idea from paintings at Piantani, in the neighbourhood of Naples, standing with a sheathed sword in her hand, and watching the children at play (Helbig, Wandgemälde Campaniens, Nos. 1262-1265).

TIMON, of Athens, the noted misanthrope, celebrated in Shakespeare's play, lived during the Peloponnesian War. He is more than once alluded to by Aristophanes and other comedians. Plutarch introduces a short account of his life in his biography of Mark Antony (ch. 70), who built a retreat called Timonium (Strabo xvii. 794) at Alexandria. Timon also gave his name to one of Lycias's dialogues. Shakespeare probably derived his knowledge of Timon mainly from Plutarch; but the Timon of Shakespeare so resembles the Timon of Lucian that Shakespeare (or whoever wrote the first sketch of the play) may have had access to the dialogue.

TIMON (c. 320-230), of Phlius, Greek sceptic philosopher and satirical poet, a pupil of Stilpo the Megarian and Pyrrho of Elis. Having made a fortune by teaching and lecturing in Chaldexon he spent the rest of his life chiefly at Athens, where he died. His writings (Diogenes Laërtius, ix. ch. 12) were numerous both in prose and verse: besides the ΣΑΛΟΣ, he is said to have written epic poems, tragedies, comedies and satyr dramas. But he is best known as the author of the ΣΑΛΟΣ, three books of sarcastic hexameter verses, written against the Greek philosophers.

The fragments that remain (about 140 lines or parts of lines, printed in F. W. A. Mullach, Frag. phil. graec. i. 84-98) show that Timon possessed some of the qualities of a great satirist, together with a command of the hexameter; but he had no loftier aim than to awaken laughter. Philosophers are "excessively cunning murderers of many wise saws" (p. 96); the only two whom he spares are Xenophon, "the modest censor of Homer's lies" (p. 97), and Pyrrho, against whom "no other mortal dare contend" (p. 126). Besides the ΣΑΛΟΣ we have some lines preserved from the Ιθέλοιαν, a poem in elegiac verse, which appears to have inculcated the tenets of scepticism, and one or two fragments which cannot be with certainty assigned to either poem. There is a reference to Timon in Aus. Praep. Ex. xiv. (Eng. trans. by E. H. Gifford, 1903, p. 761). Fragments of his poems have been collected by Wilke, De graecor. Philocontro (Wiesbaden, 1882), and by Pape, Aprodile (Berlin, 1877), and Wachsmuth, Sillographorum graec. reliquiae (Leipzig, 1885).

TIMOR, an island of the Malay Archipelago, the easternmost and largest of the Lesser Sunda Islands, stretching S.W. and N.E.
for 300 m. between 8° 40' and 10° 40' S., and between 123° 30' and 129° E. It has a mean breadth of 60 m., and an area of about 12,500 sq. m. Politically its north-eastern half is Portuguese, as are two small enclaves in the south-western half, the remaining being Dutch. Timor lies in deep water a little to the west of the hundred fathom line, which marks in this direction the proper limit of the shallow Arafura Sea, extending between it and northern Australia. It differs considerably from the other members of the Sundanese group both in the direction of its main axis and in the prevalence of old rocks and slighter charcoaliferous circumstances. southwestward. The region stretching from the north of Sumatra, through Java and the other Sundanese islands, round to Ambon, Tidore, Ternate, Halmahera and the Philippines. There appear to be volcanic centres in both the east and the west of the island, and the surface is everywhere extremely rugged, with ridges from 4000 to 8000 ft. high, forming a confused orographic system, which is by no means fully understood. Mount Kabalaki in the north rises above 10,000 ft.; the culminating point appears to be Mt Alas (over 12,000 ft.) near the coast. Owing to the prevalent dry easterly winds from the arid plains of north Australia and New Guinea, the islands, and the islands beyond, have a much drier climate, and a poorer vegetation, than islands further west, and has few perennial streams and no considerable rivers. Hence, apart from almost untouched mineral wealth, such as iron, copper and gold, the island is poor in natural resources. Coal and petroleum have been found. At Kupang, on the south coast, the number of rainy days per month in the six months May to October dwindles from 4 to 0, while the monthly rainfall gradually sinks from a little less than 2 in. to nil; the northern districts are better watered. Though the mineral pit deposits are varied, the supply of ores of copper has proved scanty; besides which their exploitation is rendered difficult by the lack of labourers, water and wood. The uplands yield fairly under cultivation, while the woodlands, which nowhere form true forests, contain much excellent sandalwood.

This and a noted breed of hardy ponies form the chief articles of export. Owing to the deep water between Timor and the Arafura Sea, the fauna of Timor presents scarcely any Australian types beyond a marsupial cuscus. The few mammals; such as deer, civet, pigs, shrews and monkeys, as well as the birds and insects, resemble ordinary Malayan forms.

The name Timor is of uncertain origin. The Timor Islands consist of a core of Jurassic rocks (Archean?) upon which rest Permian and later deposits of sedimentary origin. Volcanic rocks are also present but they are not so extensively developed as in the islands of the Javan arc. The Permian beds consist chiefly of sandstone and limestone similar to those of eastern Java. The middle and upper divisions of the Proterozoic limestone of northern India and the Artinsk stage of the Urals. The best-known locality is the bed of the Ayer Mati near Kupang. These rocks were originally referred to the Carboniferous system, and similar limestones have been recorded in many parts of the island. Triassic beds with *Halobia* and *Monotis* are well-developed in Rotti and appear also to occur in Timor. The fauna is similar to that of the Mediterranean Trias. Fragments of Jurassic rock have been found amongst the volcanic material on the island of Rotti, but they have not yet been discovered in situ. The Tertiary deposits form a fringe around the older rocks, and in some places this fringe extends far up into the interior of the island.

The bulk of the population is certainly Papuan, but intermingled with Malay, Polynesian and other elements; hence it presents an extraordinary diversity of physical characteristics. There is a great number of portrait and caricature heads in the portraits figured in H. O. Forbes's *Naturalist's Wanderings in the Eastern Archipelago*. The natives, still mainly independent of their nominal Dutch and Portuguese rulers, are divided into hostile tribes, speaking as many as forty distinct Papuan and Malay languages or dialects. Some are addicted to head-hunting, at least during war, and to other barbarous practices. In the primitive churches and other traditional arts, rites are performed resembling those of the Polynesian islanders.

**PORTUGUESE TIMOR** includes the neighbouring isle of Pulo Kambing, and has an area of about 7450 sq. m. Estimates of the population vary from 300,000 to over half a million. Dili, on the north coast, the administrative headquarters and chief settlement, is a poor little place of some 3000 inhabitants, containing hardly any European or Europeanised persons. Official statistics allow 3,000 Portuguese residents unites to Portuguese Timor till 1896, and still pays a contribution to the revenue. The estimated revenue for 1901–1902 was £25,196 (£7200 from Macao), and in 1905–1906 it was £26,968; the estimated expenditure was £35,532 in the earlier and £43,320 in the later period. Few ships visit the colony, except Dutch vessels trading in the archipelago, which call regularly at Dili. Exports (principally copra) are estimated at about £55,000 annually, and imports at about the same amount.

**Dutch Timor** has an area of a little over 5000 sq. m. Kupang, the chief town of the residency, contains some 8000 inhabitants, of whom 1000 are Europeans and about 43 Arabs. In agriculture, European plants have not been successful, and of native products the supply is only sufficient for the home consumption. The export of sandalwood, ponies, rhinoceros horns and nuts of *Hedyosmum* is a slight but growing trade. Dutch Timor gives its name to a residency comprising, besides its own territory, the small adjacent islands, Rotti, Pemam, &c., the Samboja Islands, Sumbawa, Lombok, all islands of eastern Sumatra, and the eastern half of Flores, all lying between 8° 5' and 12° 5' S. and 125° 3' and 125° 15' E., the total area being 17,698 sq. m. It is divided into four administrative districts—Timor, Rana, Rana, Ambon, Larantuka (eastern Flores) and Sumba. Pop. of the residency (1905), 308,500.

It is possible that the Portuguese visited Timor before the Spanish did so in 1521. They were followed by the Dutch, who established on the island when the Dutch expelled them from Kupang in 1613. During the 18th century the two powers came frequently into conflict; and in 1895 their boundaries were settled by treaty. This treaty was replacing the deep seas area of the 18th century, and the Dutch had proved irksome in many ways, especially as it left portions of the territory belonging to protected chiefdoms of each power as enclaves within the boundaries of the other. This led to frequent difficulties, and a mixed boundary commission was therefore appointed under the new treaty and determined more satisfactory boundaries. The new treaty, moreover, stipulates that all future disputes shall be referred to arbitration. The declaration, signed at the same time, that either power would favour the interests of the other in granting concessions, &c., to the exclusion of all others. Thus Portugal and Holland secured the exclusive possession of Timor to themselves.

See P. A. van der Lith, *Nederlands-Indië* (Leiden, 1893–1894). H. O. Forbes, *A Naturalist's Wanderings in the Eastern Archipelago* (London, 1889); and other general works (cf. MALAY ARCHIPELAGO). Some of the problems connected with the physical characteristics of Timor are discussed in H. Zondervan's "Timor en de Timorezen," *Tijdsschr. Aard. Gen.* (1888), vol. v. (with bibliography); K. Martin and A. Wichert, "†Roteck,* Arch. Naturkund. Berlin, *Aussagen* (Leiden, 1887–1884); and A. Wichert, *Infor, über die Reise nach der Timoreischen Inseln, Archipel," *Tijdsschr. Aard. Gen.* (1889–1892), with sketches of Timor, map, &c.; A. Rothpletz, *Die Perm-, Trias- und Jura-Formation auf Timor und Rotti im Timorischen Archipel, Palaeonoeigraphica* (1892) pp. 57–106. There is a summary of Rothpletz's results in *American Naturalist* (1891), xxv. 959–962. For the remarkable flying survey of the south coast by the commandant of the Siboga expedition, replacing the deep seas area of the 18th century, and the Dutch had proved irksome in many ways, especially as it left portions of the territory belonging to protected chiefdoms of each power as enclaves within the boundaries of the other. This led to frequent difficulties, and a mixed boundary commission was therefore appointed under the new treaty and determined more satisfactory boundaries. The new treaty, moreover, stipulates that all future disputes shall be referred to arbitration. The declaration, signed at the same time, that either power would favour the interests of the other in granting concessions, &c., to the exclusion of all others. Thus Portugal and Holland secured the exclusive possession of Timor to themselves.

**TIME LAUT** ("Seaweed Timor"; Dutch, *Timor Laeot*), Teninber of Tenimbar, a group of islands in the Malay Archipelago, S.W. of the Aru Islands, between 6° 20' and 8° 30' S., and 130° 40' and 132° 5' E. By the Dutch, in whose residency of Ambon they are included, they are politically divided into two districts; Larat, including the inhabited islands of Larat, Vord, Molu, and Maro, together with many uninhabited islands; and Sera, including the Sera Islands, Selaru, and the southern part of Yamdena, all inhabited. Only Yamdena and Selaru are by the natives called Timor Laeot; all the others they call Tenimbar. The group is in the main coralline. Vordate, Molu and south-eastern Yamdena have a maximum height of 820 ft.; the rest are low and flat, except Labobor, apparently a volcanic islet on the west, which has an extinct crater 2000 ft. high. Yamdena, the largest island, has an area of about 1100 sq. m.; the rest together about 1000. Rtalbel in Larat is the only safe roadstead during the east and west monsoons. The vegetation includes many species of *Hedysomum*, cuscus, some bats, the beautiful scarlet lory, rare varieties of the ground-thrush, honey-eater and oriole. The population is estimated at about 19,000. The aborigines are Papuans, but mixed much with Malay and perhaps Polynesian elements. They are a fine race, often over 6 ft. tall, noted for their artistic sense. In other respects they are pagans in a low state of culture, mostly divided into hostile communities and addicted to piracy. The only means of subsistence is primitive agriculture.
TIMOTHEUS—TIMOTHY, FIRST EPISTLE TO

on a poor soil, turtle and trepang fishery and cattle-rearing. The yearly export (trepang, turtle and kamuong wood) is valued at only £60 to £160.


TIMOTHEUS, Athenian statesman and general, son of Conon, the restorer of the walls of Athens. From 378-356 B.C. he frequently held command in the war between Athens (in alliance with Thessalia), and Sparta. The object of Athens was to revive the old confederacy (see Delian League, § 2), and to regain command of the sea, and in 375 Timothues was sent with a fleet to sail round the Athenians by way of demonstration against Sparta. He gained over Cephallenia, secured the friendship of the Acazarians and Molossians, and took Corcyra, but used his victory with moderation. Want of funds and jealousy of the Thebans led to a short peace. In 373 Timothues was appointed to the command of a fleet for the relief of Corcyra, then beleaguered by the Spartans. But his ships were not fully manned, and to recruit their strength he cruised in the Aegean. The delay excited the indignation of the Athenians, who brought him to trial; but, thanks to the exertions of his friends—Jason, tyrant of Phocis, and Alcetas, king of the Molossians, both of whom were dear to Athens and expelled the Athenians in three days. He had previously been superseded in his command by Iphicrates. Being reduced to great poverty—for he had pledged his private property in order to put the fleet in an efficient state—he left Athens and took service with the king of Persia. We next hear of him about 366, when, having returned to Athens, he was sent to support Arbobarzanes, satrap of Phrygia. But, finding that the satrap was in open revolt against Persia, Timothues, in conformity with his instructions, abstained from helping him and turned his arms against Samos, then occupied by a Persian fleet. He hurried to Athens to plead his cause—he was acquitted.

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He then took Sestus, Crithote, Torone, Potidaea, Methone, Pydna and many other cities; but two attempts upon Amphipolis failed. An action was brought against him by Apollodorus, the son of the banker Pasion, for the return of money lent by the father. The speech for the plaintiff is still extant, and is attributed (though not unanimously) to Demosthenes. It is interesting as showing the manner in which Timothues had exhausted the large fortune inherited from his father and the straits to which he was reduced by his sacrifices in the public cause. In 358 or 357, the Athenians, in response to a spirited appeal of Timothues, crossed over to Samos and expelled the Persians. In the course of the Social War Timothues was despatched with Iphicrates, Menestheus, son of Iphicrates, and Chares to put down the revolt. The hostile fleets sighted each other in the Hellespont; but a gale was blowing, and Iphicrates and Timothues decided not to engage. Chares, regarding their opposition, lost many ships, and in his despatches he complained so bitterly of his colleagues that the Athenians put them on their trial. The accusers were Chares and Aristophon, both men of notoriously bad character. Iphicrates, who had fewer enemies than Timothues and was acquitted; but Timothues, who had always been disliked for his reserve, was condemned to pay a very heavy fine. Being unable to pay, he withdrew to Chales, where he died soon afterwards. The Athenians showed their regret by remitting the greater part of the fine to his son Conon. His remains were buried in the Ceramicus and statues erected to his memory in the agora and the acropolis.

See Life by Cornelius Nepos; Diodorus Siculus xiv., xvii., Isocrates, De permutacione: Pseudo-Demostenes, Adversus Timothemum; C. K. Wood, Life of Iphicrates, Charioteer, Timol. (1845); and especially Holm, Hist. of Greece (Eng. trans., vol. iii).

TIMOTHEUS, an Athenian sculptor of the 4th century B.C., and one of the artists employed on the Mausoleum of Halikarnassus. An inscription at Epidauros shows that he was employed to furnish models for the pedimental sculptures of the temple of Aesculapius on that site, and to execute marble the external decorations (acroteria) for one of the gables. Considerable remains of the acroteria and the pedimental figures have been discovered (see Gerasen Arct, fig. 44; and Euphaurus). TIMOTHEUS, of Miletus (c. 465-437 B.C.), Hesych. Hist. of Greece, bk. v. ch. 2. He composed musical works of a mythological and historical character. Fragments in T. Bergk, Poetae lyrici graeci. A papyrus-fragment of his Persians (the oldest papyrus in existence), discovered at Aburaz has been edited by Usher and published in J. R. Riedel (1903), with discussion of the name, metre, the number of strings of the lyre, date of the poet and fragment. See V. Strazzulla, J. Persiani di Eschilo ed il nome di Timoteo (1904); S. Sudaus in Rhein. Mus., xviii. (1903). See also J. R. Riedel and M. Croiset in Revue des études grecques, xvi. (1903), pp. 62, 332.

TIMOTHY, in the Bible (Acts xvi. 17, xvi. 14, &c.), a Lycaonian, the son of a Gentile father and a Jewish mother, Eunice (2 Tim. i. 5), was born at Lystra, and was already a member of the Christian Church there at the time of Paul's second visit. He took the place formerly occupied by John Mark in Paul's company, and in deference to Jewish feeling was circumcised. He accompanied the apostle on many of his journeys, and was employed by him on important missions (Acts xvi. 4). See also (2 Cor. iv. 17, xvi. 10). Paul speaks of him as his "son," and the fact (see Acts xvi. 22) that he was brought up a Jew rather than to spiritual parentage. He was especially interested in the Macedonian churches, which he helped to found. His name is associated with that of Paul in the opening salutations of both epistles to the Thessalonians, the second epistle to the Corinthians, and those to the Philippians and Colossians. He was, therefore, with Paul at Rome. At a later date he is mentioned in Heb. xiii. 23 as having undergone imprisonment, but as having been released. On the basis of the epistles of Paul to Timothy, Timothy is traditionally represented as bishop of Ephesus and traduced to the charge that he suffered under Domitian. His martyrdom is celebrated on the 24th of January in the Latin Church, on the 22nd in the Greek.

The apocryphal Acta Timothei (Greek and Latin) have been edited by Usener (Bonn, 1877) as Lipsius, Apokr. Apostelgeschichten (1884), ii. 2.

TIMOTHY, FIRST EPISTLE TO. This book of the New Testament is really a pastoral letter upon church order, addressed by the apostle Paul to the Asiatic Christian communities in and round Ephesus (i. 3). The object of the writing is stated in i. 5: "τὸ πάσαν ἐκ σοῦ ἀκοὴν ἀκοῦσα ἰδοὺ." It is thrown into the hands of Timothy, and covered with superlatives. The writer, Timothy, but, as the closing salutation indicates (vi. 21, "τῇ ἤγειρεν εἰς σε ἀγάπην " σεῖν τῇ ἐξουσίᾳ ταύτῃ συνήθεια"), the writer really has the Church in his mind all through. The Pauline standard of discipline is set up (i. 3-20) as the norm of thought and practice. This trust and tradition is to be maintained throughout the church. It involves, the writer proceeds to argue, the proper conduct of public worship (i. 1 seq., 8 seq.), and the proper qualification for episcopi (ii. 2 seq.) and diacontes (iii. 8 seq.). The finale of this section (iii. 15-16) leads, by way of contrast, to a sharp prophetic warning against contemporary errorists (iv. 1 seq.), with advice upon the proper manner of judging of offending brethren, and upon the church (v. 1 seq.). Special attention is given to the ecclesiastical "widows" (3 seq.) and to presbyters (17 seq.). After a word on slaves and masters (vi. 1-2), the epistle recurs to the errorists (vi. 3 seq.), passing into a warning against wealth (6 seq.) and an impressive closing charge (11 seq.). The writing closes with the ἐν ἡμνίῳ μεθ ὑμῶν of verse 21. The context and contents of vi. 17-21 suggest that it is a later interpolation, such as writings on church discipline were.

1 The same motive occurs in the Preface to Irenaeus's treatise, Adv. haer.

2 The opposite view, which insists upon the definite character of the pastoral, is ably stated by A. Ruegg in Aus Schriften und Geschichte (1898), pp. 53-108. Otto and Kölling attempt to refute the view (i. 3) to Timothy, not to Paul, and in this way to refer the subject to Acts xii. 22; but this is exegetically untenable.
particularly exposed to (Harnack). Their inorganic character naturally permitted later generations to bring them up to date, and accretions of this kind may be suspected in 1 Tim. iii. 1-13, v. 17-20 (22a), vi. 17-21, as well as in Tit. i. 7-9.

Other verses, like iii. 11 and v. 23, have all the appearance of misplaced glosses, perhaps from the margin. When vi. 20-21 is thus taken as a later addition, it becomes possible to see in the reference to ἀπότομα τῆς γενεσεως γνῶσις an allusion to Marcion's well-known volume.

It has been made by some critics, particularly Hesse (Die Entstehung der neuesten. Hiirtenbriefe, 1859: i. 1-10, 18-20, iv. 1-16, vi. 3-16, 26 seq.) and Knoke (Probt. theolog. Kommentar, 1862, 1889: a-i. 3 seq., 18-20, ii. 1-10, iv. 1, v. 1, 13-6, 11-15, 19-23, 24 seq., written to Timothy from Corinth; b-i. 12-17, iii. 14-16, iv. 11-13, 16-20, iv. 12-15, v. 7 seq., vi. 17-19, i. 5-11, vi. 2c-16, 20 seq., written from Caesarea), to disentangle one or more original notes from Paul of subsequent additions, but the comparative evenness of the style does not favour such analyses. They have more relevance and point in 2 Tim. than in 1 Tim. P. Ewald, in his Probilias betr. d. Test. des 1 Tim. (1903) has, for instance, upon the occasion of the papyrus leaves or sheets having been displaced, and conjectures that i. 12-17 originally lay between i. 2 and 3, while iii. 14-10 has been misplaced from after vi. 2. But his keen criticism of Hesse and Knoke is more successful than his positive explanation of the textual phenomena, and a more thorough-going process of literary criticism is necessary in order to solve the problems of the epistle.

Its irregular character, abrupt connexions and loose transitions are due to the nature of the subject rather than to any material disarrangement of its paragraphs.

The phenomena of style have to be viewed in a broad light. Allowance must be made for the difference of vocabulary produced by change of subject. The evidence of Plutarch (Bella Buc. 180) is always to be received with caution and strict scrutiny; no hard and fast rule must be set up to judge the language of a man like Paul. Yet such considerations apart, the argument that all the arrangements of the pastoral chapters did not come from Paul's pen.

The words and phrases which are common to the pastorals and the rest of the Pauline epistles are neither so characteristic nor so numerous as those peculiar to the former, and the data of style may be summed up in the verdict that they point to a writer who, naturally reproducing Paul's standpoint as far as possible, and acquainted with his epistles, yet betrays the characteristics of his later milieu in expressions as well as ideas. Thus, of 1143 used in the occurrence of the papyri (of all the New Testament writings), 97 are foreign to the Septuagint and 116 to the rest of the Pauline letters. This proportion of 49.7 per cent. is large. If the size of the vocabulary is not taken into account, and its significance is heightened by the further fact that several of Paul's characteristic expressions tend to be replaced by others (e.g. πραπαταν and στοιχεία by ανωτάτητα, καθαρατος, ἀκριβος, ef.), the result is not a mere scrambling of vocabulary, but a genuine change in the nature of the number of Pauline words are entirely absent (e.g. δίωκος, ἀδελφος, καθαρατος, μεταφυσικα, πολλαπλασιασμος, θεωρητης, σωφρονισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλογισμος, διαλοɡισ}
TIMOTHY, SECOND EPISTLE TO

In this book of the New Testament, after a brief thanksgiving for the faith of Timothy (1. 1–5), Paul is represented as warning him against false shame (6 seq.), adducing his own example and that of Onesiphorus. The need and the reward of endurance are then urged (ii. 1–13), and Timothy is bidden to adhere in his work to the Pauline gospel against the seductions of controversial and immoral heretics (ii. 14 seq.). The practices of the latter are pungently depicted6 (iii. 1–9); Paul reiterates his opening counsels (10 seq.) and then closes with a solemn appeal to personal faithfulness. A note of personal matters concludes the epistle (iv. 6–22).

The last verse, with its two-fold greeting (6 καὶ γεροντὶς ἐκαθόρισεν σε ὧδε ἔκτενεν, ἄλογον), shows unconsciously but plainly that, while the epistle professes to be a private letter to Timothy, it is in reality addressed to a wider circle, like 1 Tim. and Titus. But its composite origin is also clear. Thus iv. 6–22a, which is certainly authentic, is not homogeneous in itself, the situation of verses 6–8 hardly agreeing with that of 9 seq., while verse 11 (6 Luke alone is with me) cannot have been written at the same time as verse 21. Various schemes of arrangement are needed to this and other passages of the same nature in the epistle, e.g. i. 15–18; iv. 1–18. But the general result of such reconstructions is tentative. All that criticism has succeeded in establishing is the fact that the author had some reliquiae Paulinae at his disposal, notes written either before or during his last imprisonment in Rome, and that these have been worked up into the present letter by one who rightly believed that his master would stoutly oppose the current errors of the age.

2 Timothy, like 1 Timothy, is written with fair precision the period and aim of the writer of the pastoral. Evidently (cf. Acts chs. 20 seq.) the Pauline literature of Ephesus was imperilled seriously during the last quarter of the 1st century. Its very growth invited attacks to weave ascetic, theosophic, semi-Jewish fancies round the faith, not unlike the attempts often made in modern India to assimilate Christian and local philosophies of religion. Against such the writer argues in Paul’s name, as Luke had already done. From the composition of a speech in Paul’s name (for, though the farewell in Acts goes back to first-hand tradition, it represents the author’s standpoint as well as Paul’s), it was but a step to compose letters in his name, some of whose contents are ascribable to local circumstances of the time.5 The general concern for local Christianity is the writer’s justification for his work, and any idea of fraudulent aims must be dismissed at once.6 “To a writer of this period, it would seem as legitimate an artifice to compose a letter as to compose a speech in the

1 Bahnson gives an ingenious analysis of this section of the epistle. In ii. 8–13, 16 it is developed; in ii. 14–26, ii. 4; and in iii. 1–4 (8), ii. 5. But this is as artificial as Otto’s attempt to classify the contents of the epistle under the three notes of the σὺμπαθεία in i. 7.
2 Rev. 2 and 3, the fragment from Paris quoted by Engb. Prac. Evang. viii. 11.
3 Cf. the epistle was an integral as we have it, its genuineness can only be maintained (L. Haag in Paulus: Leben, Lehre, Wirkung, 275). Imschenetzky, “Paulus und die chrysostomatischen Briefe,” Z. f. Theol. Wiss. 21, 245 seq., notes the same passage as a whole, and “Paul’s teaching as a whole may be denoted as the Didache.”
4 Bacon (Story of St. Paul, 198) and Clemen both assign part of the epistle to the Caesarean imprisonment, the former disentangling iv. 9, 11–18, against 20–21a, 22b, the latter iv. 9–18. Hitzig had already found a Caesarean letter in i. 15, iv. 13–16, 20–22a. One great point in favour of such theories is that they give a natural sense to iv. 16, Paul’s first defence being that before the Jews or before Felix.
5 Cf. the present writer’s Historical New Testament (2nd ed., 1907), for intimations of the same sort. See chs. 15, 16, 19. “It is beyond doubt that the Pauline society at Corinth was more or less a veritable centre of paganism” (E. L. Young, Biblical Essays, 146). A thorough knowledge of ancient pseudo-pseudo-Jewish literature is required to be written; meantime, further reference may be made to the older essays of Mosheim (Uebers. der christl. Staatsrecht des rom. Kaiserreichs, 2 vols., 1776), and Bentley’s Dissertation on Plutarus, pp. 80 seq.; K. R. Köstlin’s article in Theol. Jahrbücher (1851), p. 199–221, on “Deus puer, Litteratur der ältesten Kirche”; and A. Gudemann, in Classical Studies in Honour of H. Drissler, pp. 52–74 (New York, 1894).

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name of a great man whose sentiments it was desired to reproduce and record; the question which seems so important to us, whether the words and even the sentiments are the great man’s own or only his historian’s, seems then hardly to have occurred either to writer or reader” (W. H. Simcox, Writers of the New Testament, 61). The second letter to Ephesus, warning them against heresies (Acts xx. 29 seq.) and solemnly bidding them exercise their disciplinary duties. The Second Epistle to Timothy carries on this line of advice. Here Paul, being dead, yet speaks through Timothy to the local Christians who are exposed to such mischievous tendencies in their environment.

Where the writer has hardly succeeded in representing Paul is in ascribing advice to Timothy. May we admit that, strictly speaking, the latter at the age of about thirty-five-five years is a very young man, and that Paul might conceivably have termed him still his visor. But the counsels addressed to him seem rather out of place when one recollects the position which he occupied. To a writer who desired a situation for such advice on church life and doctrine from the lips of Paul to his lieutenant, it was natural to think of a temporary absence. But many of the directions are much too serious and fundamental to have been given in this form; one can hardly imagine that Paul considered Timothy (or Titus) still in need of elementary advice and warning upon such matters. It is especially true that Paul’s letter is not grouped as typical figures of the later episcopi of the Church, the point of this emphasis upon elementary principles and duties is at once clear: they outline graphically the qualifications for the church office of bishop.

The pressing need of the Church, as the writer conceives it, is to maintain the true Pauline tradition (2 Tim. i. 13, 14, &c.) against every heretical and speculative notion. This maintenance takes the twofold classical form of (1) an argument against the false teaching of the “sound teaching” and (6) insistence on a succession of church officials (2 Tim. ii. 1–2) who are not merely to preside but to teach. The last point is significant in view of Didache iv. 1. The standpoint of the author is practically that of Clement Romans (xii. seq.), who asserts that the apostles preached “everywhere in country and town, appointing their first-fruits, when they had proved them by their works, to be bishops and deacons.” But the interests of discipline and doctrine were thus to be preserved. Paul’s lieutenants possess the central deposit of the apostolic faith, to carry it out as well as the right of exercising the authority with which they are invested.

The occasional coincidences between the pastorals and Barnabas or Clemens Romano do not prove anything more than a common milieu of thought, but the epistles were plainly familiar to Polycarp, who alludes to 1 Tim. i. 1, vi. 7, 10, and 2 Tim. ii. 11, 25, iv. 10 (for this and the other passages from Polycarp, see The New Testament in the Apostolic Fathers, 1905, pp. 95 seq.). This indubitable use of the pastorals in Polycarp throws the terminus ad quem of their composition back into the first decade of the 2nd century, and additional confirmation of this would be forthcoming were the evidence for their use in Ignatius more secure. The drawback was that, if Paul was soon to see his colleagues after his death (1 Tim. i. 3), such delayed advice was hardly necessary; but this imperfection was inevitable. The post-Pauline atmosphere of the ecclesiastical regulations is felt most plainly in the references to such sub-apostolic features as the organized register of “wibes.” The ἱστορία, the ἱστορία, and the χρονάρια are also forbidden to contract a second marriage.

Such, at any rate, seems the fairest interpretation of 1 Tim. iii. 2 (ἦσανον) in the light of early Christian tradition, for although the “husband” in the one passage may be a designation as a prohibition of polygamy or vice (=holy husband, or sober, married man), the antipathy to second marriages (cf. Jacoby, New Testament, 75, pp. 310, 311) is clearly based on the idea that the same state of life might be a test of Christian practice. It is almost as un-Pauline as the assumption that every ἱστορία must be married. Cf. on this whole subject Hilgenfeld (Zeitschrift für wiss. Theologie, 1886, pp. 456 seq.) and Schmiedel (Gotth. Zeitschr. 1891, pp. 1311, 1312). "The New Testament Church by Hort (Christian Ecclesia, 1898, 189 seq.) and Dr T. M. Lindsay (Hibbert Journal, i. 166 seq., and in The Church and the Ministry in the Early Christians, 1903, pp. 139 seq.)

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secure. The occasional similarities of thought and expression between them and the Lucan writings suggest that the period of their origin lies within a quarter of a century after Paul's death, and, when one or two later accretions are admitted, the internal evidence, either upon the organization of the church or upon the errors controverted, tallies with this hypothesis.

LITERATURE.—Special monographs on this epistle by Leo (1859) and Bahnsen (Die sogenannte Pastoralebriefe, I., der 2 Tim., 1876) are to be noted. For a textual discussion of ii. 19, cf. Resch's Paulinismus, pp. 258-259. The allusion to the βασιλιάς, βασιλέως Ρώμης (iv. 13) has produced a wealth of discussion; the latter were probably pigulileris membranes, sheets for private memoranda. The books may have included the Logia or Evangelic Scriptures from which 1 Tim. x. 18 is quoted (so Resch), but this is a mere conjecture. Cf. on the whole question, Birt's Das antike Buchwesen, pp. 50 seq., 65, 88 seq., and Nestle's Einführung in das griechische N. T. (1899), pp. 39 seq. (J. MT.)

TIMUR (Timur i Leng, the lame Timur), commonly known as Tamerlane, the renowned Oriental conqueror, was born in 1336 at Kesh, better known as Shahr-i-Sabz, "the green city," situated some 50 m. south of Samarkand in Transoxiana. His father Teregai was head of the tribe of Berias. Great-grandson of Karachar Nevian (minister of Jagaati, son of Jenghiz Khan, and commander-in-chief of his forces), and distinguished among his contemporaries by his personal valor, Timur might have assumed the high military rank which fell to him by right of inheritance; but like his father Burkul he preferred a life of retirement and study. Under the paternal eye the education of young Timur was such that at the age of twenty he had not only become an adept in manly outdoor exercises but had earned the reputation of being an attentive reader of the Koran. At this period, if we may credit the Memoirs (Malijafrad), he exhibited proofs of a tender and sympathetic nature.

About 1358, however, he came before the world as a leader of men with the capture of the city of Tabaristan. The next ten years of his career may be thus briefly summarized from the Memoirs. Allying himself both in cause and by family connexion with Kurgan, the dethroner and destroyer of Kazan, chief of the western Jagaati, he was despatched to invade Khorasan at the head of a thousand horse. This was the second warlike expedition in which he was the chief actor, and the accomplishment of its objects led to further operations, among them the subjection of Khwarizam and Urgan. After the murder of Kurgan the contentions which arose among the many claimants to sovereign power were arrested by the invasion of Toqiluk Timur of Kashgar, a descendant of Jenghiz. Timur was appointed as the successor of the chief of Urgan, and it is recorded that he might have been appointed to the government of Mawarān- Inhār (Transoxiana). By the death of his father he was also left hereditary head of the Berias. The exigencies of his quasi-sovereign position compelled him to have recourse to his formidable patron, whose reappearance on the banks of the Sihon created a consternation not easily allayed. Mawarān- Inhār was taken from Timur and entrusted to a son of Toqiluk; but he was defeated in battle by the bold warrior he had replaced at the head of a numerically far inferior force. Toqiluk's death facilitated the work of reconquest, and a few years of perseverance and energy sufficed for its accomplishment, as well as for the addition of a vast extent of territory. During this period Timur and his brother-in-law, Hosain—at first fellow-fugitives and wanderers in joint adventures full of interest and romance—became rivals and antagonists. At the close of 1369 Hosain was assassinated and Timur, having been formally proclaimed sovereign at Balkh, mounted the throne at Samarkand, the capital of his dominions.

The next thirty years or so were spent in various wars and expeditions. Timur, not only consolidated his rule at home by the subjection of intestine foes, but sought extension of territory by encroachments upon the lands of foreign potentates. His conquests to the west and north-west led him among the Mongols of the Caspian and to the banks of the Ural and the Volga; those to the south and south-west comprehended almost every province in Persia, including Bagdad, Kerbela and Kurdistan. One of the most formidable of his opponents was Toqtamish, who after having been a refugee at the court of Timur became ruler both of the eastern Kipchak and the Golden Horde, and quarrelled with Timur over the possession of Khwarizam. It was not until 1395 that the power of Toqtamish was finally broken (see MONGOLS; GOLDEN HORDE).

In 1398, when Timur was more than sixty years of age, Farishta tells us that, "informed of the commotions and civil wars of India," he "began his expedition into that country," and on the 12th of September "arrived on the banks of the Indus." His passage of the river and upward march along the valley of the Indus to the north bank the same year, is indicated by the Tartaric conqueror to erect a mosque at Samarkand. The war with the Turks and Egyptians which succeeded the return from India was rendered notable by the capture of Aleppo and Damascus, and especially by the defeat and imprisonment of Sultan Bayzid I. (see TURKEY: HISTORY, AND EGYPT: HISTORY, Mahomedan period). This was Timur's last campaign. Another was projected against China, but the old warrior was attacked by fever and ague when encamped on the farther side of the Sihon (Syr-Daria) and died at Attrār (Otrar) on the 17th of February 1405. Marked as the "earliest known history of Timur, and the only one written in his lifetime"; and vol. i. of the Malātā'is- Sa'dīn—a choice Persian MS. work of 1495—in­troduced to Orientalists in Europe by Hammer, Jahrbücher, Dern and (notably) Quatremère. There are also the Memoirs (Malijafrad) and Institutes (Tuṣūkāt), of which an important section is styled Designs and Enterprises (Tedbīrāt wa Kangāshāhā). Upon the genuineness of this doubt has been thrown. The circumstance that this discovery and presentation to Shah Jahan in 1637 was of itself open to suspicion, the Alhazen, quoted by Purchas in his quaint notice of Timur and referred to by Sir John Malcolm, can hardly be accepted as a proof of the originality of the work. The fact that the same book is to be found in the History of Tamerlane, by De Sainctyson, published at Amsterdam in 1678. But, although the existence of this Alhazen of Jean de Bec has been believed by many, the more trustworthy critics consider the history and historian to be equally fictitious of Timur's grandson, Jahan.

Reference may be made to two more sources of information.

1 The pastors in this aspect are closer to Clemens Romanus than to Ignatius.
TIN

(1) Supposed likenesses of Timur are to be found in books and in the splendid collection of Oriental manuscripts and drawings in the Bibliothèque Nationale. Shah Tahmasp II described him as “a great specimen of illuminated Persian manuscript and exquisite calligraphy—represents a most ordinary, middle-aged Oriental Man.” Another portrait is included in a set of sketches by native artists, some of which, taken probably from life, show great care and cleverness. Timur is here displayed as a stout, long-bodied man, beardless, with a beard that unite not unlike the first portrait, but with thicker and more straggling hair, and distinetly, though not more agreeable character in the facial expression, yet with a sterner and grander expression of mind and more celebrity. The uncomfortable figure in the Bodleian Library does not give much help. Sir John Malcolm has been at some pains to invest his portrait of Timur with individuality. But an analysis of his results leaves the reader in more perplexity than satisfaction at the kind of information imparted, and he reverts insensibly to the sources from which his instructor has himself been instructed. (2) As regards plays, in Macbeth’s Tamberlane Timur is described as tall of stature, straightly fashioned, large of limb, having joints strongly knotted, long and sinewy arms, a breadth of shoulders to bear old Atlas’s burden; pale of complexion, and “broadly built” and “broad-chested” and “broadshouldered, well-built but lame, of a fierce countenance and with receding eyes, which express cruelty and strike terror into the lookers-on.” But Jean du Bec’s account of Timur’s appearances is quite different. Now Tamberlane was written in 1586. The first English translation of Jean du Bec is dated in 1595, the Life by Peroninus in 1600, and Petis de la Croix did not introduce Shahriu ‘d-Din or Ab’l Yazid to European readers till 1722. The dramatist must have heard of Timur in other quarters, equally or may be with those available in the present stage of Oriental research. At the beginning of the 18th century Timur was represented in the Tamberlane as a model of valour and virtue. The plot, however, has little to do with history, and is improbable and void of interest. By Matthew Gregory Lewis again Timour” is depicted as the conventional tyrant of a prosperous Persian, slaying, burning, slaughtering and committing every possible atrocity until checked by a violent death and a poetical climax.

Apart from modern European savants and historians, and the more strictly Oriental chroniclers who have written in Persian, Turkish or Arabic, the following authorities may be cited—Laoniuc Alchonqyds, Joannes Leuchndaviu, Joachim Camerarius, Petrus Lactantius, Franciscus Spinellus and other savants.

A score or so of other names are given by Samuel Purchas. See also Sir Clements Markham’s Clavijo, in the Hakluyt Society’s publications; White’s edition of Davy’s translation of the Inslent (1789); Tommasi’s History of Persia; and Trans. Roy. Soc. (1885): Horn, “Gesch. Iran. in Islam. Zeit,” in Geiger and Kuhn, Grundr. der iranisch. Philol. (1902); works quoted, e.g. Mongols. (F. J. G.)

TIN (Lat. stannum, whence the chemical symbol “Sn”; atomic weight=117.6, 0=16), a metallic chemical element. Being a component of bronze, it was used as a metal thousands of years prior to the dawn of history; but it does not follow that prehistoric bronzes were made from metallic tin. When the unalloyed metal was first introduced cannot be ascertained with certainty. The tin of the Bible (cauæripse in the Septuagint) corresponds to the Hebrew bedil, which is really a compound. It is not known exactly when the word tin was introduced into Europa. It is not known whether the word tin was introduced into Europa. It is not known whether the word tin was imported from Cornwall into Italy after, if not before, the invasion of Britain by Julius Caesar. From Pliny’s writings it appears that the Romans in his time did not realize the distinction between tin and lead: the former was called plumbum album or candidum to distinguish it from plumbum nigrum (lead proper). The word stannum definitely assumed its present meaning in the 4th century (J. Kopp).

By the early Greek alchemists the metal was named Hermes but at the beginning of the 6th century it was termed Zephor Jupiter, and the symbol Z assigned to it; it was also referred to as diabolus metalorum, on account of the brittle alloys which it formed.

Occurrence.—Grains of metallic tin occur intermingled with the gold ores of Siberia, Guiana and Bolivia, and in a few other localities. Of minerals containing this element mention may be made of cassiterite (q.v.) or tinstone, SnO₂, tin pyrites, Cu₂SnS₄+(Fe,Sn)SnS₄; the metal also occurs in some epidotes, and in company with columbium, tantalum and other metals. Of these tinstones is that of the greatest commercial importance. It occurs in its matrix, either in or closely associated with fissure veins or disseminated through rock masses. It is also found in the form of rolled lumps and grains, “stream tin,” in alluvial gravels; the latter are secondary deposits, the products of the disintegration of the first-named primary deposits. Throughout the world, primary deposits of tinstone are in or closely connected with granite or acid erupitive rocks of the same type, its mineral associates being tourmaline, fluor spar, topaz, wolfram and arsenical pyrites, and the invariable gangue being quartz: the only exception to this mode of occurrence is in Bolivia, where the tin ore occurs intimately associated with silver ores, bismuth ores and various sulphides, whilst the gangue includes barytes and certain carbonates. Over five-sixths of the world’s total production is derived from secondary alluvial deposits, but all the tin obtained in Cornwall (the alluvial deposits having been worked out) and Bolivia is from vein mining, while a small portion of that yielded by Australasia comes from veins and from granitic rocks carrying disseminated tinstone.

Production.—During the 16th century the world’s supply of tin was mainly drawn from the deposits of England, Saxony and Bohemia; but the fall of both these sources was then rapid, while the supplies of Saxony and Bohemia had been greatly diminished. The English supply increased, with some oscillations, to between six and seven thousand tons annually in the period 1840-1860, when it suddenly rose to about 10,000 tons, and this figure was fairly well sustained until about 1890, when a period of depression set in; the yield for 1900 was 4335 tons, and for 1905 about 4200 tons. In the opening decades of the 19th century supplies began to be drawn from Banks; in 1820 this island contributed 1200 tons; the production was increased to 17,000 tons in 1900, and the diminution set in, 1906 being the year of the largest production. Billinton became of note in 1853 with a production of 40 tons, which increased to 6000 in 1900 and has since declined to about 3000 tons in 1905. The Straths Settlements ranked as an important producer in 1870 with 2337 tons; it now supplies the greater part of the world’s supply, contributing 46,705 tons in 1900, and over 60,000 tons in 1905. Australian deposits were worked in 1872, and in the following year the production was 3000 tons; the maximum outputs were in 1851-1853, averaging 10,000 tons annually, but the supply declined to 2.40 tons in 1868 and has since increased to about 5000 tons in 1905. Bolivia produced 501 tons in 1883, 10,245 in 1900 and 19,150 in 1905.

The world’s supply in 1900 was 72,911 long tons; this increased in 1904 to 97,750 tons, but in 1905, principally owing to a shortage in the supplies from the Straths and Banks, the yield fell to 94,089 tons.

Metallurgy.—The operations in the metallurgy of tin may be enumerated; as: (1) mining and dressing; (2) smelting; (3) refining. The first stage has for its purpose the production of a fairly pure tinstone; the second the conversion of the oxide into metallic tin; and the third preparing a tin pure enough for commercial purposes.

Mining and Dressing.—The alluvial deposits are almost invariably worked openly, those of the Malay Peninsula and Archipelago chiefly by Chinese labour: in a few instances hydraulic mining has been resorted to, and in other cases true underground mining is carried on; but the latter is both exceptional and difficult. The alluvium extracted, which in the Malay Peninsula and Archipelago carries from 5 to 60 lb of tinstone (or “black tin,” as it is termed by Cornish miners) to the cubic yard of gravel, is washed in various simple sluicing appliances, by which the lighter clay, sand and stones are removed; the tinstone is then treated with water containing usually 65 to 75% of metallic tin (purely commercial tinstone contains 78.7%).

Lode tin, as tinstone derived from primary deposits is often termed in the ordinary method, the very hard gangue in
Tin

which occurs necessitating a liberal use of explosives. The vein-stuff is broken small either by hand or in rock-breakers, and stamped to fine powder in stamp mills, which are practically large mechanically-worked pestles and mortars, the stamp proper weighing from 3000 to 4000 lb. The resulting powder is of such size that the coarsest particles are removed by washing with perforations 1/16 in. in diameter, leaves the stamps in suspension in water, and passes through a series of troughs in which the heavier mineral is collected; this then passes through a series of washing operations, either in a mixture of water and pyrites or a mixture of water and arsenical pyrites, which is calcined and washed again, until finally black tin containing about 60 to 65% of metal is left. The calcination is preferably effected in mechanical roasters, it being especially necessary to produce pure tin ore containing as little antimony as possible; crude tin stuff raised in Cornwall carries on an average a little over 2% of black tin. The Bolivian tin ore is treated by first extracting the sodium and potassium oxides, &c., by roasting the ore, and then concentrating the residues; 

therefore, however, considerable difficulty is experienced in treating the poorer of these very complex ores, and several chemical processes for extracting their metallic contents have been worked out. Of the impurities of the ore the wolframite (tungstate of iron and manganese) is the most troublesome, because on account of its high specific gravity it cannot be washed away as gangue. To remove it, Oxyld fuses the ore with a certain proportion of carbonate of lime which suffices to convert the tungsten into soluble alkaline tungstate, without producing noteworthy quantities of soluble stannate from the oxide of tin; the tungstate is easily removed by treatment with hydrogen sulphide.

Smelting.—The dressed ore is smelted with carbon by one of two main methods, viz., either in the shaft furnace or the reverberatory; the former is the better suited to stream tin, the latter to lode tin. A shaft furnace is a cylindrical reverberatory with a taphole; 

tin-smelting practice yields a pure metal. Shaft furnace smelting is confined to those parts of the world where charcoal can still be obtained in large quantities at moderate prices. The furnace consists of a cylindrical furnace-chamber into which alternate layers of fuel and ore are charged, an air blast being generally injected near to the bottom of the furnace by one or more tuyeres. This was the primitive process all over the world; in the East, South America and similar regions it still holds its own. In Europe, Australasia and one large works at Singapore it has been practically replaced by the reverberatory furnace process, 

finally, at least as a whole about 24%. The first time the purified ore is mixed with about one-fifth of its weight of a non-caking coal or anthracite smalls, the mixture being moistened to prevent it from being blown off by the draught, and is then fused out. The tin is dissolved in the molten flux and the metal and produced are then run off and the latter is cast into bars; these are in general contaminated with iron, arsenic, copper and other impurities.

Drossing.—All tin, except a small quantity produced by the shaft furnace process from exceptionally pure stream tin ore, requires refining by leaching and "boiling" before it is ready for the market. In the process by which the tin is consolidated into buttons and finally cast, when relatively pure tin runs off, while a skeleton of impure metal remains. The metal run off is further purified by "poling, i.e. by stirring it with the branch of a tree—the apple-tree being preferred. The operation is double; it is necessary to remove the oxygen diffused throughout the metal as oxide, part of it perhaps chemically by reduction of the oxide to metal, the rest by conveying the finely diffused oxide to the surface and causing it to be reduced to metallic tin. To this end it is necessary to rest for a time in the pot at a temperature above its freezing point and is then ladled out into ingot forms, care being taken at each stage to ladle off the top stratum. The original top stratum is the purest, and each succeeding lower stratum has a greater proportion of impurities; the lowest consists largely of a solid or semi-solid alloy of tin and iron.

The purity of the metal the tin-smelter heats the bars to a certain temperature just below the fusing point, and then strikes them with a hammer or lets them fall on a stone floor from a given height. If the tin is pure it splits into a mass of granular strings. This is known as "powder." The operation is very difficult. Is there any doubt the oxyd as mentioned above be very pure is sold as grain tin. A lower quality goes by the name of block tin. Of the several commercial varieties Banka tin is the purest; it is indeed almost chemically pure. Next comes English granular.

For the preparation of chemically pure tin two methods are employed. (1) Commercially pure tin is treated with nitric acid, which dissolves the iron, copper, and other impurities present, while the copper, iron, &c., become nitrites; the metatannic acid is washed first with dilute nitric acid, then with water, and is lastly dried and reduced by fusion with black flux or potassium cyanide. (2) At Stoblas, beautiful crystals of pure tin can be obtained as follows: A platinum basin, coated over with wax or paraffin outside, except a small circle at the bottom where the metal is placed, is placed on the upper end of a beaker, and is filled with a solution of pure stannous chloride. The beaker also is cautiously filled with acid-water up to a point below the edge of the platinum basin.

The whole is then left to itself, when crystals of tin gradually separate out on the bottom of the basin.

Properties.—An ingot of tin is pure white (except for a slight tinge of blue); the colour depends, however, upon the temperature at which it is poured. When a plate of tin is dead white and feel, it is high, iridescent. It has a considerable lustre and is susceptible of being polished on exposure to normal air. The metal is very soft and easily flattened out under the hammer, but almost devoid of tenacity. That it is very brittle is shown by the fact that a nail driven into a metal shaft filled with tin, will easily be driven out with a hammer. Tin is also peculiar in possessing a sort of elasticity, by which it is enabled to be stretched into sheets with a hard body in circumstances permitting of free vibration. The specific gravity of cast tin is 7.09, of rolled tin 7.99, and of electrolytically deposited tin 7.143 to 7.178. A tin ingot is distinctly crystalline; hence the melting point rhombohedral forms are produced, when exposed for a sufficient time to very low temperatures (to −39°C. for 14 hours), tin becomes so brittle that it falls into a grey powder, termed the "grey modification," under a pestle; it is sometimes employed merely as a protecting coating for utensils made essentially of copper or iron. At ordinary temperature tin proves fairly ductile under the hammer, and its ductility seems to increase as the temperature rises up to about 100°C. At some temperature near its fusing point it becomes brittle, and still more so above about 14°C. The specific gravity of tin is 13.17—14.6. Some alloys of tin are more brittle; arsenic, antimony and bismuth (up to 0.5%) reduce its tenacity; copper and lead (to 10%) make it harder and stronger. Tin melts at 230°C. Tin fuses at about 230°C.; at a red heat it begins to volatilize slowly; at 1600°C. it boils. The hot vapour-produced combines with the oxygen of the air into white oxide, SnO2. Its coefficient of expansion is 0.000062; its thermal and electrical conductivities are 145 in 152 and 1191 to 1410 respectively compared to silver as 1000.

Industrial Applications.—Commercially pure tin is used for making small articles of tinplating, particularly plating, brass pots, stills, &c. It is also employed for making various kinds of tin-foil—one for the silverying of mirrors (see MIRRORS), the other for wrapping up chocolates, &c. The latter is made by taking sheets of tin of the proper quality, heating it until its specific heat 0.0652, its thermal and electrical conductivities are 145 1521 and 114.5—1410, and it is used in culinary and domestic vessels. But it is expensive, and tin vessels have to be made very heavy to give them sufficient stability of form; hence it is generally employed merely as a protecting coating for utensils made essentially of copper or iron. The tinning of a copper basin is an easy operation. The tin, made scrupulously clean, is heated to beyond the fusing point of tin, and is then poured into a metal mould. To this the articles are put at a boiling heat. In the absence of metallic tin there is no visible change; but, as soon as the metal is introduced, an electrolytic action sets in and the articles get coated over with tin.

Tinning wrought iron is effected by immersion. The most important form of the operation is making tin from ordinary sheet iron (making what is called "sheet tin"). This process was mentioned by Agricola; it was practised in Bohemia in 1620, and in England a century later. The iron plates, having been carefully cleaned with sand and hydrochloric or sulphuric acid, and hastily with water, are plunged into heated tallow to drive off the moisture. The plates are then run into cold water, and steeped in a bath, first of molten ferruginous, then of pure tin. They are then taken out and kept suspended in hot tallow to enable the surplus tin to run off. The tin of the second bath dissolves itself, and is ready for the third. To this the tin are annealed to a blue or to a bright deep blue, and then the surplus tin articles must be decarburised superficially by ignition within a bath of ferric oxide (powdered haematite or similar material), then annealed, and subjected to further treatment.

Compounds of Tin.

Tin forms two well-marked series of salts, in one of which it is divalent, these salts being derived from stannous oxide, SnO, in the other it is tetravalent, this series being derived from stannic oxide, SnO2.

Stannous Oxide, SnO, is obtained in the hydrated form SnO(OH); from a solution of stannous chloride by addition of sodium carbonate; it forms a white precipitate, which can be washed with
air-free water and dried at 80 °C. without much change by oxidation; if it be heated in carbon dioxide the white SnO remains. Precipitated stannous hydrate dissolves readily in caustic potash; if the solution is cooled slowly it crystallizes, with formation of stannic acid, 2SnO + 2H₂O = K₂SnO₃ + Sn + H₂O. If it is evaporated slowly, anhydrous stannous oxide crystallizes out in forms which are combinations of the cube and dodecahedron. Distilled stannous acid is decomposed with hydrochloric acid and burns to stannic oxide, SnO₂. Stannous oxide when heated by itself in a tube leaves stannous oxide.

Stannic Oxide, SnO₂.—This, if the term is taken to include the hydroxides, exists in two forms. (1) Tinstone (see above and also Cassiterite) is proof against all acids. Its disintegration for analytical purposes can be effected by fusion with caustic alkali in small proportion with sodium carbonate or potash carbonate, or by fusing with sulphur and sodium carbonate, with the formation of a soluble stannostannate. (2) A similar oxide (flores joviis) is produced by burning tin in air at high temperatures or exposing any of the hydrates to a strong heat. Such tin oxide, as it is called, is used for the polishing of optical glasses. Flores stannis is a finely divided mixture of the metal and oxide obtained by fusing the metal in the presence of air for some time. (3) Metastannic acid (generally written H₂SnO₄) to account for the complexion of metastannates, e.g. the sodium salt, Na₂SnO₄, is the white compound produced from the metal by means of nitric acid. It is insoluble in water, but if mixed with alkali hydroxide dissolves, but if heated with this last for some time it passes into a compound, which, after the acid mother liquor has been decanted off, dissolves in water. The solution when subjected to distillation behaves very much as the stannous oxide. The white compound is nearly insoluble in water, while a solution of orthostannic acid in hydrochloric acid behaves like a solution of SnCl₂ in water, i.e. gives off no hydrochloric acid, and no precipitate of hydrated SnO. Metastannic acid is distinguished from the stannic acid by its affinity for phosphoric and sulphuric acids. The salts are obtained by the action of alkalis on the acid. (4) Orthostannic acid is obtained as a white precipitate on adding stannous chloride to potassium stannate or potassium carbonate. A precipitated calcium carbonate to a solution of the chloride. This acid, H₂SnO₄, is readily soluble in acids forming stannic salts, and in caustic potash and soda, with the formation of orthostannates. Of these salts, SnO₂, SnO₂K, SnO₂Na, SnO₂Ca, SnO₂Mg, and SnO₂Zn, are the most important. They are used in calico-printing. Alkaline and other nates when treated with aqueous hydrofluoric acid are converted into fluostannates (e.g. K₂SnO₂ from K₂SnO₂), which are closely analogous to, and isomorphous with, fluosilicates. A colloidal or soluble stannic acid is obtained by dialysing a mixture of tin tetrachloride and alkali, or of sodium stannate and hydrochloric acid. On heating it is converted into colloidal metastannic acid. A hydrated tin trioxide, SnO₂, was obtained by Spring by adding barium dioxide to a solution of stannous chloride and hydrochloric acid. The resulting mixture, when cooled, and the colloidal solution is evaporated to form a white mass of 2SnO₂·H₂O. Stannous Chloride, SnCl₂, can only be obtained pure by heating pure tin, in a current of hydrogen, yields stannous chloride and white solid, fusing at 250 °C. to an oily liquid which boils at 600 °C., and volatilizing at a red heat in nitrogen, a vacuum or hydrochloric acid, without decomposition. The vapour density below 700 °C. corresponds to SnCl₂ above 800 °C. nearly Sn₂ as the chloride readily combines with water to form a crystallizable hydrate SnCl₂·2H₂O, known as "tin salt" or "tin crystals." This salt is also formed by dissolving tin in strong hydrochloric acid and allowing it to crystallize, and is industrially prepared by passing sulphuric acid gas over granulated tin contained in stone ware bottles and evaporating the concentrated solution produced in a closed system. Stannous chloride is basic and forms at.

The crystals are very soluble in cold water, and if the salt is really pure a small proportion of water forms a clear solution; but on adding much water most of the salt is decomposed, with the formation of tin, the gas of oxidechloride, 2Sn(OH)Cl·H₂O. According to Michel and Kraft, one litre of cold saturated solution of tin crystals weighs 1827 grammes and contains 1333 grammes of SnCl₂. The same oxidechloride is produced when the moist crystals, or their solution, are exposed to the air. The crystals, kept in the laboratory give with water a turbid solution, which contains stannic in addition to stannous chloride. The complete conversion of stannous into stannic chloride may be effected by a gaseous stream of chlorine or hydrogen chloride, readily; by mercuric chloride in the heat, with precipitation of calomel or metallic mercury; by ferric chloride in the heat, with formation of ferric chloride; by the addition of hydrochloric solutions, with precipitation of chocolate-brown metallic arsenic. All these reactions are available as tests for "stannous" or the respective agents. In opposition to stannous chloride, stannic chloride is produced by various agents. A strip of metallic zinc when placed in a solution of stannous chloride precipitates the tin in crystals and takes its place in the solution. Stannous chloride is largely used in the chemical industry as a basis for the preparation of stannic chloride, in cases where the latter is not conveniently obtainable. A granulated tin contained in a retort; the tetrachloride distils over as a heavy liquid, from which the excess of chlorine is easily removed by shaking with a small quantity of tin filings and re-distilling. It is also a valuable fuming agent for crystallizing, forming solutions at -33 °C., and boils at 113.9 °C. The chloride unites energetically with water to form crystalline hydrates (e.g. SnCl₂·3H₂O), easily obtained industrially. The tin hydrate, Sn₂Cl₄·H₂O, is a so-called "button of tin." It combines readily with alkali and other chlorides to form double salts, e.g. M₂SnCl₄, analogous to the chloroplatinate; the salt (NH₄)₂SnCl₄ is known industrially as "pink salt," on account of its use in the production of starch colour. The oxysmuret of tin used by dyers is SnCl₂·SH₂O. The plain chloride solution is similarly used. It is usually prepared by dissolving the metal in aqua regia. Stannous Fluoride, SnF₂, is obtained as small, white monoclinic tables by evaporating a solution of stannous oxide in hydrofluoric acid in a vacuum. Stannic Fluoride, SnF₄, is obtained in solution with hydrofluoric acid. It shows a decided affinity for the free element, forming a characteristic series of salts, the stannofluorides, M₂SnF₄, isomorphous with the silico-, titanio-, germano- and zirconofluorides. Stannous bromide, SnBr₂, is a light yellow substance formed from tin and hydrobromic acid. Sn₂Br₄ is a yellow compound, the tin mass, melting at 33 °C and boiling at 201 °C., obtained by the combination of tin and bromine, preferably in carbon bisulphide solution. Stannous iodide, SnI₂, forms yellow red needles, and is obtained from tin and hydroiodic acid. The yellow salt of the orange-red Sn₂I₃, forms red octahedra and is prepared similarly to stannic bromide. Both iodides combine with ammonia.

Stannous Sulphate, SnSO₄, is also known as a lead-grey mass by heating tin with sulphur, and as a brown precipitate by adding sulphurated hydrogen to a stannous solution; this is soluble in ammonium polysulphide, and dries to a black powder. Stannous sulphate, SnSO₄, is soluble in water, and when heated in air oxidizes, giving stannic sulphur and sal-ammoniac in proper proportions in the beautiful form of aurum mutuum (mosaic gold)—a solid consisting of yellow, metallic lustreous scales, and used chiefly as a yellow or "bronze" pigment. Stannous sulphate can be prepared from stannic sulphide obtained by adding sulphurated hydrogen to a stannic solution readily dissolves in solutions of the alkaline sulphides to form stanniotannates of the formula M₂SnO; the free acid, H₂SnO₄, may be obtained as an almost black powder by drying the yellow precipitate formed when hydrochloric acid is added to a solution of a stannostannate.

Tin compounds when heated on charcoal with sodium carbonate or potassium cyanide in the reducing blowpipe flame yield the metal and a scantly ring of white SnO₂. Stannous salt solutions yield a brown precipitate of SnS₂ with sulphurised hydrogen, which is converted into stannic oxide by heating, while stannic salts with hydrogen chloride yield SnCl₂ and sal-ammoniac. Stannous salt solutions give a yellow precipitate of SnS₂ with sulphurised hydrogen, which is insoluble in cold dilute acids but readily soluble in sulphide of ammonium, and is re-precipitated therefrom as SnS₂ on acidification. Only stannous salts (not stannic) give a precipitate of calomel in mercuric chloride solution. A mixture of stannous and stannic chloride, when added to a sufficient quantity of solution of chloride of gold, gives an intensely purple precipitate of gold purple (purple of Cusani). The test is very delicate, although the colour is not in all cases a pure purple. Tin is generally quantitatively estimated as the dioxide. The solutions are oxidized, precipitated and re-dissolved in hydrochloric acid, and re-thrown down by boiling with sodium sulphate. The precipitate is filtered, washed, dried and ignited.

Bibliography.—For the history of tin and its products, see: Bernard Neumann, Die Metalle (1901); A. R. Rowan and J. H. Robinson, "The Chemistry and Metallurgy of Tin", 1911. For its chemistry see Roscoe and Schorlemmer, Traite de chimie minérale; O. Dammer, Handbuch der Erdenmetalle (1891). For its production and metallurgy see Svedberg, "Flavina"; T. H. Dinsmore, "Tin Mining"; Henry Louis, The Production of Tin, and C. Schabel, Handbook of Metallurgy (English trans. by Louis, 1907). General sources of Sn are: tin bars and rats from the metal; the metallurgy, etc., are recorded annually in The Mineral Industry.

TINAMOU, the name given in Guiana to a certain bird, as stated in 1741 by P. Barrère (France equinose, p. 138), from whom it was taken and used in a more general sense by Buffon (Hist. nat. oiseux, iv. 502). In 1783 J. Latham ( Synopsis, II. 724) adopted it as English, and in 1790 (Index, ii. 633) Latinized. 

TINAMOU
it *Tinamus*, as the name of a new and distinct genus. The "Tinamou" of Barrère has been identified with the "Macucaga" described and figured by Margrav in 1648, and is the *Tinamus* major of modern authors.\(^1\)

Buffon and his successors saw that the Tinamous, though passing among the European colonists of South America as "Partridges," could not be associated with those birds, and Latham's step, above mentioned, was generally approved. The genus he had founded was usually placed among the Gallinae, and by many writers was held to be allied to the bustards, which, it must be remembered, were then thought to be "struthions." Indeed the likeness of the Tinamous' bill to that of the Rhea (q.v.) was remarked in 1811 by Illiger. On the other hand L'Hérimier in 1827 saw features in the Tinamous' sternum that in his judgment linked the bird to the Railidae. In 1830 J. Wagler (Nat. Syst. Amphilith., &c., p. 127) placed the Tinamous in the same order as the ostrich and its allies; and, though he did this on very insufficient grounds, his assignment has turned out to be not far from the mark, as in 1862 the great affinity of these groups was shown by W. K. Parker's researches, which were afterwards printed in the Zoological Transactions (v. pp. 205-232, 236-238, pls. xxxix.-xli.), and was further substantiated by him in the Philosophical Transactions (1866, pp. 172-178, pl. xv.). Shortly after this T. H. Huxley in his often-quoted paper in the Zoological Proceedings (1867, pp. 425, 426) was enabled to place the whole matter in a clear light, urging that the Tinamous formed a very distinct group of birds which, though not to be removed from the Carinatae, presented so much resemblance to the Ratitae as to indicate them to be the bond of union between those two great divisions. The group from the resemblance of its palatal characters to those of the Eme (q.v.), Dromaeus, he called Dromaeognathae, but it is now more usual to place them in a separate order, the Tinamiformes.

The Tinamous are comparatively insignificant in numbers. They are peculiar to the neotropical region—a few species finding their way into southern Mexico and none beyond. Some of them inhabit forests and others the more open country; but setting aside size (which in this group varies from that of a quail to that of a large common fowl) there is an unmistakable uniformity among them as a whole, so that almost anybody having seen one species of the group would always recognize another. Yet in minor characters there is considerable difference among them; and about sixty-four species are recognized, divided into the genera *Tinamus*, *Nothoherus*, *Crypturus*, *Rhynchosus*, *Nothoprocta*, *Noturu*, *Tearumrhus*, and *Tinamomax*.

To the ordinary spectator Tinamous have much the look of partridges, but the more attentive observer will notice that their plumage is generally inconspicuous: some tint of brown, ranging from rufous to slaty, and often more or less closely barred with a darker shade or black, is the usual style of coloration; but some species are characterized by a white throat or a bay breast. The wings are short and rounded, and in some forms the feathers of the tail, which in all are hidden by their covert, are soft. In bearing and gait the birds show some resemblance to their distant relatives the Ratitae, and A. D. Bartlett showed (Proc. Zool. Soc., 1868, p. 115, pl. xil.) that this is especially seen in the newly hatched young. He also noticed the still stronger Ratitæ character, that the male, in taking on himself the duty of incubation. The eggs are very remarkable objects, curiously unlike those of other birds; and their shell looks as if it were of highly-burnished metal or glazed porcelain, presenting also various colours, which seem to be constant in the particular species, from pale primrose to sage-green or light indigo, or from chocolate brown to pinkish orange. All who have eaten it declare the flesh of the Tinamou to have a most delicate taste, as it has a most inviting appearance, the pectoral muscles being semi-opaque. Of their habits not much has been told. Darwin (Journ. ch. iii.) has remarked upon the silliness they show in allowing themselves to be taken, and this is wholly in accordance with what W. K. Parker observes of their brain capacity and is an additional testimony to their low morphological rank. At least one species of Tinamou has bred not infrequently in confinement, and partly successful attempts to naturalize the species *Rhynchosus rufescens* have been made in England.

(A. N.)

**Tincture** (Fr. teinture, Lat. tinctura, tingere, to dye, stain), the colour with which a substance is dyed; hence, metaphorically, distinctive character or quality. The term is used in heraldry of the, metals, argent, or, of the colours, sable, azure, &c., or of the furn, ermine, tair, &c. Since the 16th century a conventional arrangement of lines and dots gives the equivalents of these tinctures in black and white (see Heraldry). In medicine, a tincture is a fluid solution of the essential properties of some substance, animal, vegetable or mineral; the menstruum being either alcohol, ether or ammonia; the various kinds are accordingly distinguished as alcoholic, ethereal or ammoniated tinctures.

**Tindal, Matthew** (d. 1733), English deist, the son of a clergyman, was born at Beer Potters (Farrs), Devonshire, on 4 Jan. 1657. He studied law at Lincoln College, Oxford, under the high churchman George Hickes, dean of Worcester; in 1678 he was elected fellow of All Souls College. About 1685 he saw "that upon his High Church notions a separation from the Church of Rome could not be justified," and accordingly he joined the latter. But discerning the "absurdities of popery," he returned to the Church of England at Easter 1688. His early works were an Essay of Obedience to the Supreme Powers (1694); an Essay on the Power of the Magistrate and the Rights of Mankind in Matters of Religion (1697); and The Liberty of the Press (1698). The first of his two larger works, The Rights of Church associated against the Roman Church and all other priests who claim an independent power over it, pt. i., appeared anonymously in 1706 (2nd ed., 1706; 3rd, 1707; 4th, 1709). The book was regarded in its day as a forcible defence of the Erastian theory of the supremacy of the state over the Church, and at once provoked criticism and abuse. After several attempts to proscribe the work had failed, a case against the author, publisher and printer succeeded on the 12th of December 1707, and another against a bookseller for selling a copy the next day. The prosecution did not prevent the issue of a fourth edition and gave the author the opportunity of issuing A Defence of the Rights of the Christian Church in two parts (2nd ed., 1709). The book was, by order of the House of Commons, burned, along with Sacheverel's sermon, by the common hangman (1710). It continued to be the subject of denunciation for years, and Tindal believed he was charged by Dr. Gibbon, bishop of London, in a Pastoral Letter, with having undermined religion and promoted atheism and infidelity—a charge to which he replied in the anonymous tract, An Address to the Inhabitants of London and Westminster, a second and larger edition of which appeared in 1730. In this tract\(^2\) he makes a valiant defence of the deists, and anticipates

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\(^1\) Brisson and after him Linnaeus confounded this bird, which they had never seen, with the Trumpeter (q.v.).

\(^2\) A Second Address to the Inhabitants, &c., with replies to some of the critics of that book, bears the same date (1730), though some of the works it refers to appeared in 1731.
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here and there his Christianity as Old as the Creation; or, the Gospel a Reproduction of the Religion of Nature (London, 1730, 2nd ed., 1731; 3rd, 1732; 4th, 1733), which was regarded as the "Bible" of deism. It was really only the first part of the whole work, and the second, though written and entrusted in manuscript to a friend, never saw the light. The work evoked many replies, of which the ablest were by James Foster (1730), John Clarke (1732), John Leland (1733) and Bishop Butler (1736).

It was translated into German by J. Lorenz Schmidt (1741), and from it dates the influence of English deism on German theology. Tindal had probably adopted the principles it expounds before he wrote his essay of 1697. He claimed the name of "Christian deist," holding that true Christianity is identical with the eternal religion of nature. He died at Oxford on the 16th of August 1733.

The religious system expounded in Christianity as Old as the Creation, unlike the earlier system of Lord Herbert of Cherbury, was based on the empirical principles of Locke. It assumed the traditional deistic antitheses of external and internal, positive and natural, revelations and religions, and perpetuated at the same time the prevalent misconceptions as to the nature of religion and revelation. The system was worked out by the a priori method, with an all but total disregard of the facts of religious history. It starts from the assumptions that true religion must, from the nature of God and his method of working, be universal, simple and perfect; that this religion can consist of nothing but the simple and universal duties towards God and man, the first consisting in the fulfillment of the second—in other words, the practice of morality. The author's method is to expound his presuppositions, and then to show, utilitarian. True revealed religion is simply a reproduction of the religion of nature or reason, and Christianity, if it is the perfect religion, can only be that reproduction, and must be as old as creation. The special mission of Christianity, therefore, is simply to deliver men from the superstition which had perverted the religion of nature. True Christianity must be a perfectly "reasonable service," reason must be supreme, and the structures of the different religious doctrines must submit; only those writings can be regarded as divine Scripture which tend to the honour of God and the good of man. The strength of Tindal's position was the conviction of the essential harmony between man's religious and rational nature. Its weakness was a consequence of the standpoint of modern theology was that, like the whole religious philosophy of the time, it was founded on a misconception of religion and revelation, and on a disregard of the contrast between man's religious development.

See works quoted under Deism.

TINDER (O. Engl. tyndre, from tindan, tendan, to kindle, cf. Dan. tonder, Ger. anwinden), a term applied to any dry substance that will readily take light from a spark and so be used for kindling a fire. Before the invention of matches (see MATCH) fire or light was procured by the ignition of tinder through sparks obtained by the striking of flint against steel, the whole apparatus of tinder, flint and steel being contained in a metal box, which was an essential utensil of all households and was also carried on the person of everyone who might require a light in an emergency.

The usual material of "tinder" was a mass of charred linen, but the term was also applied to "touchwood," or wood converted into an easily ignitable consistency by the action of certain fungi. Another form of "tinder" was "touchpaper," paper dipped in nitre and used as a slow-match for igniting gunpowder.

In both these words "touch" stands for an earlier tach, tache or tasche, tinder, of which the origin is unknown. It may be related to Du. tak, bough, twig, and would thus mean dried twigs used as tinder.

TINEO, a town of northern Spain, in the province of Oviedo; on a small tributary of the river Narcea, among the northern outliers of the Cantabrian Mountains, and on the high road from Cangas de Tineo to the Biscayan port of Cadilero. Pop. (1900), 21,865. Mining, agriculture and stock-rearing are the principal industries.

TINKER, an itinerant mender of kettles, pots, pans, &c. The name means simply one who makes a tinkling sound as he mends the vessels, and the word is found as "tinkler" in the 16th century. From early times "tinkers" were looked on as vagabonds, and were so classed in the act of Elizabeth against vagrancy.

TINNE, ALEXANDRINE PETERONELLA FRANCINA (1830—1860), Dutch traveller in Africa, born at the Hague on the 17th of October 1839, was the daughter of Philip F. Tinné, a Dutch merchant who settled in England during the Napoleonic wars, but afterwards returned to his native land, and of his wife, Baroness Van Steengracht-Capellen. Her father died when she was five years old, leaving her the richest heiress in the Netherlands. After travelling in Norway, Italy and the East, and visiting Egypt, when she ascended the Nile to Gondokoro, Miss Tinné left Europe again in 1860 for the Nile regions. Accompanied by her mother and her aunt, she set out from Cairo on the 9th of January 1862. After a short stay at Khartum the party ascended the White Nile to a point above Gondokoro, and explored a part of the Sobat, returning to Khartum in November.

Baron Theodor von Heuglin (q.v.) and Dr H. Steudner having meantime joined the ladies at Khartum, the whole party set out in February 1863 for the Bahr-el-Ghazal. The intention was to explore that region and ascertain how far westward the Nile basin extended; also to investigate the reports of a vast lake in Central Africa eastwards of those already known—reports referring in all probability to the lake-like expanses of the middle Congo.

Ascending the Bahr-el-Ghazal the limit of navigation was reached on the 10th of March. From Meshira-er-Rek a journey was made overland, across the Bahr Jur and south-west by the Bahr Kosango, to Jebel Kosango, on the borders of the Niam-Niam country. During the journey all the travellers suffered severely from fever. Steudner died in April and Madame Tinné in June, and after many fatigue and dangers the remainder of the party reached Khartum in July 1864, where Miss Tinné's health wavered, and Miss Oudebrand left the expedition. The geographical and scientific results of the expedition were highly important, as will be seen in Heuglin's Die Tinnésche Expedition im westlichen Nilgebiet (1863—1864 (Gotha, 1865, and Reise in das Gebiet des Weissen Nils Leipzig, 1866). A description, by T. Kotschy and J. Peyritsch, of some of the plants discovered by the expedition was published at English in 1867 under the title of Plantes Tinneennes. At Cairo Miss Tinné lived in Oriental style during the next four years, visiting Algeria, Tunisia and other parts of the Mediterranean. In January 1869 she started from Tripoli with a caravan, intending to proceed to Lake Chad, and thence by Wadai, Darfur and Kordofan to the upper Nile. On the 1st of August, however, on the route from Murzuk to Ghat, she was murdered, together with two Dutch sailors, by Tuareg in league with her escort, who believed that her iron water tanks were filled with gold.


TINNEVELLY, a town and district of British India, in the Madras presidency. The town is on the left bank of the Tambraparni river, on the other side of which is Palamcottah, the administrative headquarters of the district. Pop. (1901), 40,460. It is the terminus of a branch of the South Indian railway, 444 m. S.W. of Madras. Its most noteworthy building is a beautifully sculptured temple of Siva.

The DISTRICT of TINNEVELLY has an area of 5380 sq. m. It is for the most part a plain with an average elevation of 200 ft., sloping to the east with slight undulations. It is watered by numerous short streams, the principal being the Tambraparni with a length of 80 m. The chief irrigation work is the Sreevankutam anicut or dam on this river. In the north the scenery is unattractive and the soil poor; in the south the sandy soil prevails in which little save the Palmyra palm will grow. This palm yields toddy as well as a coarse sugar. Along the banks of the rivers are rice-fields and a variety of trees and crops; and coffee is grown on the slopes of the Travancore hills. The district contains many ancient and magnificent buildings. But the most interesting antiquities are the large sepulchral earthen urns of prehistoric races, which have been found at several places, especially along the course of the Tambraparni; they contain bones, pottery, beads and bronze ornaments, iron weapons, implements, &c. The South Indian railway has its maritime terminus at Tuticorin, the chief seaport. The
principal exports are rice to Ceylon and cotton to Japan and Europe. In 1901 the population was 2,059,607, showing an increase of 8% in the decade. The number of native Christians was 159,213, Tinnevelly being the most Christian district in India. The Society for the Propagation of the Gospel and the Church Missionary Society have important and flourishing stations at Tinnevelly town and Palamcottah, as also have the Jesuits. It was here that St Francis Xavier began his preaching in India. The Shans, or caste of toddy-drawers, have supplied many converts to Christianity. In 1899 their treatment by the Vellalars, or cultivating caste, led to serious riots and bloodshed.

The early history of Tinnevelly is mixed up with that of Madura and Travancore. Down to 1781 it is a confused tale of anarchy and bloodshed. In that year the nawab of Arcot assigned the revenues to the East India Company, which then undertook the [internal] administration. So the road of subjection took place, and in 1801 the whole Carnatic, including Tinnevelly, was ceded to the British.

**TIN-PLATE and TERNE-PLATE.** Tin-plate consists of sheets of iron or steel which have been thinly coated with tin by being dipped in a molten bath of that metal. Terne-plate is a similar product, but the bath is not of tin, but of tin and lead mixed, the latter metal constituting from 75-90% of the whole; it has not the bright lustre of tin-plate, whence its name, from *terne*, dull, tarnished. The sheets employed in the manufacture are known as "terne plates," or "black plates," by which the quality of tin-plate is still designated, although iron is no longer used. Tin-plate is consumed in enormous quantities for the manufacture of the tin cans in which preserved meat, fish, fruit, biscuits, cigarettes and numerous other products are packed, and also for the household utensils of various kinds made by the tinsmith or silversmith; terne-plates, which began to be produced in England in the 18th century, are widely employed in America for roofing purposes.

The manufacture of tin-plate was long a monopoly of Bohemia, but tin-plate "he-imported spread to Saxony in 1665. From Yarranton (1616-1684), an English engineer and agriculturist, was commissioned to go to Saxony and if possible discover the methods employed. According to his own account ("England's Improvement," ii. 39), he was "very well treated and was allowed to see the whole process. On his return to England his friends undertook the manufacture on an experimental scale, but though they were successful they had to abandon it, because the smelting of the metal was a "patent up" by a rival, who, however, from lack of technical skill was unable to work it. Half a century later the manufacture was revived by Major John Kay of Penrith, who "made use of the iron plates by means of cylinders," said to have been devised by him, enabled more uniform black plates to be produced than was possible with the old plan of hammering, and in consequence the English tin-plate became recognized as superior to the German. During the next hundred years or so the industry spread steadily in England and Wales, and after 1834 its expansion was rapid, especially in Wales, Great Britain becoming the chief producer. The world's known production in 1870 was 180,000 boxes of 108 lb each (in America a box is 100 lb), in 1848 it was 429,000 boxes, in 1860 it reached 1,700,000 boxes, in 1870 nearly 3,400,000 M. and in 1890 it eranged 6,500,000 boxes. In the United States the manufacture of tin- and terne-plates did not make much way until about 1890, and up to 1892 the bulk of the supply was imported from Great Britain. But subsequently the advance was swift and steady, with the American production, and in 1907 only 20% of the American tin-plate mills were at work, while the British production reached 14 million boxes.

Terne-plates are used for the tinning of the black plates. In the "palm-oil" process, which is the older, the plates, after being properly annealed, are scoured with sand and water and pickled in dilute sulphuric acid alternately until they are perfectly clean and bright. They are then washed in water, and after being boiled in palm oil to remove all traces of acid and water are dipped into a bath of molten tin, covered with oil to prevent oxidation. They are then removed to a second bath containing a little copper and molten tin, and finally to a third bath containing a little zinc and molten tin. After this they are scoured with a hempen rubber and dipped in a third bath containing the purest tin of all; then they are passed through rolls to finish the surface and regulate the thickness of the coating. As the tin in the third bath becomes alloyed with iron from the operation, it is removed into the second, pure fresh tin being substituted; and similarly the metal of the second, as the tin in it is alloyed with iron in the third, is removed. In the "acid process" only a single bath of tin is required. The molten metal is covered with a layer of muriate of zinc, which acts as the flux, and the plates are passed through rolls that are passed through this down into the tin, to be brought out at another point in the bath where there is a layer of oil on the surface.

**TINTAGEL,** or Trevena, a village in the Launceston parliamentary division of Cornwall, England, on the north coast, 43 m. from Camelford. Pop. (1901), 868. It stands on a bare upland, close to the sea; and below it is Tintagel Haven, or Porth, a small cave surrounded by cliffs of almost black slate. The scanty ruins of a castle are built partly on the mainland, partly on a rugged promontory spoken of as the Island, but united by a narrow peninsula to the shore. They have been celebrated as the birthplace of King Arthur, or as the stronghold of King Mark, in a host of medieval romances, and in the poems of Tennyson and Swinburne. The Norman walls are so darkened and weathered that, from a little distance, they seem a part of the rock itself. Portions of a chapel remain, dating from the 13th century, and including a porch and a stone altar; while beside it is the trace of a track to the bower of the slate, and some domestic building which was afterwards turned into a temple and church door. The cruciform parish church of St Marcelliana stands on a high clifl, west of the castle. Although it has been restored, there remain traces of Saxon workmanship in the chancel, besides two Norman doorways, a font of the same period, a stone altar bearing five crosses and a fine 15th-century brass. In the churchyard the graves are buttressed, storms being frequent and violent on this unprotected coast. For a time the church belonged to Fontevrault Abbey in Normandy; but it was made over by Edward IV. to the collegiate church of Wimborne Minster. The walls have always been defaced by the "mem-" of the various occupants. Portions of the vicarage date from the 14th century, and in its garden there is a stone dovecote of great age. A little slate is quarried, being taken from the rocks below the church, and exported in the small vessels which can visit Tintagel Haven in calm weather. The magnificence of the coast has inspired more than one famous painting.

Tintagel (Tintol, Dudnegal) is a parish a portion of which appears in the Domesday Survey as Bosinney (Botcinou). The latter was held in the time of the Confessor by a thegn of St Petrock and at the time of the survey by Robert, count of Mortain, and the whole belonged to the capital. The first grant of land and the next place of greatest distinction is there is the pre-Saxon times. Under the Norman earls of Cornwall this was rebuilt, embattled and furnished with munitions of war. Its officers included a constable and a chaplain. It was in a ruinous condition in Leland's time (c. 1540). Queen Elizabeth abolished the office of constable. In the parish of Tintagel is the hamlet of Bosinney which under the name of Tintagel received a charter (undated) from Richard king of the Romans, granting freedom to the borough and to the burgesses freedom from portage and stallage throughout Cornwall, a market on Wednesdays and a three days' fair at Michaelmas. This charter was confirmed in 1386. In 1335 the burgesses, those who held tenements within the borough, numbered 100. The borough, which apparently owed its existence to the castle, shared its fortunes. Leland calls attention to the decay of a great number of houses. Its charter was surrendered to Charles II. and a new one obtained from his brother in 1685. Under the latter a mayor, recorder, six common councillors, a coroner, six freemen and a common clerk were to constitute the corporation. For supplying vacancies in it the votes of those only who were members of it were required. Provision was made for the administration of the borough. Bossiney acceded to the privileges of Tintagel in 1553, the franchise being originally vested in the freeholders within the borough. By the middle of the
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18th century the franchise had become restricted to the freemen or burgesses. In 1784 the vicar of Tintagel, as mayor and only qualified elector, enjoyed the probably unique privilege of returning two members to the House of Commons. In 1832 there were ten resident legal voters within the borough and nine out-voters. The Reform Act transferred their votes to the county. There is now no market, and the only fair is held on the 21st of October.

TINTERN ABBEY, in Monmouthshire, one of the most famous ecclesiastical ruins in England. It is beautifully situated on the right bank of the river Wye. The abbey was founded by Walter de Clare in 1131 for Cistercian monks. The existing church, however, dates from the later part of the 13th century; it is unroofed, and the nave is imperfect, but many of the finest details of a style transitional from Early English to Decorated are preserved. The church is cruciform. Cloisters and other monastic buildings, of which there are considerable remains, lay to the north of the church. The foundation was dissolved by Henry VIII. At the time, Tintern Abbey was a station on a branch of the Great Western railway.

TINTORETTO, JACOPO ROBUSTI (1577–1649), one of the greatest painters of the Venetian school, was born in Venice in 1577, though most accounts say in 1572. His father, Battista Robusti, was a dyer, or “tintore”; hence the son got the nickname of “Tintoretto,” little dyer, or dyer’s boy, which is Englished as Tintoret. In childhood Jacopo, a born painter, began daubing on the dyer’s wails; his father, noticing his bent, took him round, still in boyhood, to the studio of Titian, to see how far he could be trained as an artist. We may suppose this to have been towards 1533, when Titian was already (according to the ordinary accounts) fifty-six years of age. Ridolfi is our authority for saying that Tintoret had only been ten days in the studio when Titian sent him home once and for all. The reason, according to the same writer, is that the great master observed some very spirited drawings, which he learned to be the production of Tintoret; and it is inferred that he became at once jealous of so promising a scholar. This, however, is mere conjecture; and perhaps it may be fairer to suppose that the drawings exhibited so much independence of manner that Titian judged that young Robusti, although he might become a painter, would never be properly a pupil. From this time forward the two always remained upon distant terms—Robusti being indeed a professed and ardent admirer of Titian, but never a friend, and Titian and his adherents turning the cold shoulder to Robusti. Active disparagement also was not wanting, but it passed unnoticed by Tintoret. The latter sought for no further teaching, but studied on his own account with laborious zeal; he lived poorly, collecting casts, bas-reliefs, &c., and practising by their aid. His noble conception of art and his high personal ambition were evidenced in the inscription which he placed over his studio—“Il disegno di Michelangelo ed il colorito di Tiziano” (Michelangelo’s design and Titian’s colour). He studied more especially from models of Michelangelo’s “Dawn,” “Noon,” “Twilight” and “Night,” and became expert in modelling in wax and clay—a method (practised likewise by Titian) which afterwards stood him in good stead in working out the arrangement of his pictures. The models were sometimes taken from dead subjects dissected or studied in anatomy schools; some were draped, others nude, and Robusti was wont to suspend them in a wooden or cardboard box, with an aperture for the entrance of air. He would frequently paint round the night as well as by day. The young painter Schiavone, four years Robusti’s junior, was much in his company. Tintoret helped Schiavone gratis in wall-paintings; and in many subsequent instances he worked also for nothing, and thus succeeded in obtaining commissions. The two earliest mural paintings of Robusti—done, like others, for next to no pay—were said to have been “Bedshazzer’s Feast” and a “Cavalry Fight,” both long since perished. Such, indeed, may be said to have been the fate of all his frescoes, earlier or later. The first work of his which attracted some considerable notice was a portrait-group of himself and his brother—the latter playing a guitar—with a nocturnal effect; this also is lost. It was followed by some historical subject, which Titian was candid enough to praise. One of Tintoret’s early pictures still extant is in the church of the Carmine in Venice, the “Presentation of Jesus in the Temple”; also in S. Benedetto are the “Annunciation” and “Christ with the Woman of Samaria.” For the Scuola della Trinità (the school or schools of Venice were more in the nature of educational institutions than of educational institutions) he painted four subjects from Genesis. Two of these, now in the Venetian Academy, are “Adam and Eve” and the “Death of Abel,” both noble works of high mastery, which leave us in no doubt that Robusti was by this time a consummate painter—one of the few who have attained to the highest eminence by dire study of their own, unseconed by any training from some senior proficient.

Towards 1546 Robusti painted for the church of the Madonna dell’Orto three of his leading works—the “Worship of the Golden Calf,” the “Presentation of the Virgin in the Temple,” and the “Last Judgment”—now shamefully repainted, and he settled down in a house hard by the church. It is a Gothic edifice, looking over the lagoon of Murano to the Alps, built in the Fondamenta de’ Mori, still standing, but let out cheap to artisans. In 1548 he was commissioned for four pictures in the Scuola di S. Marco—the “Finding of the body of St Mark in Alexandria” (now in the church of the Angeli, Murano), the “Saint’s Body brought to Venice,” a “Votary of the Saint delivered by invoking him from an Unclean Spirit” (these two are in the library of the royal palace, Venice), and the highly lusty celebrated “Miracle of the Slave.” This last, which forms at present one of the chief glories of the Venetian Academy, represents the legend of a Christian slave or captive who was to be tortured as a punishment for some acts of devotion to the evangelist, but was saved by the miraculous intervention of the latter, who shattered the bone-breaking and blinding implements which were about to be applied. These four works were greeted with signal and general applause, including that of Titian’s intimate, the too potent Pietro Aretino, with whom Tintoret, one of the few men who scorned to curry favour with him, was merely in disrepute. It is said, however, that “Tintoret at one time painted a ceiling in Pietro’s house; at another time, being invited to do his portrait, he attended, and at once proceeded to take his sitter’s measure with a pistol (or a stiletto), as a significant hint that he was not exactly the man to be trifled with. The painter having now executed the four works in the Scuola di S. Marco, his straits and obscure endurances were over. He married Faustina de’ Vescovi, daughter of a Venetian nobleman. She appears to have been a careful housewife, and one who both would and could have her way with her not too tractable husband. Faustina bore him several children, probably two sons and five daughters.

The next conspicuous event in the professional life of Tintoret is his enormous labour and profuse self-development on the walls and ceilings of the Scuola di S. Marco, a building which may now almost be regarded as a shrine reared by Robusti to his own genius. The building had been begun in 1525 by the Lombardi, and was very deficient in light, so as to be particularly ill-suited for any great scheme of pictorial adornment. The painting of its interior was commenced in 1560. In that year five principal painters, including Tintoret and Paul Veronese, were invited to send in trial-designs for the centre-piece in the smaller hall, only to be overruled by the Scuola, who fixed on Sala dell’Albergo, on the subject of which the painter had been recommended into Heaven. Tintoret produced not a sketch but a picture, and got it inserted into its oval. The competitors remonstrated, not unnaturally; but the artist, who knew how to play his own game, made a free gift of the picture to the saint, and, as a by-law of the foundation prohibited the rejection of any gift, it was retained in situ—Tintoret furnishing gratis the other decorations of the same ceiling. (This is one version of the anecdote: there is another version, which, though differing in incident, has the like general bearing.) In 1565 he resumed his work at the scuola, painting the magnificent “Crucifixion,” for which a sum of
250 ducats was paid. In 1576 he presented gratis another centre-piece—that for the ceiling of the great hall, representing the "Plague of Serpents"; and in the following year he completed this ceiling with pictures of the "Paschal Feast," and "Moses striking the Rock."—accepting whatever pitance the confraternity chose to pay. Robusti next launched out into the painting of the entire scuola and of the adjacent church of S. Rocco. He offered in November 1577 to execute the works at the rate of 100 ducats per annum, three pictures being due in each year. This proposal was accepted and was punctually fulfilled, the painter's death alone preventing the execution of some of the ceiling-subjects. The whole sum paid for the scuola throughout was 2447 ducats. Disregarding some minor performances, the scuola and church contain fifty-two memorable paintings, which may be described as vast suggestive sketches, with the mastery, but not the deliberate precision, of finished pictures, and adapted for being looked at in a hasty half-light. "Adam and Eve," the "Visitatio," the "Adoration of the Magi," the "Massacre of the Innocents," the "Agony in the Garden," "Christ before Pilate," "Christ carrying His Cross," and (this alone having been marred by restoration) the "Assumption of the Virgin" are leading examples in the scuola; in the church, "Christ curing the Paralytic." It was probably in 1560, the year in which he began working in the Scuola di S. Rocco, that Tintoretto commenced his numerous paintings in the ducal palace; he then executed there a portrait of the doge, Girolamo Priuli. Other works which were destroyed in the great fire of 1577 succeeded—the "Excommunication of Frederick Barbarossa," and "Venus and Adonis," and "Venus of Lepanto." After the fire Tintoret started afresh, Paul Veronese being his colleague; their works have for the most part been disastrously and disgracefully retouched of late years, and some of the finest monuments of pictorial power ever produced are thus degraded to comparative unimportance. In the Sala dello Scrinio Robusti painted the "Capture of Zara from the Hungarians in 1446 amid a Hurricane of Missiles"; in the hall of the senate, "Venice, Queen of the Sea"; in the hall of the college, the "Espousal of St Catherine to Jesus"; in the Sala dell'Anticollegio extra ordinary masterpieces—"Bacchus, with Ariadne crowned by Venus," the "Three Graces and Mercury," "Minerva discarding Mars," and the "Forge of Vulcan"—which were painted for fifty ducats each, besides materials, towards 1578; in the Antichiesetta, "St George and St Nicholas, with St Margaret" (the female figure is sometimes termed the princess whom St George rescued from the dragon), and "St Jerome and St Andrew"; in the hall of the great council, nine large compositions, chiefly battle-pieces. We here reach the crowning production of Robusti's life, the last picture of any considerable importance which he executed, the vast "Paradise," in size 74 ft. by 30, Alpoge, to be the latest painting ever done upon canvas. It is a work so stupendous in scale, so colossal in the sweep of its power, so reckless of ordinary standards of conception or method, so pure an inspiration of a soul burning with passionate visual imagining and a hand magical to work in shape and colour, that it has defied the connoisseurship of three centuries, and has generally (though not with its first Venetian contemporaries) passed for an eccentric failure; while to a few eyes (including those of the present writer) it seems to be so transcendent a monument of human faculty applied to the art pictorial as not to be viewed without awe, nor thought of without admiration. While the commission for this huge work was yet pending and unassigned Robusti was wont to tell the senators that he had prayed to God that he might be commissioned for it, so that paradise itself might perchance be his recompense after death. Upon eventually receiving the commission in 1588 he set up his canvas in the Scuola della Misericordia and worked indefatigably at the task, making many alterations and doing various heads and costumes direct from nature. When the picture had been brought well forward he took it to its proper place and there finished it, assisted by his son Domenico for details of drapery, &c. All Venice applauded the superb achievement, which has in more recent times suffered from neglect, but fortunately hardly at all from restoration. Robusti was asked to name his own price, but this he left to the authorities. They tendered a handsome amount; Robusti is said to have abated something from it, which is even a more curious instance of ungenerosity for pelf than earlier cases which we have cited where he worked for nothing at all.

After the completion of the "Paradise" Robusti rested for a while. He never undertook any other work of importance, though there is no reason to suppose that his energies were exhausted had his days been a little prolonged. He was seized with an attack in the stomach, complicated with fever, which prevented him from sleeping and almost from eating for a fortnight, and on the 31st of May 1594 he died. A contemporary record states his age to have been seventy-five years and fifteen days. If this is accurate, the 16th of May 1595 must have been the day of his birth; but we prefer the authority of the register of deaths in S. Marciliano, which states that Tintoret died of fever, aged seventy-five years, eight months and fifteen days—thus bringing us to the 16th of September 1518 as the true date of his birth. He was buried in the church of the Madonna dell'Orto by the side of his favourite daughter Marietta, who had died in 1590, aged thirty; there is a well-known tradition that as she lay dead the heart-stricken father painted her portrait. Marietta had herself been a portrait-painter of considerable skill, as well as a musician, vocal and instrumental; but few of her works are now traceable. It is said that up to the age of fifteen she used to accompany and assist her father at his work, dressed as a boy; eventually she married a jeweller, Mario Augusta. In 1566 the grave of the Vezovio and Robusti was opened, and the remains of nine members of the joint families were found in it; a different locality, the chapel on the right of the choir, was then assigned to the grave.

Tintoret painted his own portrait at least twice, one of the heads being in the Uffi zi Gallery of Florence and the other, done when his age was advanced, in the Louvre. It is a very serious face, somewhat blunt and rugged, but yet refined without the varnish of elegance—concentrated and resolute, its native ardour of frankness and energy welded down into lifelong laboriousness, with a pent look as of smouldering fire. The eyes are large, dark and round; the grizzled hair close and compact. The face has been held to bear some resemblance to that of Michelangelo, but this does not go very far. Robusti appears also as one of the figures in the two vast pictures by Paul Veronese—the "Marriage in Cana" and the "Feast in the House of Levi." Audacious and intrepid, though not constantly correct, as a draughtsman, majestically great as a colourist, prodigious as an executant, Tintoret was as absolute a type of the born painter as the history of art registers or enables us to conceive. Whatever the melancholy and tragic pictures which his imagination suggested (he was eminently capable of painting a lovely female countenance or an heroic man), often imposing and Romantic, fully as often turbulent and reckless, sometimes trivial, never unpainter-like or prosaic. When he chose—which was not always—he painted his entire personages characteristically; but, like the other highest masters of Venice, he conceded and attended little to the expression of his faces as evincing incidental emotion. In several of his works—as especially the great "Crucifixion" in S. Rocco—there is powerful central thought, as well as inventive detail; but his imagination is always concrete: it is essentially that of a painter to whom the principle of life—itching to make visible—asserts itself above all else, distribution—are the typical and necessitated realities. What he imagines is always a visual integer, a picture—never a treatise, theoretical—his whole art is strictly visual; he supposes that one could see—that is his ideal, not something that one could narrate, still less that one could deduce and demonstrate. In his treatment of action or gesture the most constant peculiarity is the immense relative size of figures; he deliberately increased every forest-boughs in a gale; stiffness or immobility was entirely foreign to his style, which has therefore little of the monumental or severe character. Perhaps he felt that there was no other way for combinations of Titan with the design of Michelangelo. The whole strength and the transcendent fervour of energy of the supreme Florentine might to some extent be emulated; but, if they were united with the weakness of the Venetian, this could only be attained by a process of relaxing the excessive tension and modifying muscular into elastic force. In this respect he was a decided innovator; but he had many imitators, comparatively feebly if we except Paul Veronese.
Tintoretto scarcely ever travelled out of Venice. He loved all the art of the Florentines and Venetians, as well as that of all of his own invention, and designed theatrical costumes and properties, was versed in mechanics and mechanical devices, and was a very agreeable companion. For the sake of his work he lived in a manner not requiring a large amount of money. When not painting he would remain in his working room surrounded by casts. Here he hardly admitted any, even intimate friends, and he kept his modes of work secret and away from his assistants. He abounded in pleasant witty sayings whether to guest or peer. He would also have the house wrap up money for him in a handkerchief, and on his return expected an account of it; Tintoretto's accustomed reply was that he had spent it in alms for the poor or to prisoners. In 1574 he was awakened by the sudden breaking of a window in the fondaico, with power to bequeath it—an advantage granted from time to time to pre-eminent painters. For his phenomenal energy in painting he was termed "Il Porfido." An agreement is extant showing that he undertook to finish in two months two historical pictures each containing twenty figures, seven being portraits. The number of his portraits is enormous; their merit is unequal, but the really fine ones cannot be surpassed. Sebastiano del Piombo remarked that Robusti could paint in two days as much as himself in two years; Annibale Caracci that Tintoretto was in many pictures equal to Titian, in others inferior to Tintoretto. This was the general opinion. The one who said that he had three pentimenti, the second of gold, the second of silver and the third of iron. The only pictures (if we except his own portraits) on which his signature is the church of St. Mark, of Venice (painted originally, for the brotherhood of the Crociferi), the "Miracle of the Virgin," in the Gallery, and the "Crucifixion" in the Scuola di S. Rocco; the last was engraved in 1889 by Agostino Caracci. Generally he painted at once on the canvas, without any underdrawing; and on art have been recorded as follows by Ridolfi: "the art of painting remains increasingly difficult;" "painters in youth should adhere to the best masters, these being Michelangelo and Titian, and should be strict in representing the natural forms," "the first glance at a picture is the crucial one;" "black and white, as developing form, are the best of colours;" "drawing is the foundation of a painter's work;" and "the snows, masses, etc., in the paintings by well-practised men, as the real is often wanting in beauty." Of pupils Robusti had very few; his two sons and Martin de Vos of Antwerp were among them. Domenico Robusti (1562–1637), whose work has already had occasion to mention, frequently assisted his father in the groundwork of great pictures. He himself painted a multitude of works, many of them on a very large scale; they would at best be mediocre, and, coming from the son of Tintoretto, are exasperating; still, he must be regarded as a considerable sort of pictorial practitioner in his way.

We conclude by naming a few of the more striking works of Tintoretto's works that have been left to us: Among them are:

In Venice (S. Giorgio Maggiore), a series of his later works, the "Gathering of the Manna," the "Last Supper," "Descent from the Cross," "Resurrection," "Martyrdom of St. Stephen," "Coronation of the Virgin," "Miracle of St. Ignatius," (the painted originally, for the Brotherhood of the Cross of the Bishops); (S. Francesco, Vigna) the "Entombment;" (the Frari) the "Massacre of the Innocents;" (S. Cassano) a "Crucifixion," the figures seen from behind along the hill slope; (St. Mark's) a mosaic of the "Baptism of Christ," the "Lamentation over the Dead Christ;" (Venetian Theatre, Milan) "St. Helena and other saints." In Florence (Pitti Gallery), "Venus," "Vulcan," and "Cupid." In Cologne (Wallraf-Richartz Museum), "Ovid and Cyma." In Augsburg (the town-hall), some historical pictures, which biographers and tourists alike have unaccountably neglected—one of the siege of a fortified town is astonishingly fine. In England (Hampton Court), "Esther and Ahasuerus," and the "Nine Muses;" (the National Gallery), "The Origin of the Milky Way," a memorable tour de force, "Christ washing Peter's Feet," a grand piece of colour and execution, not greatly interesting in other respects, also a spirited smallish version of "The Annunciation." In Dragoon Street, the writer who has done by far the most to establish the fame of Tintoretto at the height which it ought to occupy in Ruskin in his Stones of Venice and other books; the depth and scope of the master's power had never before been adequately brought out, although his extraordinarily and somewhat arbitrarily used executive gift was acknowledged. Ridolfi (Mervaglie dell' Arte) gives interesting personal anecdotes. Dr. Kane (On Art; a Handbook for Students) (1876) is a solid account. For an English reader the most handy narrative is that of W. R. Oliver (Tintoretto, 1879), in the series entitled "The Great Artists." Here the biographical facts are clearly presented, and a flattering account of the man but not of his work. Other works deserving of mention are: L. Menard, Études sur Tintoret (1881); T. P. Stevens, Four Great Venetians (1901); H. Thode, Tintoretto (1901); Stoughton Holborn, Jacobo Robusti (1903).

TIPASA—TIPPERA

of the commune (1906), 2725. The modern town, founded in 1857, is remarkable chiefly for its pleasant situation and sandy beach. The roadstead is exposed to the N.E. and N.W. There is a mole about 90 ft. long and anchorage in six fathoms. A considerable trade is done. The Roman city of Tipasa was built on three small hills which overlooked the sea. Of the houses, most of which stood on the cliffs, no traces remain; but there are ruins of three churches—Great Basilica and the Basilica Alexander on the western hill, and the Basilica of St Salsa on the eastern hill—two cemeteries, the baths, theatre, amphitheatre and nymphaeum. The line of the ramparts can be distinctly traced and at the foot of the eastern hill the remains of the ancient harbour. The basilicas are surrounded by cemeteries, which are full of coffins, all of stone and covered with mosaics. The basilica of St Salsa, which has been excavated by S. Gsell, consists of a nave and two aisles, and still contains a mosaic. The Great Basilica served for centuries as a quarry, but it is still possible to make out the plan of the building, which was divided into seven aisles. Under the foundations of the church are tombs hewn out of the solid rock. Of these one is circular, with a diameter of 60 ft. and space for 24 coffins.

Tipasa was founded by the Phoenicians, was made a Roman military colony by the emperor Claudius, and afterwards became a municipium. Commercially it was of considerable importance, but it was not distinguished in art or learning. Christianised early, and in the third century Tipasa was a bishopric. The see's existence has been rarely attested until, according to the legend, Salsa, a Christian maiden, threw the head of their serpent idol into the sea, whereupon the enraged populace stoned her to death. The body, miraculously recovered from the sea, was buried, on the hill above the harbour, in a small chapel which gave place subsequently to the stately basilica. Salsa's martyrdom took place in the 4th century. In 484 the Vandal king Huneric (477–484) sent an Arian bishop to Tipasa; whereupon a large number of the inhabitants fled to Spain, while many of the remainder were cruelly persecuted. After this time the city disappeared from history; and, whether or not its ruin was caused by the Arabs, they seem to have made no settlement there.

(2) Another town which in Roman times was called Tipasa is in the department of Constantine, Algeria, 55 m. due south of Bona, 3140 ft. above the sea; it is now called Tiféf. The chief ruin is that of an extensive fortress, the walls of which are 9 ft. thick.

TIP-CAT (also called Cat and Cat and Dog), a pastime which consists in tapping with a stick a short billet of wood with sharpened ends upon one of these ends, so that it jumps in the air, and the hitting of it with another stick continued heathens for many varieties of the game, but in the most common the batter, having placed the billet, or cat, in a small circle on the ground, tips it into the air and hits it to a distance. His opponent then offers him a certain number of points, based upon his estimate of the number of hops or jumps necessary to cover the distance. If the batter thinks the distance underestimated he is at liberty to decline the offer and measure the distance in jumps, and score the number made. The game is one or more hundred.

TIPPERA (Tripora), a native state and also a British district of India, in Eastern Bengal and Assam. The state, which is held as Hill Tippera (q.v.), represents that portion of the raja's territory that was never conquered by the Mahommedans. The dynasty, which is of great antiquity, was converted to Hinduism many centuries ago; but the people still profess an aboriginal religion, similar to that of the neighbouring hill tribes. The raja owns an estate of 570 sq. m., yielding an income of more than £40,000, in the British district, where he ranks as an ordinary zamindar. His residence is at Agartala, just within the boundary of Hill Tippera.

The British district of Tippera, with administrative headquarters at Comilla, has an area of 2499 sq. m. It has a flat and open surface, with the exception of the isolated Lālmāi range.
TIPPERARY

(100 feet), and is for the most part laid out in well-cultivated fields, intersected by rivers and _kahls_ (creeks) partially affected by the tides. In the lowlands the soil is light and sandy; but in the higher parts a deep alluvial soil alternates with bands of clay and sand. The principal rivers are the Meghana, or estuary of the Brahmaputra; and the Gunti, Dakkattait, and Tittas, which are also navigable for a considerable portion of their course. There are many marshes or _blys_. The wild animals include tigers, leopards, wild boars and buffaloes. The climate is mild and healthy. In 1901 the population was 2,117,991, showing an increase of 19% in the decade, being the highest rate in the province. The northern parts of Tipperary are fully one-third as densely populated as the southern. Rice is the staple crop, followed by peas, varieties of betel-nut and betel leaves, and chillies are also grown. The chief exports are rice, jute and betel-nuts; and the principal imports cotton goods, salt, and kerosene oil.

The eastern border of the district is traversed by the Assam-Bengal railway, with branches from Laksham to Chandpur and Noakhali; but waterways remain the chief means of communication.

Tippera came under the East India Company in 1755; but more than a fifth of its present area was under the immediate ruler of the hill rajahs till 1748, when Tippera was divided into six subdivisions: it produces elephants. At that time Tippera with Noakhali formed part of Jalpur, one of Shuja-ud-Din's divisions of the province of Bengal; but in 1822 it was separated, and since then great changes have been made in its boundaries. With the exception of a serious raid in 1860 by the Kukis or Lushais, nothing has disturbed the peace of the district.

_TIPPERARY_, a county of Ireland in the province of Munster, bounded N.W. by Galway, N.E. by King's County, E. by Queen's County and Kilkenny, S. by Waterford, and W. by Cork, Limerick, Clare and Galway. The county is the second in size of the Irish counties, having an area of 1,062,963 acres, or about 1,661 sq. m. The surface is varied and picturesque. The Knockmealdown Mountains on the southern border reach an elevation of 2,500 ft. To the north of this range are the picturesque Galty or Galtee Mountains (Galtymore 3,015 ft.).

To the east, bordering Kilkenny, are the Slieveardagh Hills, and near Templemore the Devil's Bit Mountains (1,583 ft.) with a curious gap on the summit. In the north-west is Keeper Hill, 2,278 ft. The greater part of the county, however, is a gently undulating plain. From the rich level country the Rock of Cashel, the ancient earl's seat, is the most prominent feature on the horizon. The Suir, which has its source in the Devil's Bit Mountains, and flows southward and eastward by Templemore, Thurles, Caher, and Clonmel. The Nore, which also rises in the Devil's Bit Mountains, soon passes into Queen's County, and the Shannon forms part of the western border. The Mitchelstown stalactite caverns, discovered accidentally in 1833, attract a large number of visitors.

There are two round towers within the county—one at Roscrea and another near Cashel. The Rock of Cashel, on an outcrop of sandstone, is known as a centre of remains of several ecclesiastical foundations of the highest interest. Of these the following are described under the names of the respective towns: the remarkable collection of buildings and adjacent to the Rock of Cashel; the Cistercian abbey of Holy Cross near Thurles, one of the finest monastic ruins in Ireland; and the abbey and Franciscan friary at Roscrea. The stronghold of Caher, occupied as a barracks, is in good preservation. At Roscrea one of the towers of the castle built by King John remains, and the stronghold of the Ormondes, erected in the reign of Henry VIII., forms the dépot attached to the barracks. The other principal ecclesiastical remains are the priory of Athassel, founded for Augustinian monks about 1200; and Fethard Abbey, founded in the 12th century, now used as a chapel.

**TIPPERARY, a market town of Co. Tipperary, Ireland. Pop. (1901), 6281. It is beautifully situated near the base of the Slievenamon hill, a branch of the Galty**

_crops. The centre of the county is occupied by the Golden Vale, the most fertile district in Ireland, which stretches from Cashel to the town of Limerick. On the higher districts the soil is light and thin, ppartaking much of the character of the clay slate and sandstone on the extreme north-east. But the Bog of Allen encroaches on the north-eastern part of the county. The proportion of tillage to pasture is roughly as 1 to 24, and the area under the standard crops of oats and potatoes has decreased, but the proportion of wheat has been more than doubled. As an agricultural region, Tipperary is well maintained, as distillation causes a steady demand for this grain. Turnips are also an important and steady crop. The numbers of cattle, sheep, pigs, goats and poultry also increase generally; and potatoes, being occupied by the county, are much employed in mining, but the occupation of the inhabitants is chiefly agricultural. There is a considerable number of meal and flour mills._

Communications are supplied by the Great Southern & Western railway, the main line of which crosses the county from north-east to south-west by Templemore and Thurles. The Ballybrophy ( upt.o. El., Clonmel) railway, whose line is joined near the south of the county at Clonmel (junction for Birr) and Ennagh. The Waterford & Limerick line passes through the south of the county by way of Clonmel and Tipperary, crossing the main line at Limerick junction. The two lines are also connected by the Thurles, Fethard and Clonmel branch.

**Population and Administration.—The population (175,217 in 1801; 160,232 in 1901) shows a serious decrease (though much less so than formerly), and emigration is very heavy. Of the total about 94% are Roman Catholics, and about 76% constitute the rural population. The principal towns are Clonmel (the county town, pop. 10,167), Tipperary (6381), Carrick-on-Suir (5400), Ennagh (4704), Thurles (4411), Cashel (a cathedral city, 2938), Roscrea (2935), Caher (2058), Templemore (2934), and Cahir (1492). Tipperary is divided into two districts, north and south, each consisting of six baronies. For parliamentary purposes it is separated into four divisions—East, Mid, North and South—each returning one member. Before the Union in 1800 the county returned two members to the Irish parliament, and the boroughs of Cashel, Clonmel and Fethard each two; afterwards, until the Redistribution Act of 1885, the county returned two members and Cashel and Clonmel each one. Assizes for the north riding are held in Ennagh and for the south riding in Clonmel. Quarter-sessions are held at Cashel, Clonmel, Ennagh, Roscrea, Thurles and Tipperary. Ecclesiastically the county belongs to the Protestant dioceses of Cashel and Killaloe, and the Roman Catholic dioceses of Cashel, Killaloe, Waterford and Lismore._

**History and Antiquities.—Tipperary is one of the counties generally considered to have been formed by King John in 1210; in 1328 Edward III. made it a county palatine in favour of the earl of Ormond; and, though the king shortly afterwards resumed his regal prerogative, the county was regranted in 1337. In 1372 the grant was confirmed to James Butler, 1st earl of Ormond, the lands belonging to the Church remaining, a small area on the south border forming the county of Cross Tipperary, or the Cross of Tipperary. In 1621 James I. took the county palatine into his own hands. It was, however, restored in 1664 to James, 12th earl and 1st duke, whose regalities were further made to include the county of the Cross. On the attainder of James, 2nd duke, in 1715, the jurisdiction reverted to the Crown, and the last of the Irish palatines thus ceased to exist._

There are two round towers within the county—one at Roscrea and another near Cashel. The Rock of Cashel, on an outcrop of sandstone, is known as a centre of ecclesiastical remains of several ecclesiastical foundations of the highest interest. Of these the following are described under the names of the respective towns: the remarkable collection of buildings and adjacent to the Rock of Cashel; the Cistercian abbey of Holy Cross near Thurles, one of the finest monastic ruins in Ireland; and the abbey and Franciscan friary at Roscrea. The stronghold of Caher, occupied as a barracks, is in good preservation. At Roscrea one of the towers of the castle built by King John remains, and the stronghold of the Ormondes, erected in the reign of Henry VIII., forms the “depot” attached to the barracks. The other principal ecclesiastical remains are the priory of Athassel, founded for Augustinian monks about 1200; and Fethard Abbey, founded in the 12th century, now used as a chapel._

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TIJJO SAHIB—TIRAH CAMPAIGN

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range, on the Waterford & Limerick line of the Great Southern & Western railway, 3 m. S.E. of Limerick Junction and 1104 S.W. of Cork. It is governed by an urban district council. It is situated in the centre of a fine agricultural district, and its butter market ranks next to that of Cork. Condensed milk is manufactured. The town is of great antiquity, but first acquired importance by the erection of a castle by King John, of which there are no remains. A monastery founded for Augustinians by Henry III. gave a second impulse to its growth. The gatehouse, all that remains of this foundation, is the only building of antiquity in the town. Formerly Tipperary was a corporation from a grant made in 1310 by Edward II. New Tipperary was founded outside the town by Mr William O'Brien in 1890 during the "Plan of Campaign" inaugurated to boycott the Smith-Barry estate, in order to accommodate the tenants who vacated their holdings, but the scheme was a failure, and the place was abandoned and sold. TIJJO SAHIB (1753—1799), sultan of Mysore, son of Hyder Ali (q.v.), was born in 1753. He was instructed in military tactics by French officers in the employment of his father. In 1767 in the invasion of the Carnatic he commanded a corps of cavalry, and he distinguished himself in the Mahrrat War of 1775—79. On the outbreak of the first Mysore War in 1780 he was put at the head of a large body of troops, and defeated Brathwaite on the banks of the Coleroon in February 1782. He succeeded his father in December 1782, and in 1784 concluded peace with the British, and assumed the title of sultan. In 1786 he had Van Noort and Nairn invaded and provoked British invasion by ravaging the territories of the raja of Travancore. When the British entered Mysore in 1790, he retaliated by a counter-invasion, but was compelled by Cornwallis' victory near Seripagapatam to cede half his dominions (March 16, 1792). The British having deemed it necessary to renew hostilities in March 1799, he was shut up in Seripagapatam and finally killed during the storm (May 4, 1799). Tippero was of cruel disposition, and inferior in military talents to his father.


TIJSTAFF (Mid. Eng. tipped staf), a staff of officer mounted with a tip or cap of metal, or with a crown, carried by a constable or sheriff's officer, the term being hence applied to such an officer. Tipstaffs are attached to the king's bench and chancery divisions of the High Court of Justice in England; their duty is to arrest or take into custody any person on an order of committal, if within the precincts of the court, and convey him to the king's prison at Holloway. The tipstaff for the common law courts was originally appointed by the marshal of the king's bench, and the constable of the lord-chancellor's library reported to the Fleet prison. Since the abolition of these prisons the tipstaffs have been appointed by the lord chancellor and lord chief justice respectively.

TIPTON, an urban district of Staffordshire, England, in the parliamentary borough of Wednesbury, adjacent to Dudley (1½ m. S.), served by the London & North Western and Great Western railways. Pop. (1901), 30,543. Its streets are interspersed with coal-mines and iron works. Heavy iron goods are the principal products, anchors and cables being a speciality; there are numerous furnaces and rolling mills; also cement works, brick-works and maltings. The village round which the modern town sprang up is mentioned in Domesday as Tibbington; its ancient church was undermined and collapsed in 1797.

TIROBOSCHI, GIROLAMO (1731—1794), the first historian of Italian literature, was born at Bergamo on the 18th of December 1731. He studied at the Jesuit college at Monza, entered the order, and was appointed in 1755 professor of eloquence in the university of Milan. Here he produced (1766—1768) Vetra humilitatirum monumentis (3 vols.), a history of the extinct order of the Humilitati, which made his literary reputation. Nominated in 1770 librarian to Francis III., duke of Modena, he turned to the acquiring of the materials there accumulated for the composition of his Storia della letteratura italiana. This vast work, in which Italian literature from the time of the Etruscans to the end of the 17th century is traced in detail, occupied eleven years, 1771—1782, and the thirteen quarto volumes embodying it appeared successively at Modena during that period. A second enlarged edition (16 vols.) was issued from 1808 to 1812, and a third in 1840. Of late years, abridgments in German, French and English. Tiroboschi died at Modena on the 3rd of June 1794, leaving a high reputation for virtue, learning and piety.

Tiroboschi wrote besides Biblioteca moderna (6 vols., 1781—1786); Notizie de' pittoa, scultori, incisori, ed architetti moderni (1786); Memorie storiche moderni (5 vols., 1793—1794), and many minor historical works, including a valuable edition of Petrarch (1799), and left materials for a work of great research entitled Dizionario topografico-storico degli stati estensi (2 vols. 4tos, Modena, 1824—1825).

TIRAH, a mountainous tract of country on the Peshawar border of the North-west Province of India. It lies between the Khyber Pass and the Khanki Valley, and is inhabited by the Afridi and Orakzai tribes. It is chiefly notable as the scene of the Khyber Campaign and the war waged by the British in the mountains, off all the roads to India, from the difficulty of its passes and the fierceness of its inhabitants had hitherto preserved it inviolable from all invaders. Tirah comprises an area of some six to seven hundred square miles and includes under this general name all the valleys lying round the source of the Bara river. The five valleys are Maldan, Raigul, Waran, Bara and Mastura.

Maidan, the summer home of the Afridis, lies close under the snow-bound ridges of the Safed Koh at an elevation of about 6400 ft. It is oval plain about seven miles in length, and three miles wide, and slopes inwards towards the centre of its northern side, where all the drainage gathered from the four corners of the plain is shot into a narrow corkscrew outlet leading to the Bara Valley. The flat summit is studded with small tented encampments, and rich alluvial soil and made it one of the most fertile valleys on the frontier. All its alluvial slopes are terraced and revetted and irrigated till every yard is made productive. Here and there ditches in clusters all over the plain are square-built two-storied mud and timber houses, standing in the shade of gigantic walnut and mulberry trees. Up on the hillsides surrounding the Maldan basin are wild olives in wide-grown clumps, almost amounting to forest, and occasional pomegranates. Higher still are the blue pines; but below on the shelving plains are nothing but fruit trees. Raigul Valley lies north of Maidan, from which it is separated by a steep range of cold-well wooded mountains, and separated from the west of the Bara Valley, which it joins at Dwatoi. It is ten miles long, four to five miles at its widest, and has an elevation of 5000 ft. It is inhabited by the Afridis, and is known to be another valley about the same size as Maidan, lying east of it, and separated from it by the Tseri-Kandao Pass. It was the home of the Afridi mullah Sayad Akbar, and is the country of the Aka Khels. The Raigul collection is in the hands of Mr. A. F. North. Drainage at Dwatoi, the united stream receives the name of Baran, and the valley through which it flows down to its exit in the Peshawar Valley is also known by this name. The elevation of the valley is from 5000 ft. at Dwatoi to 2000 at Kajuri; on the north side it is hemmed in by the Surghar range, which divides it from the Bazar Valley; on the south lies another range dividing it from Maidan and the Waran Valley. The heat of the Bara Valley in summer is said to be excessive, malaria prevalent, and mosquitoes very troublesome, so the hamlets are deserted and the Afridis migrate to the pleasant heights of Maidan. The Mastura Valley occupies the southern half of Tirah, and is inhabited by the Orakzai and the Afridi. It is the southern valley on the frontier, lying at an elevation of 6000 ft. The Orakzais live, for the most part, in the Miranzai Valley, in the winter, and retreat to Mastura, like the Afridis, during the summer months. The chief passes in this valley are the Tseri-Kandao Pass (5695 ft.), separating Maldan Valley from Maidan; Saran Sar (8650 ft.), leading from the Zacka Khel portion of Maidan into the Bara valley; the Tseri-Kandao Pass (6565 ft.), separating Maidan from the Waran Valley, and the Sapi Pass (5150 ft.), leading from the east of the Mastura Valley into the Bara Valley in the direction of Maldan. The whole region is thoroughly explored and mapped at the time of the Tirah Expedition.

TIRAH CAMPAIGN, an Indian frontier war in 1897—98. The Afrids had for sixteen years received a subsidy from the Indian government for the safeguarding of the Khyber Pass, in addition to which the government had maintained a detachment.
purpose a local regiment entirely composed of Afridis, who were stationed in the pass. Suddenly, however, the tribesmen rose, captured all the posts in the Khyber held by their own countrymen, and attacked the forts on the Samana Ridge near Peshawar. It was estimated that the Afridis and Orakzaiz could, if united, bring from 40,000 to 50,000 men into the field. The preparations for the expedition occupied some time, and meanwhile the Mohmand rising north-west of the Khyber Pass was first dealt with (see Mohmand).

The general commanding was General Sir William Lockhart (g.v.) commanding the Punjab Army Corps; he had under him 34,582 men, British and native, in addition to 20,000 followers. The frontier post of Kohat was selected as the base of the campaign, and on 1st October the expedition was headquartered there. The traversing of the 18th of October the operations commenced, fighting ensuing immediately. The Dargai heights, which commanded the line of advance, were captured without difficulty, but abandoned owing to the want of water. On the 20th the same positions were gallantly stormed, with a loss of 190 killed and wounded. The progress of the expedition, along a wretched track through the mountains, was obstinately contested on the 20th of October at the Samgapeh Pass leading to the Mastara valley, and on the 31st at the Aryanah Pass from the Mastara to the Tirah valley. The force, consisting of a dozen brigades, now proceeded to traverse the Tirah district in all its length and breadth, and fortified hamlets of the Afridis. The two divisions available for this duty numbered about 20,000 men. A force about 3200 strong commanded by Brigadier-General (afterwards Major-General Sir Richard) Westmacott was first employed to attack Saran Sar, which was easily carried, but during the retirement the troops were hard pressed by the enemy and the casualties numbered sixty-four. On the 11th of November Saran Sar was again attacked by the brigade of Brigadier-General (afterwards Sir Alfred) Gaselee. Experience enabled better dispositions to be made, and the casualties were only three. The traversing of the valley continued, and on the 13th of November Brigadier-General Kempster's brigade visited the Waran valley via the Tseri Kandao Pass. Little difficulty was experienced during the advance, and several villages were destroyed; but on the 16th, during the return march, the rearguard was hotly engaged all day, and had to be relieved by fresh troops next morning. The casualties numbered seventy-two. Almost daily the Afridis, too wise to risk general engagements, waged a perpetual guerrilla warfare, and the various bodies of troops engaged in foraging or survey duties were constantly attacked. On the 21st of November a brigade under Brigadier-General Westmacott was detached to visit the Rajgil valley. The road was exceedingly difficult and steady opposition was encountered. The objects were accomplished, and the casualties during the retirement alone numbered twenty-three. The last important work undertaken was the punishment of the Chamkanis, Mamuzais and Massozais. This was carried out by Brigadier-General Gaselee, who joined hands with the Kurram movable column ordered up for the purpose. The Mamuzais and Massozais submitted immediately, but the Chamkanis offered resistance on the 1st and 2nd of December, the British casualties numbering about thirty. The 1st division under Brigadier-General Yeatman Biggs (d. 1898), and accompanied by Sir W. Lockhart, to move along the Bara valley. The base was thus to be transferred from Kohat to Peshawar. The return march began on the 9th of December. The cold was intense, 21 degrees of frost being registered before leaving Tirah. The movement of the 1st division though arduous was practically unsupported, but the 40 miles to be covered by the 2nd division was contested almost throughout. The actual march down the Bara valley (34 miles) commenced on the 10th, and involved four days of the hardest fighting and marching of the campaign. The road crossed and recrossed the icy stream, while snow, sleet and rain fell constantly. On the 10th the casualties numbered about twenty. On the 11th some fifty or sixty casualties were recorded among the troops, but many followers were killed or died of exposure, and quantities of stores were lost. On the 12th the column halted for rest. On the 13th the march was resumed in improved weather, though the cold was still severe. The rearguard was heavily engaged, and the casualties numbered about sixty. On the 14th, after further fighting, a junction with the Peshawar column was effected. The 1st division, asked by the Peshawar column, now took possession of the Khyber forts without opposition. Negotiations for peace were then begun with the Afridis, who under the threat of another campaign in favour of the Afridis, who under the threat of another campaign in favour of the Afridis, who under the threat of another campaign in favour of the Afridis, who under the threat of another campaign in favour of the Afridis, who under the threat of another campaign, was immediately opened.

TIRANA, a town of Albania, European Turkey, in the vilayet of Scutari; 20 m. E. by N. of Durazzo, at the southern extremity of the plain of Kroa. Pop. (1903) about 12,000. Tirana is beautifully situated on the border of the richly wooded highlands inhabited by the Albanians. It is a picturesque town with a large bazaar and many mosques, gardens and olive groves. It was founded early in the 17th century and was long the see of a Greek bishop, although the majority of its inhabitants have always been Moslems. Kroa, the ancient stronghold of Scanderbeg (g.v.), is 14 m. north.

TIRARD, PIERRE EMMANUEL (1827-1893), French politician, was born of French parents at Geneva on the 27th of September 1827, and, after studying in his native town, became a civil engineer. After five years of government service he resigned to become a jeweler merchant. His determined opposition to the empire, and his conviction in 1870 that the candidate opposed to Ollivier, was rewarded by his election as mayor of the 11th arrondissement of Paris and as deputy for the Seine. Nominated a member of the Commune, he protested against the tyranny of the central committee, and escaped from Paris to resume his place among the extreme Left in the National Assembly at Versailles. In 1876 he was returned for the 1st arrondissement of Paris to the Chamber of Deputies, and was re-elected next year. He specially devoted himself to finance, being for a short time president of the customs commission before the Albanians. It is a picturesque town with a large bazaar and many mosques, gardens and olive groves.

TIRE, an homonymous word, of which the meanings are (1) to wear away, (2) to adorn, or, as a substantive, a head-dress, (3) the quotient of a division. "Tire" in sense (1) is from the Old English teorian, to weary, transitory and intransitive. Ultimately this word is connected with "tear," to rend, the stages of meaning being to rend apart, to wear out, to be made exhausted.
In sense (2) the word is a shortened form of "attire," dress, equipment; this is from the Old French attier, to put in order, to dress, from a root that is now scarcely recognizable. Its meaning has been etymologically altered. It may be connected with "attire," especially with reference to a similarity to the band of a woman's head-dress, or it may be a corruption of "tie," "tie" meaning that which "ties" or fastens together, though this is rejected by Skeat. The spelling "tyre" is not now accepted by the best English authorities, and is unrecognized in America.

The tire of a wheel is the outer circumferential portion that rolls on the ground or the track prepared for it. When the track is smooth and level, as in a railway, the principal functions of the tire are to provide a hard, durable surface for the wheel, and to reduce to a minimum the resistance to rolling. Railway vehicle wheels usually have hard steel tires, this combination with the hard steel rail giving the maximum endurance and the minimum rolling resistance. For road vehicles also, in which durability is the prime consideration, the tires are usually rings of iron or steel or shrunk on the wooden wheels.

In bicycles, motor-cars, and other road vehicles in which freedom from vibration and shock from uneven road surface is desired, rubber or pneumatic tires are employed. These elastic tires are capable of absorbing small irregularities in the road surface without transmitting much vibration to the frame of the vehicle. Their range of yield is, however, too limited to absorb the larger irregularities met with on rough roads, so that their use does not obviate the necessity of spring support of the carriage body on the wheel axes. The pneumatic tire has a very much smaller rolling resistance than a solid rubber tire. Where the driving power is limited, as in bicycles, this consideration is by far the most important. A pneumatic tired bicycle requires less power to drive it at a given speed than does one with solid rubber tires—in popular language, it is much faster; hence pneumatic tires are now almost universally used on bicycles.

Rolling Resistance.—Professor Osborne Reynolds, in his investigations on the nature of rolling resistance, found that it is due to actual sliding of the surfaces in contact. Fig. 1 shows an iron roller resting on a flat, thick sheet of India-rubber. A series of equidistant parallel lines drawn on the India-rubber are distorted by the pressure, as shown in the figure. The distance between the marks on the periphery of the roller corresponds to that between the lines on the undisturbed sheet of rubber. The motion of the roller being from left to right, actual contact takes place between C and D. The surface of the rubber is depressed at P, is bulged up in front at D, and behind at C. The vertical compression of the rubber at P causes it to bulge laterally, this causing a lateral contraction of the sheet which in turn changes the area of contact. Of course, the frictional force is proportional to the area of contact. From this picture, the reader will readily see that the contact area is responsible for the sliding resistance of the roller and the associated work of deformation of the rubber.

FIG. 1.

The area of contact varies as the normal pressure and is inversely proportional to the coefficient of friction. The area is not constant, but varies with the load, the radius, and the length of the roller, so that although the coefficient of friction is a constant, the area of contact is not constant. This is a fundamental property of the area of contact, and it is the basis of the study of the area of contact.
TIRE

Outer Cover.—The outer cover has to be strong enough to withstand the air-pressure inside the tire and to transmit the driving or the braking effort from the wheel to the road surface. For the latter purpose, the threads of the fabric (the best disposed spirally, as shown in fig. 6) while driving in the direction of the arrow the tension on the fibres cc will be slightly increased, that on fibres dd decreased. The distortion of space to driving is thus reduced to a minimum. A woven fabric is sometimes used, but one made up of two or more layers of parallel threads embedded in rubber is better. This construction makes the outer cover more flexible, and consequently less energy is wasted in the distortion of the tire, when the tire rolls on and off the ground, while greater durability is also secured. Fig. 7 shows a plain woven fabric, from which it is seen that each thread takes the form of a sinus line. As the air-pressure inside the tire is increased the threads tend to become straighter and to press together with a cutting action. The total tension on a layer is greater than that of two layers of parallel threads, while on the latter the threads can be faced closer together. The woven fabric is therefore stiffer, weaker and less durable than that built up of parallel layers. The average tensile stress per inch width on the longitudinal section of the cover is given by the formula $pd = 4d$; that on the transverse section, $b$ by $pd = 4b$, $d$ being the diameter of an air-tight. In most tires for cycles and motor-cars an inner tube of india-rubber, made separate from the outer cover. In these double tubes the outer cover is more or less easily detachable from the rim.

The air-pressure is partly confined inside the inner cover. In accordance with the spiral disposition of the threads, as shown in fig. 6, this inequality of stress in the two principal directions is due to the transverse size of the tire, while at the same time tending to contract the tire on the rim.

Single tube, Double tube and Tubular Tires.—A tire, beside being strong enough to resist the stresses to which it is subjected under air-tight. In most tires for cycles and motor-cars an inner tube of india-rubber, made separate from the outer cover. In these double tubes the outer cover is more or less easily detachable from the rim. The air-pressure is partly confined inside the inner cover. In accordance with the spiral disposition of the threads, as shown in fig. 6, this inequality of stress in the two principal directions is due to the transverse size of the tire, while at the same time tending to contract the tire on the rim.

Attachment of Tires to Rims.—A tire can be cemented directly to the rim. For detachable double-tube tires on bicycles, two methods, the Dunlop-Welch endless wire (fig. 9), and the "beaded edge" (fig. 11), are employed for the attachment of the inner cover. In the Dunlop-Welch tire the endless wires are embedded in the two edges of the outer cover respectively, the transverse tension of the fabric being transmitted to them. Each endless wire is formed of three coils, so as to give flexibility to the edge of the cover. Each embedded endless wire is smaller in diameter than the edge of the rim. The middle portion of the rim is deepened, its diameter being less than that of the ring of endless wire. To detach the tire after deflation, one part of the cover is bent over, and the tire is forced on the rim by means of a pulling tool. For a slow speed vehicle an ordinary steel tire, shrunken or hydraulically pressed on a wooden wheel, is cheap and durable. At higher speeds over uneven roads the rubber is less satisfactory; the wheel, forming with the tire one rigid body, receives violent accelerations vertically as well as laterally, and tends to fly apart, and the tire is thenceforth useless for any further use. For passenger cars an elastic tire is a necessity. The solid rubber tire, not being able to puncture, is trustworthy if made of sufficient sectional area, but it is expensive and lacks the comfort and easy running of the pneumatic. The motor car pneumatic tire is made up of three layers of canvas. The Palmer cord tire is built up of two layers of cord (fig. 12) arranged spirally, each cord being composed of four strands of six threads. The cords are flattened between $T$ and $Q$. Then for each inch length of tire $T = pd/3$, $Q = T\cos \theta$; while $P = OQ/2$. Combining these results we get

$P = pdD/3 \cos \theta$. If $\theta = 90^\circ$, $P = 0.29pdD$,

which is a formula for the section of wire for any size can be calculated.

The "beaded edge" forming, thickened edges on the outer cover take into corresponding edges formed on the rim, and are securely held therein when the tire is inflated.

Prevention of Punctures.—The outside of the tire is covered with a thick layer of rubber, which protects the fabric from injury by contact with the rough road surfaces. In full roadster tires this outer layer of rubber is thinner at the sides than at the tread (the part which actually rolls on the ground), but still completely covers the fabric. In light roadster and racing tires the sides are not covered, and an appreciable gain in speed or ease of driving is due to the greater flexibility of the cover thus obtained. Numerous puncture proof banca and other devices have been tried with the object of absolutely preventing punctures, or making the tire self-sealing after puncture; but they increase the rolling resistance, and therefore the effort necessary to drive the bicycle at a given speed.

All Value for Pneumatic Tire.—A non-return valve is permanently attached to the inner tube of the tire, which allows the air forced from the inflater to pass inside the inner cover. The most commonly used, the Dunlop-Woods valve, consists of a short piece of rubber tubing mounted on a brass stem, which has a small hole communicating from its outer end to the inner surface of the rubber tube. Normally, the tubing closes the mouth of this hole, preventing the escape of air from the tire, but lifts freely when air is being forced from the inflater. The arrangement of the parts for deflating and for getting access to the rubber tubing is very simple and effective. The cyclist should be careful that the small piece of valve tubing, and the two flaps covering the ends of the flexible connector which serve to make air-tight the two joints between the latter and the pump and valve stem respectively, are always in good condition. If either of these seemingly small details is out of order it may be impossible to pump the tire hard enough; the bicycle being ridden, the tires may be nipped in many places between the rim and sharp edges on the road surface, and practically ruined.

Tires for Motor Cars.—In the cost of upkeep of a motor car the tires are the most expensive item. For a slow speed vehicle an ordinary steel tire, shrunken or hydraulically pressed on a wooden wheel, is cheap and durable. At higher speeds over uneven roads the rubber is less satisfactory; the wheel, forming with the tire one rigid body, receives violent accelerations vertically as well as laterally, and the tire is thenceforth useless for any further use. For passenger cars an elastic tire is a necessity. The solid rubber tire, not being able to puncture, is trustworthy if made of sufficient sectional area, but it is expensive and lacks the comfort and easy running of the pneumatic. The motor car pneumatic tire is made up of three layers of canvas. The Palmer cord tire is built up of two layers of cord (fig. 12) arranged spirally, each cord being composed of four strands of six threads. The cords are flattened
somewhat, their narrow surfaces being together at the tread of the tire, and their wide ones at the beaded edge. The anchorage of the cord to the beaded edge is obtained by steel pins passing through the fabric of the cord and into the canvas beads (fig. 13). The cords, tread and beads being all vulcanized together, the tire is practically impervious to moisture, and therefore less tendency to rot than a canvas tire. Further, the threads, by the process of manufacture, are insulated each from the other by a layer of rubber, and there is thus less tendency for them to fray or saw each other as the tire yields during contact.

These features of construction tend to greater durability.

**Pneumatic Tires for Heavy Loads.**—As each portion of the tread comes in contact with the ground it is flattened, while the rest of the transverse section has its radius of curvature slightly decreased (fig. 3). Thus the transverse section is repeatedly undergoing curvature through a range extending from flatness (radius of curvature infinity) to a radius of curvature slightly less than that of the normal section. On the longitudinal section the range of flexure is from flat to a radius of curvature equal to that of the normal section. The latter range is therefore much less than the former. The necessary thickness of the fabric and rubber to resist the air pressure and punctures involves a certain amount of stiffness; consequently the energy expended in the flexure of the tire is much greater than in a thin cycle tire. This energy appears as heat; the temperature of the cover rises until the heat carried away by the air is equal to that generated by flexure. At very high speeds this heating becomes so great as to have the injurious action on the rubber and fabric. Unfortunately, the solid rubber tire is worse off in this respect, its elastic hysteresis, and therefore the heating effect, being greater than that of a pneumatic tire. It is evident that increase of the diameter of the tire-section lessens the heating action, while reduction of diameter of the wheel has no effect, so long as the range of longitudinal flexure is less than the transverse. Nearly all tire fabrics are equally stiff longitudinally and transversely; but probably greater durability would be obtained from a fabric more flexible transversely, even if somewhat stiffer longitudinally.

**Non-Skid Devices.**—As a pneumatic tire flattens where it is in contact with the road, under certain conditions of road surface a semi-liquid film of mud gets interposed, and the frictional contact is reduced to a minimum. The vehicle has then no lateral constraint, and side-slipping or skidding may occur. On a bicycle this means a dismount, probably a severe fall; on a three or four-wheeled vehicle the steering control is temporarily lost. Cycle tires are usually provided with longitudinal ridges at the tread (figs. 8, 9, 11); the narrow surfaces of the ridges penetrate the mud and get a better grip on the solid road surface. Motor car tires are sometimes left with a smooth tread (fig. 14); fig. 13 shows a non-slippering tread with longitudinal ridges. The Dunlop non-slippering tread is formed by a series of lateral grooves about 2 in. apart all round the tire. Fig. 16 shows a tire fitted with a non-skid leather band, to which hard steel studs are fastened.

This type of non-skid band can be either vulcanized to the tire or independently fastened to the rim at the beaded edges. The Parnone "non-skid" device consists of a chain crossing the tire at right angles and fitting loosely over its surface; they are fastened at intervals to two chain rings one on each side of the wheel, and can be easily adapted to any tire.

**TIREH (anc. Tetra),** a town of Asia Minor, situated in the valley of the Kichik Menders (Casystrus) at the foot of Mt Messogis. It was the capital of the amirate of Aidin in the 14th century, and is described by Ibn Batuta as a fine city with streams and gardens. Pop. over 14,000, the latter half Moslems. It is connected with Smyrna by a branch of the Aidin railway, and has trade in raisins, wheat, rice, tobacco and cotton.

**TIRGOVISHTEA** (Rumanian Targoviste, or Târgovişte, sometimes incorrectly written Targoviste or Targoist), the capital of the department of Dimbovita, Rumania; situated at the foot of the Carpathians, on the right bank of the river Jalomiita, 48 m. N.N.W. of Bucharest. Pop. (1900), 3568. A branch line connects Targoviste with the main Walachian system, and is prolonged northwards into the hills, where there are rich deposits of petroleum, salt and lignite. Coal is also found but not worked. Apart from the splendid ruins of a 14th-century palace, the most interesting building in the town is the Metropolitan church, still one of the finest in the country, with its nine towers and monuments of the princely house of Cantacuzino. It was founded in 1515 by Neagoe Basarab, builder of the famous cathedral of Curtea de Argesh. Targoviste is a garrison town, with a cavalry training school and an artillery depot and repairing arsenal.
Under Mircea the Old (1383–1410) Targoviste was the third capital of Walachia. In the 15th century it was sacked by the Szeklers. Michael the Brave defeated the Turks under its walls in 1597. In the 16th century it had a population of 60,000 and contained 70 churches and 40 convents. After Constantine Brancovan moved the seat of government to Bucharest in 1608, Targoviste lost its importance and the population decreased.

TIRGU JIU (often incorrectly written TIRGJIU), the capital of the department of Gorj, Rumania; situated among the lower slopes of the Carpathians, on the left bank of the river Jiu, and at the terminus of a branch railway which joins the main Rumanian line between Turnu Severin and Craiova. Pop. (1900), 6,634. The town has a small trade in timber, petroleum and farm produce. Anthracite coal is found in the neighbourhood.

TIRGU OCNA (Rumanian also Targul Ocna), a town of Rumania, on the left bank of the river Trotosh, an affluent of the Sereth, and on a branch railway which crosses the Ghimesh Pass into Transylvania. Pop. (1900), 8,503. Tirgu Ocna is built among the Carpathian Mountains, on bare hills formed of rock salt. Outside the town stands the largest prison in Rumania, and in this are the mines, worked, since 1876, by convicts, who receive a small wage. The thickness of the salt is unknown; the mines yield about 11,000 tons annually.

TIRHUT, or TIRHOUT, the historic name of a tract in northern India, being that portion of Behar which lies north of the Ganges. It corresponds roughly with the ancient Hindu kingdom of Mitila (q.v.). Down to 1873 it formed a single district, which was then divided into the two districts of Darbhanga and Muzaffarpur. In 1908, when, the division of Patna was abandoned, the name of Tirhut was again officially given to a new division, containing the four districts of Darbhanga, Muzaffarpur, Saran and Champaran: total area, 12,588 sq. m.; total pop. (1901), 9,867,373. It is a continuous alluvial plain, traversed by many winding rivers, and it supports the densest population in all India. It is the main centre of the indigo industry, conducted by European planters, which is now in a declining condition. Other crops are rice, millets, wheat, maize, oilseeds, sugar-cane and tobacco. Apart from indigo there are no large industries. Since the famine of 1874 the whole country has been saved from its former isolation by the construction of the Bengal & North-Western railway, with numerous branches; but the Ganges is nowhere bridged.

TIRIDATES, or TIRIDATOS, a Persian name, given by Arrian in his Parthica (preserved by Photius, cod. 58, and Syncellus, p. 539 seq.) to the brother of Arsaces I., the founder of the Parthian kingdom, whom he is said to have succeeded. But Arrian’s account seems to be quite unhistorical (cf. PARTHIA).

The king commonly called Tiridates II. was set up by the Parthians against Phraates IV. in 32 B.C., but expelled when Phraates returned with the help of the Scythians (Dio Cass. li. 18; Justin xiii. 5 seq.; cf. Horace, Od. i. 26). Tiridates fled to Syria, where Augustus allowed him to stay, but refused to support him. During the next years Tiridates invaded Parthia again; some coins dated from March and May, 26 B.C., with the name of a king "Arsaces Philoromaios," belong to him; on the reverse they show the king seated on the throne, with Tyche stretching out a palm branch towards him. He was expelled again, and brought a son of Phraates into Spain to Augustus. Augustus gave the boy back to his father, but declined to surrender "the fugitive slave Tiridates" (Justin xiii. 5; Dio liii. 33; cf. Mom. Ancyr. 5, 54; in li. 18 Dio has wrongly placed the death of the son, 20 B.C).

Tiridates III., grandson of Phraates IV., lived as a hostage in Rome and was educated there. When the Parthians rebelled against Artabanus II. in a.d. 35 they applied for a king to Tiberius, who sent Tiridates. With the assistance of L. Vitellius Tiridates entered Seleucia, but could not maintain himself long (Tacitus, Ann. vi. 32 sqq.; Dio Cass. lixiv. 26).

The name Tiridates is also borne by some local kings of Persis, and by some Arsacid kings of Armenia and Georgia. The best known of the Armenian kings is the Tiridates (a.d. 238–314) who was baptized by Gregory the Illuminator (see ARMENIAN CHURCH).

TIRLEMONT (Flemish Thiienen), a town of Belgium in the province of Brabant, 11 m. S.E. of Louvain. Pop. (1904), 15,340. It still preserves its enceinte, 6 m. in circumference. The principal church, Notre Dame du Lac, begun in the 12th and enlarged in the 15th centuries, is still unfinished. The church of St Germain also dates from the 12th century, and contains a fine altar-piece by Wappers. John Boltand, the Jesuit who began the collection of the Acta sanctorum, was born here in 1596. The principal industries are brewing, soap manufacture and tanning.

TIRMIDHĪ [Abā Ṣāḥib Mohammed ibn Ṣāh ut-Tirmidhī] (d. 852), Arabian traditionalist, was born at Tirmidh in the Jihān. He was a scholar of the traditionalist Bukhārī, and in his search for traditions travelled through Khurasan, Irak and Hejaz. His al-Jāmi’ us-Saḥḥāḥ is one of the six canonical collections of traditions. In it he admitted every tradition that had ever been used to support a legal decision, indicating the doctrine it supported and mentioning the doctrines opposed to it. It was published at Bulaq in 1875. He also wrote the Kishād us-Samā‘, a study of the character and life of Mahommed (see Mahommed, N. 951, Calcutta, 1846). (G. W. T.)

TIROL (or Tyrol), the most southerly province of the Austrian Empire. It makes a great bend southwards towards Italy, by which it is bounded on the S.E., S. and S.W., while on the W. it adjoins part of present Switzerland (till 1652 the Lower Engadine was Tyrolean, and not Swiss) and also the Austrian province of Vorarlberg; to the N. it borders on Bavaria and to the E. the province of Upper Austria. It is traversed from west to east by the main chain of the Alps, which rises in many snow-covered summits; the most important being the Ortler (12,802 ft., the loftiest peak in Tirol and in the Eastern Alps generally), the Wildspitze (12,882 ft., Oetzthual group), the Zuckerhütt (11,550 ft., Stubai group), the Hochfeiler (11,550 ft., Zillerthual group), the Gross Venediger (12,000 ft.) and the Gross Glockner (12,461 ft., both in the Tauern range), while more to the south are the Dolomites, which culminate in the Marmolata (10,972 ft.). It is divided into two very distinct portions by the Brenner Pass (4495 ft.), connecting the Stubai and the Zillerthual groups; over this pass a splendid railway was built in 1864–1867 from Innsbruck to Tarvis on the Drave (east). The river is navigable from the earliest times been of immense importance from every point of view. The Brenner, too, being on the main watershed of the Alps, separates the two main river systems of which Tirol is composed. To the north this province comprises the middle portion of the Inn Valley, with its tributaries, as well as the upper portion of the Lech valley, all flowing towards the Danube and so to the Black Sea, while south of the pass is the great upper valley of the Adige or Etsch, with many tributaries, as well as since 1500 a portion of the upper Drave valley, which physically belongs to Carinthia—all these (save the Drave) flow to the Adriatic Sea. The area of Tyrol is 10,204 sq. m. In 1900 its population was 859,712 (but wholly Romanist), of whom more than half were German-speaking, and many in the south Italian-speaking, while in certain side valleys of the Adige system the quaint old Ladin dialect, still surviving also in the Swiss Engadine, is the prevailing tongue; in the southern half of the region there are a few German-speaking among the Italian-speaking folk. The capital is Innsbruck, while other important towns are Trent, Botzen and Rovereto.

The present very irregular shape of the district is due to historical causes. The eastern part represented part of the middle Inn valley and of the uppermost portion (the Vintschagau) of the Adige valley. In 1350, by inheritance from the counts of Götz, the Pusterthal and upper Drave valley (east) were added; in 1503 the lower portion of the Zillerthual, with the Inn (1) To speak, as is commonly done, of the "Tyrol" is as absurd as speaking of the "England." As regards the English spelling of the name adopted throughout the Ency. Brit., it should, however, be stated that the writer of this article regards "Tyrol" as more correct.—(Ed.)
TIROL

Valley from its entrance to Kufstein, and the Kitzbühel region (north-east) were all won from Bavaria; in 1517 Rovereto and several other places on the present south-eastern frontier were acquired from Venice; in 1803 many fiefs in the bishoprics of Trent and Trieste were lost to the French, here again, as in the case of the bishoprics; while finally the rest of the Zillerthal, with Windisch Matrei, was obtained in 1816 from the archbishopric of Salzburg. Besides the great railway line over the Brenner, there are other lines from Botzen past Meran to Mals, from Franzensfeste up the Pustertal to Lienz in the Drave valley, and from Innsbruck, by a tunnel beneath the Arlberg Pass to the Vorarlberg and the Rhine valley.

The majority of the population is devoted to pastoral, and in some cases to alpine, pursuits as a whole, as in the same lands, being the mainstay of the peasants. In summer they are driven up to the mountain pastures (called here Almen, but Alpen in Switzerland), which are, however, less carefully looked after than in Switzerland, partly because in many cases they have been alienated by the neighbouring hamlets to far distant places. Forestry also employs a certain proportion of the population, but the felling of trees is carried on wastefully, though less so than in former times. A few minerals are found in the district, but in this department the saltworks of Hall, near Innsbruck, take the first place. In southern Tirol, silk-spinning is still one of the principal industries, which is accompanied by the production of wine and tobacco. There are also some factories of preserved fruits and tobacco. But, save in the towns, Tirol is above all a pastoral land.

The peasants are famous for their devotion to the Roman Catholic religion, devotedness to their pastor, their duchy, their excellent marksmanship, and their love of singing and music, the zither being the national instrument. There is a university at Innsbruck, but primarily, and usually, to the ordinary peasant, knowledge not attainable at a high degree of excellence, as in summer the schools are closed, for all hands are then required in the fields or on the mountain pastures. The picturesque local costumes have nearly altogether disappeared, save in the Passeierthal, near Meran, while the increasing crowds of summer visitors have largely spoilt the simplicity of the natives. Ecclesiastically, Tirol is ruled by the archbishop of Salzburg and his two suffragans, the bishops of Trent and of Brixen. The country is divided into 21 administrative districts (Bezirke), each composed of a number of communes or civil parishes. Tirol sends 25 representatives to the Austrian parliament at Vienna. Locally it is ruled by an Imperial governor (the Statthalter) who resides at Innsbruck, where, too, meets annually the local legislature or Diet (the Landtag), composed (according to the constitution of 1861) of 68 members; the archbishop of Salzburg, the bishops of Trent and Brixen, and the rector of the university of Innsbruck sit in person, while the great ecclesiastical corporations send four deputies, the chambers of commerce of Innsbruck, Trent and Rovereto each one, the nobles ten, the towns 13, and the peasants 34.

History.—By far the greater portion of the region later called Tirol was inhabited, when it makes its appearance in history, by the Raetians (perhaps the Bagaudae, who were conquered by the Etruscans), who were conquered (14 B.C.) by Drusus and Tiberius, and were later organized into the Roman province of Raetia. In the 5th and following centuries the north portion was Teutonized, first by the Ostrogoths, mainly by the Baiouarii, but the Teutonic Langobardi who pressed up from the south became Romanized themselves, so that the double character of the inhabitants of the land appears quite early. In 774 the Carolingians conquered the Langobardi or Lombards, and in 788 the Baiouarii. But the officials charged with the rule of these parts gradually became Austrianized, and in 1667 Austria took over the region north of Trent. Some time after the break-up of that duchy in 976, the emperor Conrad II entrusted all temporal powers in the northern region to the bishop of Brixen, and in the southern portion to the bishop of Trent, detaching these southern districts from Italy (to which they had always belonged, save from 951 to 962, when the march of Verona was annexed to the duchy of Carninthia) and incorporating them with Germany. The bishops, in their turn, had to exercise their temporal rights through lay vassals, of whom the most powerful in the 12th century were the lords of Andechs, near Munich. On the extinction of this family in 1248, most of their fiefs were given by the two bishops to the father-in-law of the last lord of Andechs, Albert, count of Tirol. This new family took its name from the still existing castle of Tirol (later Roman, Teriolis), above Meran, in the upper Adige valley, and is mentioned for the first time in 1140. Albert's elder daughter, Adelaide, married Meinhard, count of Götz (north of Trieste); their elder son Meinhard (d. 1205) took Tirol, and the younger Götz; but in 1500 the latter's line became extinct, and the elder line thereby gained the possession of the duchy of Tyrol. Long before that time the senior branch of the elder line had ended in Margaret, nicknamed die Maultasche (the Pocket-mouth), who, in 1342, married Louis of Brandenburg (d. 1361), and whose only child Meinhard died in her lifetime in 1363; Tirol accordingly passed by agreement in the latter year of the junior branch of the elder line, the Habsburgs, dukes of Austria since 1282. In this way Tirol came to the dynasty which has ever since held it (save 1805–1814). From that time onwards till 1665 Tirol was generally entrusted to a cadet of the Austrian house, who ruled first at Meran, and then from 1674 to 1705 at Innsbruck, as a nearly independent principality, but since 1665 the province has been governed from Vienna. We have noted above the manner in which the limits of Tirol were gradually extended. Several of these additions were due to the archduke Maximilian, who ruled Tirol from 1490 onwards, becoming emperor in 1493 and dying in 1519. His memory is still cherished in the district, for he conferred on it the title of Gefürthte Grafenschaft, spent much time in it, and erected in the chief church of Innsbruck a sumptuous monument as his tomb.

As Tirol stands to its position astride of the Alps, and so commanding the road across them, Tirol has often been the scene of sharp fighting. In 1499 the Swiss won a victory in the Calven gorge (near the head of the Adige valley) against Maximilian, which resulted in the Swiss gaining their practical independence of the empire. In 1703 the Bavarians and French, during the War of the Spanish Succession, took Innsbruck, but were then driven back. In 1805, by the peace of Pressburg, Napoleon forced Austria to hand over Tirol to his ally, Bavaria, which held it till 1814. On the outbreak of war (1809) between France and Bavaria, the people, still adhering to the old faith, refused to acknowledge Hofer (b. 1757), a small innkeeper of the Passerental, and under him the peasants repeatedly defeated the Bavarian, French and Saxon troops. Three times (April 13, May 29 and Aug. 13) did they drive the foe out of Innsbruck. On the 15th of August, Hofer, yielding to the popular wish, assumed the government of Tirol. But in October the ill-success of the Austrians against the French elsewhere forced them to conclude the peace of Vienna, by which Tirol was definitely secured to Bavaria. The peasants refused to believe in the bad news, and continued to resist the French, but without success, though their leader was Andreas Hofer (b. 1757), a small innkeeper of the Passerental, and under him the peasants repeatedly defeated the Bavarian, French and Saxon troops. Here he was betrayed by a neighbour to the French (Jan. 27, 1810), who took him captive to Mantua, where, by express order of Napoleon, he was shot (Feb. 20, 1810) for the sole offence of being loyal to his emperor and his native land. His bones now lie in the great church at Innsbruck, side by side with those of his two chief supporters, the Capuchin friar and army chaplain, Joachim Haspinger (d. 1858), and the peasant, Joseph Speckbacher.

See in general vol. xii., Tirol (Vienna, 1863), of the great official work entitled Die österreichisch-ungarische Monarchie in Wort und Bild. The following more special works may be consulted: A. Achteliner and E. Ubl, Tirol und Vorarlberg (Leipzig, 1898); J. Alton, Die ladinischen Idiomen in Ladvinien, Gröden, Fassa, Buchenstein, Ampezzo (Innsbruck, 1879); F. Arens, Das tiroler Volk in seinen Weisthumern (Gotha, 1904); W. A. Baillie-Grohman, Tirol and the Tirolers (London, 1876), Gaedingen with a Primitve People (Leipzig, 1879); A. Berti, li Alpi (London, 1896); and The Land in the Mountains (1905); Miss H. R. Bush, The Valleys of Tirol (London, 1874); E. H. Compton and W. A. Baillie-Grohman, Tyrol and its People (London, 1880); J. D. Emmett, Tirol (London, 1887); J. Gilbert and G. C. Churchill, The Dolomites Mountains (London, 1864); Max Haushofer, Tirol (Bielefeld and Leipsic, 1890); J. Hinr, Tirols Erhebung im Jahre 1800 (Innsbruck, 1890); Altons Higher, Geschichte d. Vereinigung Tirols mit Oesterreich (2 vols., London, 1878); W. Richter, Die Alpen (London, 1874); A. Jaeger, Geschichte d. landständischen Verfassung von Tirol (3 vols., Innsbruck, 1881–1887); W. D. McCrackan, The Tyrol (London, 1905); L. Puntcheller and H. Hess, Der Hochalpinist in den Ostalpen, 3rd ed., vols. (Leipzig and Vienna, 1903); E. Richter
Die Erschliessung der Ostalpen (1 vols., Berlin, 1893-1894); A. Schaubach, Deutsche Alpen (2nd ed., 5 vols., Jena, 1865-1871); Chr. Schneller, Landeskunde von Tirol (Innsbruck, 1872); F. A. Sinnacher, Beiträge zur Geschichte der Bischöfe, Kirche, Sitten und Bräuchen (really a special territorial history of Tirol) (1883-1884); J. Staffler, Tirol und Vorarlberg, (2 vols., Innsbruck, 1839-1846); A. Steinitz, Geschichtliche und kulturgeschichtliche Würde des Landes, und seine Entwicklung (Innsbruck, 1887); Th. von Vernaklen, Alpenagen (largely Tirolese; Vienna, 1885); Beda Weber, Das Land Tirol (3 vols., Innsbruck, 1837-1838); Martin Winkens, Die Alpenwirtschaft der Schweiz, des Altvogels, und der westosterrreichischen Alpenländer (Vienna, 1874); I. V. Zingerle, Sagen, Märchen, und Gebräuche aus Tirol (Innsbruck, 1859); I. V. Zingerle and K. Th. von Inama-Sternegg, Die tirolischen Weihnamen (4 vols., Vienna, 1879-1888).

The pseudonym Tirso is that of the Spanish dramatist Pedro de Cervantes y Silva (1571-1648), Spanish dramatist. Born at Madrid in October 1571, he studied at the Alcáalá de Henares, joined the Order of Mercy on the 4th of November 1600, and made his religious profession in the Monastery of San Antolín at Guadalajara on the 21st of January 1601. He was a dramatist of ten years' standing when he was sent by his superiors on a mission to the West Indies in 1615; returning to Europe in 1617, he resided at the Mercenarian monastery in Madrid, took part in the proceedings of the Academia poética de Madrid, founded by Sancho de Molina Aldehues in 1614, and wrote no more tournements then in vogue, and wrote copiously for the stage. His first publication, the incomplete Cigarrales de Toledo (licensed in 1621, but apparently not published till 1624), is a miscellany, containing short tales, novels, verses and three plays; one of the novels, Los Tres maridos burlados, probably derived from Il Cioco da Ferrara's Mambriano, and the play entitled El Vergonzoso en palacio are admirable examples of witty contrivance. The preface to the Cigarrales de Toledo (the second part of which was never printed) states that Tirso de Molina had already written three hundred plays, and at this period of his career he was second only to his friend Love de Vega in popularity. He avowed himself hostile to culturismo in the Cigarrales de Toledo, and made numerous enemies by his attacks on the new school in such pieces as Amar por arte mayor and La Celosa de sí misma. The realistic character of some of his productions provided his unsuccessful rivals with an excuse for denouncing him as a corrupter of public morals to the council of Castile in 1625, and, though no legal action was taken against him, he appears to have been reprimanded privately. In 1626 it was deemed advisable to transfer him to Salamanca, and Tirso de Molina left Madrid determined to write no more for the stage. Though one of his plays, La Huerta de San Juan, is dated 1626, there is no proof that it was begun after his departure from Madrid, and it seems to have kept to his resolution for eight years. But he had not lost his interest in the theatre, and felt justified in publishing twelve representative pieces as the first part of his dramatic works (1626). This may be taken as a formal protest against the weakness of those who had sacrificed him to hypocritical clamour. In other respects he was submissive, and worked zealously on behalf of his order in which he rose to important positions; he became superior of the monastery at Trajillo in 1626, was elected later to the posts of reader in theology and defensor general, and in May 1632 was appointed chronicler of the Order of Mercy. His Deleitar aprovechado (1635) is a devout counterpart of the Cigarrales de Toledo, much inferior to its predecessor in interest; a sequel was promised to this collection of pious tales, pious lyrics, and autos, but, as in the case of the Cigarrales de Toledo, the continuation never appeared. Twelve plays constitute the third part of his dramatic works which was published (before the second) in 1634 under the nominal editorship of the writer's nephew Francisco Lucas de Ávila, but the existence of this nephew is doubtful. The second part (1635), the printing of which was paid for by the confraternity of St Jerome, contains four plays by Tirso de Molina, and eight written by him in collaboration with other dramatists; one of these collaborators was Ruiz de Alarcon (q.v.), but the internal evidence goes to show that Tirso de Molina was the predominant spirit in these literary partnerships. The fourth part of Tirso's dramatic works (1635) and the fifth (1636) each contain twelve plays; the haste with which these five volumes were issued indicates the natural desire of a great author to save some part of his work from destruction. It is the appearance of a supposititious nephew's name on the title-pages of the last four volumes indicates the equally natural desire of a prominent monk to avoid conflict with the authorities. A sixth volume of dramatic pieces, consisting of light comedies, was announced; but the project was abandoned. That dramatic composition still entertained the scanty leisure of Tirso's old age is shown by the fact that the fragmentary autograph copy of Las Quinas de Portugal is dated the 8th of March 1638; but his active career as a dramatist ended two years earlier. He was probably the last of the dramatists of this so-called classical age, for in 1639 he compiled the elaborate Historia de la merced, which occupied him till the 24th of December 1639, and still survives in manuscript. As a tribute to the count of Sástago, who had accepted the dedication of the fourth part of the plays, and who had probably helped to defray the publishing expenses, Tirso de Molina is said to have compiled the Genealogia de la casa de Sástago (1640), but the ascription of this genealogical work is disputed. On the 29th of September 1645 Tirso de Molina became superior of the monastery at Soria, and died there on the 12th of October 1648.

It is only within the last few years that it has become possible to give an outline of his life; it will always be impossible for posterity to do justice to his genius, for but a fraction of his plays have been preserved. The earliest of his extant pieces is dated 1605 and bears no sign of immaturity; in 1624 he had written three hundred plays, and in 1634 he stated that he had composed four hundred within the previous twenty years; of this immense production not more than eighty plays are in existence. Tirso de Molina is universally known as the author of El Burlador de Sevilla y convidado de pie (1627), an extant and fragmentary piece, in which Don Juan is first presented on the stage; but El Burlador de Sevilla represents only one aspect of his genius. No less remarkable than his representation of perversive depravity in El Burlador de Sevilla is his dramatic treatment of a philosophical enigma in El Condenado por desconfiado. Though manifestly attracted by exceptional cases, by every kind of moral aberration, by the infamous and the terrible, his range is virtually unlimited. He reveals himself as a master of historical interpretation in La Prudencia de la mujer and of tragic paths in La Venganza de Tamar; his sympathies incline more towards the feminine in El Condenado por desconfiado, and the story is based on the most famous Spanish love affair, with the exultant clef of El Aficionado en palacio and Don Gil de las calzas verdes, and the fine divination of feminine character in Avergutelo Vargas and La Villana de Vallecas is incomparable. Tirso de Molina has neither Lope de Vega's inventive resource, nor his infinite seduction; he has neither Calderón's idealistic visions, nor his golden music; but he exceeds Lope in massive intellectual power and in artistic self-restraint, and he exceeds Calderón in humour, in creative faculty, and in dramatic intuition. That his reputation extended beyond the Pyrenees in his own lifetime may be gathered from the fact that J. Shirley's Opportunity is derived from El Castigo del pensador; but he was neglected in Spain itself during the long period of Calderón's supremacy, and his name was almost forgotten till the end of the 18th century, when some of his pieces were timidly recast by Dionisio Solá and later by Juan Carretero. The renaissance of his fame, however, dates from 1839-1842, when an incomplete but serviceable edition of his plays was published by Hartzenbusch; and he is now accepted as among the greatest dramatists of Spain.

TIRUPATI, or Tripetty, a town of British India, in the North Arcot district of Madras, with a station on the Madras railway, 84 m. N.E. of Madras city. Pop. (1901), 15,485. It is famous for a temple on the neighbouring hill of Tirumala, 2,500 ft. above the sea, which is one of the most frequented places of pilgrimage in southern India. The town contains numerous temples connected with the shrine of Tirumala, and is noted for its brass-work and wood-carving.

TIRYNOS, the Τίρυνος τευκριδεσος of Homer (II. ii. 550), a small Peloponnesian city, in the prehistoric period of the Achaean race, long before the Dorian immigration. It stood on a small rock in the marshy plain of Argolis, about 3 m. from the sea, and was fabled to have been founded by King Proetus, the brother of Acrisius, who was succeeded by the hero Perseus. It was the scene of the early life of Hercules, who is hence called Tirynthius. The massive walls, which appear to be of earlier type than those of Mycenae, were said to have been the work of Cyclopean masons. Its period of greatest splendour was probably between the 14th and 12th centuries B.C., in Homeric and subsequent times it was usually subject to Argos. The temple existed at the time of the Dorian conquest. After the Spartan defeat of Argos in 404 B.C., Tiryns regained temporary independence, and the Tirynthians fought on the Greek side at Plataea, while the Argives held aloof. Soon after, in 468 B.C., Tiryns was finally destroyed through the jealousy of the Argives, and the site has been deserted ever since, but for a brief occupation in Byzantine times.

Excavations made in 1884-1885 by Schliemann and Dörpfeld over the rock on which Tiryns stood have exposed one of the most interesting buildings, which offers the most complete example of a palace of the Mycenean age in Greece. The rock on which Tiryns is built is of an irregular oval shape, about 330 yds. long by 112 at the widest part, and is surrounded by a very massive wall, varying from 30 to 40 ft. in thickness and averaging when complete about 50 ft. in height, measuring from its base outside. Inside, the wall was never built; nor was it not more than 10 or 12 ft. high above the ground, so the masonry acts as a retaining wall to a considerable depth of earth which covers the rock (see fig. 2 below). The wall is built of very large hammer-dressed blocks, some as much as 10 ft. long by 3 ft. 3 in. wide, which were smaller ones to fill up the interstices. The whole was bedded, not in mortar, but in clay, which has mostly been washed out of the joints; originally the surface was probably protected with a coating of stucco. The only important gateway, which was on the east side, away from the sea, probably resembled the "lion gate" at Mycenae. The other entrances are mere slits in the wall. One of these and the chief gate are shown in fig. 1. Internally the area of the city was divided by cross walls into three parts at successive levels. The lowest and middle divisions have not yet been excavated; the upper part at the south end of the rock was completely exposed in 1884-1885 by Schliemann and Dörpfeld, and the almost complete plan of the various structures clearly made out. This division contains the palace of the ruler of Tiryns, a building which shows careful and skilful construction, elaborate decoration, and a well-arranged plan, suitable to the wants of a wealthy autocratic chief, who lived in a manner which partly recalls the luxury of an Oriental king, and also resembled the feudal state of a medieval baron, surrounded by a crowd of vassals. From the main gate, which was defended by a tower, a strong passage led between the outer wall and an inner one to an inner gate, thence to a propylaeum or double porch, with two wooden columns on each side, adjoining which were chambers for guards. Then came another similar but smaller propylaeum, and opposite to that was the entrance to the great court (ἀθέα), nearly 53 by 70 ft., in which stands an altar or pit of sacrifice, in a position similar to that occupied by the altar of Zeus Hercius in the later Greek house. This court was surrounded by wooden columns supporting a roof, like a medieval cloister; on the south side are chambers for attendants (θήλαμα). On the north side is the great hall (μεγαρόν), with an outer portico supported by two columns (ἀθέα) and an inner vestibule (εὔθεα) with three doors. The hall is about 40 by 30 ft., with a circular hearth in the centre (τίριλις or κρήπον). Four columns supported the roof, the central part of which probably rose above the rest like a medieval "lantern." On the west side of the hall are a

A. Inner base of wall.
B. Inside level of city.
C. Chambers in the thickness of the wall opening out of the gallery.
D. Gallery, with roof formed of projecting courses of stone in blocks.
E. Top of main wall, paved with clay, supported by the inside.
F. Wooden columns on existing stone bases, forming a portico or bowered walk along the top of the wall.
G. Outer wall of the colonnade built of large, new masonry, of an older design.
H. Probable roof of the colonnade of wood, covered with beaten clay.

Fig. 1.—Plan of the Palace in the Upper Part of Tiryns.

1. Main gate in the outer wall.
2. Inner gate, approached between massive walls.
3. Main propylaeum.
4. Inner propylaeum.
5. Court (αὖδα) surrounded by a colonnade on three sides: the altar to Zeus Hecucus is by the entrance.
6. Αἰθέα, portico of the megaron.
7. Πρόθεα, inner porch.
8. Megaron, with roof supported on four columns, and the circular hearth in the middle.
10, 10. Chambers round the great court.
11. 11. Guard chambers by the main propylaeum.
12. Passage (λαδύ) from the main propylaeum to the second house.
15. Chambers (θήλαμα).
16. Passage to the rock-cut stairs.
17. Small postern door in the semicircular bastion, approached by flight of rock-cut steps.
18, 18. Massive outer wall of city.
19. Inner wall to guard the entrance passage.
20. Part of outer wall, with intermediate passage and rows of chambers, as shown in fig. 2.
upper floor. The circuit wall round the palace is more strongly constructed than the rest. On the south is a gallery built in the thickness of the wall, and roofed by projecting courses of stone; and chambers or storehouses open out of this gallery. The wall on the south side of the building (see fig.) at the top level was covered by a colonnade of wooden pillars resting on circular stone blocks. This supported a flat roof and constituted the parapet of the palace. The colonnade was built of brick, and is now missing, as are all the brick parts of the palace, owing to the bricks having been only sun-dried.

The methods of construction employed in the Tiryns palace are of the highest interest. The foundations and about 3 ft. of the walls above the ground are made of large blocks of stone bedded in clay; above this the wall was of brick, sun-dried, and covered with stucco. The walls were protected by a glacis, or sloping parapet. The thresholds of the doors were massive blocks of stone (Δαίμων οίδεα); others were of wood (δρυῖον οίδεα). Wood was also used for all the columns, doorposts, and stumps (στυλάδες), and in some cases the walls of the rooms were lined with wood, carefully fixed by dowels, the holes for which still exist. The doors had pivots of bronze revolving in well-fitted bronze cup-like sockets let into the thickness of the wall. In the megaron and other rooms the floors are of good concrete decorated with a simple series of incised lines, coloured red and blue. The stucco of the internal wall is decorated with bold and very effective patterns—birds and scrollos and other decorative designs. The best preserved paintings show a scene from a bull-fight. Both subjects and style show close analogy to the paintings in the palace at Crossus in Crete. One example of rich and costly decoration is the representation of a female figure, seated in a chariot, in relief with rosettes and interfacing patterns, and studded with jewel-like pieces of blue glass or enamel, the θηρίδων κόλποι of Od. viii. 87. Further excavations in the lower parts of the city will probably bring to light other well-preserved dwelling houses of the palace. The great bulk of the Tirynthians must have lived in houses outside the citadel, but under the shelter of its protection, just as in medieval Italy villages grew up round the castles of any powerful lord. The relation of the palace at Tiryns to those described in the Homeric poems has given rise to much discussion. The case is somewhat altered by the discovery of other high parts of Tiryns, behind that at Mycenae, but not at Mycenae, and where in Greece; these do not, for example, show the duplication of the essential parts of the house found at Tiryns. It is now generally recognized that, while the general character of the palace at Tiryns is the same as that of other palaces described by the Homeric poet, it is a mistake to appeal to it for the explanation of details of arrangement such as probably varied considerably according to the conditions and requirements in different cases.


Tischendorf, Lobegott Friedrich Konstantin Von (1815-1874). German biblical critic, the son of a physician, was born on the 18th of January 1815 at Lengenfeld, near Plauen, in the Saxon Vogtland. From the gymnasia at Plauen he passed in 1834 to the university of Leipzig, where he was mainly influenced by J. G. B. Winer (1789-1858), and began to take special interest in New Testament criticism. In 1838 he took the degree of doctor of philosophy, and then became master at a school near Leipzig. After a journey through southern Germany and Switzerland, and a visit to Strassburg, he returned to Leipzig, and set to work upon a critical study of the New Testament text, following the guidance of Karl Lachmann. In 1840 he qualified as university lecturer in theology with a dissertation on the recensions of the New Testament text, the main part of which appeared in the following year in the prolegomena to his first edition of the New Testament. These early textual studies convinced him of the absolute necessity of new and exacter collations of MSS. From October 1840 till January 1843 he was in Paris, busy with the treasures of the great library, seeking his materials by making collations for other scholars, and producing for them his Tischendorf's Ephemerides of the Greek New Testament, one of them exhibiting the form of the text corresponding most closely to the Vulgate. The great triumph of these laborious months was the decipherment of the palimpsest Codex Ephraemi Syri Rescriptus, of which the New Testament part was printed before he left Paris and the Old Testament in 1845. His success in dealing with a MS. much of which, owing to the fact that it had been rewritten with the works of Euphemius Syrus, had been illegible to earlier collators, brought him into note and gained support for more extended critical examination of the text. Paris, he had paid short visits to Holland (1841) and England (1842). In 1843 he visited Italy, and after a stay of thirteen months went on to Egypt, Sinai, Palestine and the Levant, returning by Vienna and Munich. From Sinai he brought a great treasure, forty-three leaves of what is now known as the Codex Sinaiticus. He kept the place of discovery a secret, and the fragments were published in 1846 as the Codex Frederico-Augustinus, a name given in honour of the king of Saxony. He now became professor extraordinarius in Leipzig, and married (1845). In the same year, with his own fees, he published his first edition of the four gospels (2 vols. 1845-1846). In 1850 appeared his edition of the Codex Amiatinus and of the Septuagint version of the Old Testament (7th ed., 1857); in 1852, amongst other works, his edition of the Codex Claromontanus. In 1853 and 1859 he made a second and a third voyage to the East. In the last of these, in which he had the active aid of the Russian government, he at length got access to the remainder of the precious Sinaitic codex, and persuaded the monks to present it to the tsar, at whose cost it was published in 1862 (in four folio volumes). After a visit to Athens, he returned to Leipzig, where Tischendorf as a Russian noble. Meanwhile, in 1859, he had been made professor extraordinarius of theology and of biblical palaeography, this latter professorship being specially created for him; and another book of travel, Aus dem heiligen Lande, appeared in 1862. Tischendorf's Eastern journeys were rich enough in other discoveries to deserve the highest praise. Side by side with his industry in collecting and collating MSS., Tischendorf pursued a constant course of editorial labours, mainly on the New Testament, until he was broken down by overwork in 1873. He died on the 7th of December 1874 at Leipzig.

The great edition, of which the text and apparatus appeared in 1869 and 1872, was called by himself edition viii., but this number is usually extended if not exaggerated; in fact, and had been extended by the editor had also the advantage of using the published labours of S. P. Tregelles. No one is more important was Tischendorf's work on the Greek Old Testament. His edition of the Roman text, with the variants of the Alexandrian MS., the Codex Ephraemi and the Frederico-Augustinus, was of service when it appeared in 1850, but, being stereotyped, was not greatly improved in subsequent issues. Its imperfections, even within the limited field it covers, may be judged by the aid of C. E. Nestle's appendix to the 6th issue (1880). Besides this may be mentioned editions of the New Testament Apocrypha [De Evangelis pace apocrpyphae origine et usu (1851); Acta Apostolicae apoecrpyphae (1853); Evangelia apocrypha (1853 ed., 1876); Apocryphae apocryphae (1866)] and various minor parts of the New Testament, and apocryphal characters, such as Wann waren unsere Evangelien verfasst ? (1855; 4th ed., 1866), Haben wir den echten Schrifttext der Evangelisten und Apostel ? (1873), and Synopsis evangelica (7th ed., 1868).

See also Tischendorf's handbooks on New Testament criticism, Carl Bertheau's article on Tischendorf in Herzog-Hauck, Realencyklopadie (3rd ed., 1907).

Tisio or Tisi, Benvenuto (1481-1559), commonly called Il Garofalo, Italian painter of the Ferrarese school, was born in

1 See his Reise in den Orient (Leipzig, 1845-1846).

2 The MSS., brought to Europe on the first two journeys are catalogued in the Anecdota sacra et profana (Leipzig, 1855, enlarged in 1861). See also the Monumenta sacra et profana (2 vols. 1845, 1846), and Nova collectio of the same (1855-1869). The preface of the last volume of the New collective gives the results of his last Eastern journey.

3 The prolegomena remained unfinished at his death, and have been supplied by C. G. Gregory (cf. his Textkritik des Neuen Testaments, vol. i., 1900).
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1481 at Garofolo, in the Ferrarese territory, and constantly used the gillyflower (garofalo) as a symbol with which to sign his pictures. He took to drawing in childhood, and was put to study under Domenico Panetti (or Laneto), and afterwards at Cremona under his maternal uncle Niccolò Soriani, a painter who died in 1528, left him to the care of his brother Boccaccino. He stayed fifteen months with Giovanni Baldini in Rome, acquiring a solid style of draughtsmanship, and was two years with Lorenzo Costa at Mantua. He then entered the service of the marquis Francesco Gonzaga. Afterwards he went to Ferrara, and worked there four years. Attracted by Raphael’s fame, and invited by a Ferrarese gentleman, Geronimo Sauro, he again removed to Rome, and found the great painter very amicable; here he stayed two years, rendering some assistance in the Vatican frescoes. From Rome family affairs recalled him to Ferrara; there Duke Alfonso I. commissioned him to execute paintings, along with the Dossi, in the Villa di Belriguardo and in other palaces. Thus the style of Tisio partakes of the Lombard, the Roman and the Venetian modes. He painted extensively in Ferrara, both in oil and in fresco, two of his principal works being the “Massacre of the Innocents” (1519), in the church of S. Francesco, and the “Betrayal of Christ” (1524), accounted his masterpiece. For the former he made clay models for study and a lay figure, and executed everything from nature. He continued, according to De’ Rossi, to frequent meetings of artists, painting on all feast-days in monasteries for the love of God. He had married at the age of forty-eight, and died at Ferrara on the 6th (or 16th) of September 1559, leaving two children.

Garofalo combined sacred inventions with some very familiar details. A certain archaism of style, with a strong glow of colour, sufficed to distinguish from the true Raphael even those pictures in which he most closely resembles the great master—this sometimes very closely; but the work of Garofalo is seldom free from a certain trim pettiness of feeling and manner. He was a friend of Giacinto Brandi, Giorgio Tiarriti and Arcisio; in a picture of “Paradise” he painted Aristoco between St Catherine and St Sebastian. In youth he was fond of lute-playing and also of fencing. He ranks among the best of the Ferrarese painters; his leading pupil was Girolomo Carpi. The “Adoration of the Magi,” in the church of San Giorgio near Ferrara, and a “Peter Martyr,” in the Dominican church, Ferrara (sometimes assumed to have been done in rivalry of Tician), are among his principal works not already mentioned. The National Gallery, London, contains four, one of them being a Madonna and Christ enthroned, with St Francis and three other saints.

TISSAPHERNES (Pers. Çihrâfarname), Persian soldier and statesman, son of Hydarnes. In 413 he was satrap of Lydia and Caria, and commander-in-chief of the Persian forces against Asia Minor (413-406). When Darius II. ordered the collection of the outstanding tribute of the Greek cities, he entered into an alliance with Sparta against Athens, which in 412 led to the conquest of the greatest part of Ionia. But Tissaphernes was unwilling to take action and tried to achieve his aim by astute and often perfidious negotiations; Alcibiades persuaded him that Persia’s best policy was to keep the balance between Athens and Sparta, and rivalry with his neighbour Pharnabazus of Hellepontic Phrygia still further lessened his energy. When, therefore, in 408 the king decided to support Sparta against Tissaphernes was removed from the generalship, and limited to the satrapy of Caria, whereas Lydia and the conduct of the war were entrusted to Cyrus the Younger. On the downfall of Athens, Cyrus and Tissaphernes both claimed jurisdiction over the Ionian cities, most of which acknowledged Cyrus as their ruler; but Tissaphernes took possession of Miletus, where he was attacked by Cyrus, who gathered an army under this pretence with the purpose of using it against his brother Artaxerxes II. The king was warned by Tissaphernes, who took part in the battle of Cunaxa, and afterwards tried to destroy the Greek mercenaries of Cyrus by the same method of Raphides. He was then sent back to Lydia and Caria, which he managed to keep in his possession as general in chief and satrap of Lydia and Caria. He now attacked the Greek cities, to punish them for their allegiance to Cyrus. This led to the war with Sparta in 399. Tissaphernes, who once again had recourse to subtle diplomacy, was beaten by Agesilaus on the Pactolus near Sardis (193); and at last the king yielded to the representations of Pharnabazus, strongly supported by the chiliburn (vizier) Tithraustes and by the queen-mother Parysatis, who hated Tissaphernes on the principal cause of the death of her favourite son Cyrus. Tithraustes was sent to execute Tissaphernes, who was lured to Colossae and slain in 395.

(Ed. M.)

TISSERAND, FRANÇOIS FÉLIX (1845-1896), French astronomer, was born at Nuits-Saint-Georges, Côte-d’Or, on the 13th of January 1845. In 1863 he entered the École Normale Supérieure, and on leaving went for a month as professor at the lycée at Metz. Le Verrier offered him a post in the Paris Observatory, which he accordingly entered as astronome adjoint in September 1866. In 1869 he took his doctor’s degree with a brilliant thesis on Delaunay’s Method, which he showed to be of much wider scope than had been contemplated by its inventor. Shortly afterwards he went out to Malacca to observe the famous solar eclipse of the 38th of August 1868. In 1873 he was appointed director of the observatory at Toulouse, whence he published his Recueil d’exercices sur le calcul infinitésimal, and in 1874 became corresponding member of the Académie des Sciences. He took part in the French expeditions of 1874 to Japan, and in 1882 to Martinique to observe the transit of Venus. In 1876 he was elected a member of the Académie des Sciences, and in 1883 he was one of the number of assistants of the Bureau of the Longitudes. In the same year he was appointed professeur suppléant to Liouville, and in 1883 he succeeded Puiseux in the chair of celestial mechanics at the Sorbonne. Tisserand always found time to continue his important researches in mathematical astronomy, and the pages of the Comptes rendus bear witness to his surprising activity. His writings relate to almost every branch of celestial mechanics, and are always distinguished by rigour and simplicity in the solution of the most difficult problems. He treated in a masterly manner (Breviario di Astronomia, 1882) the problem of Jupiter’s satellites and the disturbances of the outer planets, and was, by the larger planets, and in this connexion published his valuable Critérion for establishing the identity of a periodic comet, whatever may have been the perturbations brought about in its orbit, between successive appearances, by the action of a planet. His principal work, Traité de mécanique céleste, is the noblest and most lasting monument to his memory, and is worthy to stand beside the Mécanique céleste of his fellow-countryman, Laplace. In this treatise, published in four quarto volumes, the last of which appeared only a few months before his death, he fused into one harmonious whole the works of Laplace and those of other workers in the same field since his time. It furnishes a faithful and complete résumé of the state of knowledge in that department of astronomy at the end, as Laplace’s great work did for the beginning, of the 19th century. In 1892 he succeeded Mouchet as director of the Paris Observatory, and was president of the committee of the photographic chart of the heavens he contributed largely to the success of that great project. Under his direction the revision of Lalande’s catalogue was brought to a completion, and four volumes of the Annales de l’Observatoire de Paris were prepared; two others were projected. He was also editor of the Bulletin astronomique from the beginning, and contributed many important articles to its pages. He died suddenly, in the fullness of his power, of congestion of the brain, on the 20th of October 1896.

(A. A. R.)

TISSOT, JAMES JOSEPH JACQUES (1836-1902), French painter, was born at Nantes on the 15th of October 1836. He studied at the École des Beaux Arts in Paris under Ingres, Flandrin and Lamothe, and exhibited in the Salon for the first time at the age of twenty-three. In 1861 he showed "The Meeting of Faust and Marguerite,,” which was purchased by the state for the Luxembourg Gallery. His first characteristic period made him a painter of the charms of women. Demimonde would be more accurate as a description of the series of studies which he called La Femme à Paris. He fought
in the Franco-German War, and, falling under suspicion as a Communist, left Paris for London. Here he studied etching with Sir Seymour Haden, drew caricatures for Vanity Fair, and painted portraits as well as genre subjects. It was many years before he turned to the chief labour of his career—the production of a series of 700 water-colour drawings to illustrate the life of Christ and the Old Testament. Some sudden shock or bereavement was said to have turned his thoughts from ideals of the café and the boulevard into a more serious channel. He disappeared from Paris, where he had still more after studying at the École des Beaux-Arts, and went to Palestine. In 1895 the series of 350 drawings of incidents in the life of Christ was exhibited in Paris, and the following year found them on show in London. They were then published by the firm of Lemercier in Paris, where he had paid him 1,000,000 francs for them. After this he turned to the scenes of the Old Testament, upon which he was still engaged at the abbey of Buillon, in the department of Doubs, France, where he died on the 8th of August 1902. The merits of Tissot's Bible illustrations lay rather in the care with which he studied the details of scenery than in any quality of religious emotion. He seemed to aim at all, at accuracy, and, in his figures, at a vivid realism, which was far removed from the conventional treatment of sacred types.

TISZOT, PIERRE FRANÇOIS (1768–1854), French man of letters, was born at Versailles on the 10th of March 1768. His father, a native of Savoy, was a perfumer appointed by royal warrant to the court. At the age of eighteen he entered the office of a procureur of the Châtelle, in order to learn the practice of the law; but he cultivated the Muses rather than the study of procedure, and, being a handsome youth, was occasionally invited to the fêtes of the Trianon. He devoted himself ardently to the cause of the Revolution, in spite of the fact that it had ruined his family. While with the procureur he had made the acquaintance of Alexandre Goujon, and they soon became inseparable; he married Goujon's sister, Sophie (March 5, 1793), and when his brother-in-law was elected deputy to the Convention and sent on a mission to the armies of the Moselle and Rhine, Tissot went with him as his secretary; he then returned to Paris and resumed his more modest position of secrétaire général des substances. On the 1st of Prairial he tried in vain to save his brother-in-law, who had been involved in the proscription. He set out to Salvagny, all he could do was to draw Goujon the knife with which he killed himself in order to escape the guillotine, and he afterwards avenged his memory in the Souvenirs de Prairial. He also took under his care Goujon's widow and children. His connexion with the Jacobin party caused him to be condemned to deportation after the attempt of the 3rd Nivose in the year IX., but Bonaparte, having been persuaded to read his translation of the Bucoliques, struck his name off the list. Though still a friend of the Republic, Tissot was henceforth an admirer of the First Consul; he celebrated in verse several of the emperor's victories, and the arrival in France of Marie-Louise (1810). So far he had lived on the income derived from a factory of horn lanterns in the Faubourg St Antoine; and, being at last in fairly comfortable circumstances he now devoted himself to literature. The abbé Dellile took him as his assistant at the Collège de France; and Tissot succeeded him as head of it (1813); the emperor signed the appointment as a reward for a poem composed by Tissot on his victory at Lützen. He was removed from this post, however, in 1821, in consequence of the publication of a Préci sur les guerres de la révolution, in which rather colourless work he had dared to say that the Convention had saved France and vanquished the Coalition. Deprived of his post, he was left free to attack the government in the press. He was one of the founders of the newspaper Le Constitutionnel, and of the review, the Minerve. Without laying stress on his literary works (Traité de la poésie latine, 1821; translation of the Bucoliques, 3rd ed., 1833; Études sur Virgile, 1825) we should mention the Mémoires historiques et militaires sur Carnot, which he based on the papers left by the “Organizer of Victory” (1824), the Discours du Général Foy (1826) and a Histoire de la guerre de la Péninsule also inspired by Général Foy (1827). On the overthrow of Charles X., Tissot made a successful effort to regain his position at the Collège de France; he was also elected as a member of the French Academy on the death of Dacier (1833). It was then that he published his chief works: Histoire de Napoléon (2 vols., 1833), and Histoire complète de la révolution française de 1789 à 1806 (6 vols., 1833–1836), full of inconsistencies and omissions, but containing a number of the author's reminiscences; in some places they become practically memoirs, and are consequently of real value. In 1840 a carriage accident almost cost him his sight; he had to find a new occupation, and passed the last years of his life in circumstances of increasing suffering, amid which, however, he preserved his cheerfulness and goodness of heart. He died at Paris on the 7th of April 1854.

See an excellent essay on Tissot by P. Fromageot in the Revue de Versailles et de Soissons, in 1901.

Tissot, P. F.—TISZA

TISZUB (Fr. tissu, tissue, participe of tisser, Lat. texere, to weave), properly the name of a fine textile fabric interwoven with gold and silver threads, hence used of any delicate or gauzy fabric (see Gold and Silver Thread). It was also early applied, as in French, to a ribbon, fillet or various forms of woven ligaments. In biology the word is of general use for an aggregate of cells forming a texture or fabric; in animal anatomy it is thus applied to the primary layers of which the parts are composed, and named by some qualifying word denoting its substance or its use (see Connective Tissue and Epithelial, Endothelial and Glandular Tissue).

TISTA, a river of northern India, which rises on the edge of the Tibetan plateau, and flows through the mountain gorges of Sikkim and Darjeeling, till it spills itself over the plain of Eastern Bengal. In the 18th century its course was due south to join the Ganges; but in 1787 great floods diverted the stream towards the south-east, and it now enters the Brahmaputra, the whole district of Rangpur being scored by various interlacing channels. Its total length in British territory is about 170 m.
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royal decree (Dec. 10, 1855), Tisza once more represented Debreczen and formed, with Kálmán Ghyczy (1808–1888), the Left-centre party. From 1867 onwards his influence continued to increase, to the rupture of his party, which he reconstructed at the conference of Nagyvárad (March 17, 1868), when the famous Bikari pontok, or articles of Bikar, were subscribed. The Bikari pontok started from the assumption that Hungary was a free and independent state. They bound the party to repeal all laws or instalments contrary to, and to promote all measures necessary for, the national independence. Thus the delegation system and the common ministries were marked out for attack, while every effort was to be made to procure for Hungary a separate army, a separate diplomacy and a separate financial system. It was chiefly owing to the efforts of Tisza and his party that Austria remained neutral during the Franco-German War. His speech on the 3rd of March 1875 led to the resignation of Istvan Bittó's administration and the welding of Déké's followers and the Left-centre into a new party, the Szabadlevéért or Free Principles Party, which took office under Bela Wenckheim (1811–1879), whom (Oct. 2) Tisza succeeded as prime minister, a post he held, with a few interruptions, for the next fifteen years (1875–1890). In 1877 he resigned on the discussion of the question of the Composition (Ausgleich), but he returned to office on his own terms. The same thing happened the following year, when his brief resignation compelled the Magyar Diet to agree to the occupation of Bosnia. In 1879 he materially contributed to the formation of the Austro-German alliance. Not till 1888, when the national army bill was introduced, did he encounter any serious opposition, but all laws or instalments contrary to, and to promote all measures necessary for, the national independence. On the 13th of March 1890, on the occasion of the revision of the Indigenat Act, he resigned office, but continued, as deputy for Nagyvárad to place his vast political experience at the disposal of the house. It is no exaggeration to say that Hungary owes to Kálmán Tisza a consolidated government, the formation of a parliamentary majority, a healthy public spirit, public credit, the reform of the Upper House, an admirable educational system, economical, and particularly railway, development, and administrative and judicial reconstruction on modern lines. His opponents have accused him of unscrupulous lowness and party spirit, but not one of them can deny that he reshaped Hungary and made her the leading partner of the dual monarchy. As to his personal integrity and disinterestedness there has never been the slightest doubt. It is an open secret that, on the retirement of Andrassy, he was offered the chancellorship. He refused it because, to use his own expression, "I am as wholly and solely Hungarian as the river (Theiss, Hung. Tisza) whose name I bear."

See Inre Visi, Kálmán Tisza, a political appreciation (Hung.: Budapest, 1885); Kornél Abrányi, Kálmán Tisza Life and Political Career (Hung.; Budapest, 1876); G. Gratz, Kálmán Tisza (Modern Magyar Statesmen, 1) (Hung.; Budapest, 1902); P. Busbach, The Last Five Years (Hung.; Budapest, 1895).

His youngest son, Count Stephen Tisza (1861–), was born on the 22nd of April 1861. After being educated at Berlin, Heidelberg and Budapest, he entered the ministry of the interior for the purpose of studying technical and economical questions at the fountain-head, and soon became a specialist in agrarian matters. His Magyar agrárpolitik (Budapest, 1897), authoritative on its subject, was translated into German the same year (Leipzig). In 1886 Tisza began his parliamentary career, speedily becoming a large member of the principal committees and of economical and educational questions. On the resignation of Kálmán Szell (June 17, 1903) he was entrusted with the formation of a ministry of pacification, but abandoned the attempt on finding it impossible to secure a majority. On the 27th of October, however, with the assistance of the Free Principles Party, he succeeded in composing a cabinet, in which he was minister of the interior as well as premier. From the first the ministry was exposed to the most unscrupulous opposition, exacerbated by the new and stringent rules of procedure which Tisza felt it his duty to introduce if any business were to be done. The motion for their introduction was made by the deputy Gábor Daniel, supported by the premier, and after scenes of unheard-of obstruction and violence (Nov. 16–18) the speaker, in the midst of an ear-splitting tumult, declared that the new regulations had been adopted by the house, and produced a royal message suspending the session. But the Andrássy group, immediately afterwards, separated from the Free Principles Party, and during the rest of the year the opposition made legislative impossibility. By January the situation had become ex leso or anarchical. Tisza stoutly stood by his rules, on the ground that this was a case in which the form must be sacrificed to the substance of parliamentary government. But his appeal to the country at the beginning of 1905 was unsuccessful, and his opponents triumphed by a large majority. Tisza thereupon resigned and retired from public life.

The discovery of an element as was due to William Gregor in 1789 who found in the mineral ilmenite and magnetohemite a new earth, which was regarded as the oxide of a new metal, manechin. Independently of him Klaproth in 1793 discovered a new metal in rutille, and called it titanium; he subsequently found that it was identical with Gregor's element. Klaproth, however, was unable to prepare the pure oxide, which was first accomplished in 1821 by Rose. The isolation of the pure metal is of much later date. Titanium, although pretty widely diffused throughout the mineral kingdom, is not found in abundance. The commonest titanium mineral is rutile or titanium dioxide, TiO₂; anatase and brookite are crystalline allotropic modifications. Titanium is most frequently found associated with iron; ilmenite (Ger. Titan-eelzen) is FeTiO₃, peroskite (Ca,Fe)TiO₃, and the metal occurs in most magnetic iron ores. The titanates are well marked in the mineral kingdom. Ilmenite is isomorphous with gelikelite, MgTiO₃, and pyrophanite, MnTiO₃; many of the "rare minerals"—aeschynite, euxenite, polyacryse, &c.—contain titanates (and also niobates). Silicates also occur; sphene or titanite, CaTiSiO₄, is the commonest; keilhauite is rarer.

The isolation of metallic titanium is very difficult since it readily combines with nitrogen (thus resembling boron and magnesium) and carbon. In 1822 Wollaston examined a specimen of those beautiful copper-like crystals which are occasionally met with in iron-furnace slags, and declared them to be metallic titanium. This view had currency until 1849, when Wöhler showed that the crystals are a compound, Ti(CN)₂·3TiN₄, of a cyanide and a nitride of the metal. An impure titanium was made by Wöhler and Sainte-Claire Deville in 1857 by heating to redness fluoritumate of potassium (see below) in the vapour of sodium in an atmosphere of dry hydrogen, and extracting the alkaline fluoride formed by water. The metal thus produced formed a dark brown amorphous powder resembling iron as obtained by the reduction of its oxide in hydrogen. In 1887 Nilson and Peterson (Zeit. phys. Chem. 1, p. 25) obtained a purer product by heating the chloride with sodium in a steel cylinder; it then formed yellow scales with a bluish surface colour. H. Moissan (Compt. rend., 1895, 120, p. 290) obtained a still purer metal by heating the oxide with carbon in the electric furnace. The product has a brilliant white fracture, a specific gravity of 4·87, very friable, but harder than quartz or steel. Moissan (ibid., 1906, 142, p. 673) has distilled this metal in a very intense electric furnace. When heated in air it burns with the formation of the oxide. It combines directly with the halogens, and dissolves in cold dilute sulphuric acid, in hot strong hydrochloric acid and in aqua regia, but less readily in nitric acid. Its most curious property is the readiness with which it unites with nitrogen. Several nitrides have been described. Ti₃N₅ is a copper-coloured powder obtained by heating the ammonio-chloride TiCl₄·4NH₃ in ammonia. Ti₅N₆ is a dark blue powder obtained when the oxide is ignited in an atmosphere of ammonia; while Ti₇N₈ is obtained as a bronze yellow mass as hard as the diamond by heating the oxide in an atmosphere of nitrogen in the electric furnace.
In its chemical relations, titanium is generally tetravalent, and occurs in the same sub-group of the peridote classification as zirconium, cerium and thorium. It forms several compounds, TiO, TiO₂ and TiO₃ being the best known; others (some of doubtful existence) have been described from time to time.

**Titanium dioxide, TiO₂**, occurs in nature as the three distinct mineral species rutile, brookite, and anatase. Rutile, brookite and anatase are tetravalent forms isomorphous with cassiterite, SnO₂ and also zircon, ZrSiO₄; anatase is also tetravalent, and brookite or thorbomibic. Rutile is the most stable and anatase the least, a character reflected in their decreasing stability, from rutile (474°) down to anatase (39°). The minerals are generally found together—a feature rarely met with in the case of polymorphs. They have been obtained artificially by electrolysis or by the action of fluorine and steam. At a red heat rutile is produced, at the bottom of the crucible, of zinc brookite, and of cadmium anatase. It is apparent that these minerals all result in nature from pneumatolytic action. Amorphous titanium oxide may be obtained in a pure form by fusing the material very finely powdered, with six times its weight of potassium bisulphate in a platinum crucible, then extracting the melt with cold water and boiling the filtered solution for a long time. Titanium oxide separates out as a white hydrate, which, however, is fumed. Contaminated with ferric hydrate and often with tin oxide. A better method is Wöhrle's, in which the finely powdered mineral is fused with sodium carbonate and fused again in a platinum crucible, the melted powder and treated in a platinum basin with hydrofluoric acid. The alkaline titanate first produced is converted into crystalline fluotitanate, K₂TiF₆, which is with difficulty soluble and changes into a yellow, or red, or purple mass which may be collected in glass vessels if an excess of hydrofluoric acid has been avoided, deposits the greater part of the salt on cooling. The solution is then precipitated, washed, pressed and recrystallized, whereby the impurities are removed. The precipitate is dissolved in hot water and decomposed with ammonia to produce a slightly ammoniacal hydrated oxide; this, when ignited in platinum, leaves a white mass, containing a small amount of brookite, of specific gravity of which varies from 3.9 to 4.25, according to the manner in which it was kept in igniting. The more intense the heat the denser the product. The oxide is fusible only in the oxy-hydrogen flame. It is not fused by the usual crucible oxides, and melts at 2000° with a distinct blue flame, when finely powdered. If the sulphuric acid solution be evaporated to dryness the residue, after cooling, dissolves in cold water. The solution, on being evaporated and dried, turns a yellowish brown in colour, and on heating its loss in weight increases beyond the usual proportion of water. This salt is obtained by the action of hydrofluoric acid on the hydroxide, which is decomposed by the action of hydrochloric acid, the chloro-titanate, TiCl₄, obtained by decomposing a solution of the chloroxide in cold water with alkalis. The ortho-body dissolved in cold dilute acids, the meta-body does not. If titanium oxide be fused with excess of alkali carbonate a titanate, K₂TiO₃, is obtained. This salt is decomposed by water with the formation of a solution of alkali free of titanium, and a residue of an acid titanate, which yields the free metal on fusing with charcoal in the presence of an excess of carbonic acid. The titanates are very similar to the silicates in their tendency to assume complex forms, e.g. the potassium salts are K₂TiO₃·4H₂O, K₂TiO₃·3H₂O, K₂TiO₃·2H₂O, K₂TiO₃·H₂O.

**Titanium monoxide, TiO**, is obtained as black prismatic crystals by heating the dioxide in the electric furnace, or with magnesium powder. Titanium sesquioxide, TiO₂, is formed by heating the dioxide with concentrated nitric acid. When a solution of titanium in hydrochloric acid is digested with concentrated nitric acid the trichloride is precipitated with alkalis. Titanium trioxide, TiO₃, is obtained as a yellow precipitate by dropping the chloride into alcohol, adding hydrogen peroxide, and finally ammonium carbonate or potash. When shaken with potash and air it undergoes autooxidation, hydrogen peroxide being formed first, which converts the trioxide into the dioxide and possibly perititanic acid; this acid may contain oxovanadium titanium, see W. Manchot and Richter, *Ber.*, 1906, 39, pp. 320, 488, and also Faber, *Aust. Journ. Chem. Soc.*, 1907, ii, 557.

**Titanium fluoride, TiF₄**, is a fuming colourless liquid boiling at 284°, obtained by distilling a mixture of titanium oxide, fluorine and sulphuric acid; by heating barium titanofluoride, BaTiF₄ (Emrich, *Monats.*, 1904, 25, p. 907); and by the action of dry hydrofluoric acid on the chloride (Ruff and Plato, *Ber.*, 1904, 34, p. 672). By dissolving the dioxide in hydrofluoric acid a syrupy solution is obtained which probably contains titanofluoride, H₂TiF₄. The name of this acid is well known; they are isomorphous with the silico-fluorides, see C. A. Manchot and Richter, *Ber.*, 1906, 39, pp. 320, 488, and also Faber, *Aust. Journ. Chem. Soc.*, 1907, ii, 557.

**Titanium chloride, TiCl₃**, is obtained as a colourless fuming liquid of boiling point 753° and specific gravity 1.775 on freezing 3° c. (T. E. Thorpe), by heating to dull redness an intimate dry mixture of the oxide and ignited lamp-black in dry chlorine. In the method of A. Stähler and H. Wirthwein, the titanium mineral is fused with carbon in the electric furnace, the carbides treated with chlorine, and the titanium chloride condensed. The distillate is freed from vanadium by digestion with sodium amalgam. Other methods are due to E. Vigouroux and G. Arrivaut (*Aust. Journ. Chem. Soc.*, 1907, ii, 557). In the latter, Penfield and Effinger, *J. Phys. Chem.*, 1907, 11, 124, use the chlorofluor hydrocarbon over the heated dioxide the tetra-di- and tri-chlorides of titanium, with the free metal and a gaseous hydride, TiH₃ (Renz, *Ber.*, 1906, 39, p. 249). When dropped very cautiously into cold water, the white powder forms a compound which is decomposed by ammonia to form titanium chloride, TiCl₃, or titanum acid; it forms addition compounds similar to those formed by stannic chloride, and combines with ammonia to form titanum, 8NH₃, both of which with liquid ammonia give titanamide, Ti(NH₃)₂. Titanium dichloride, TiCl₂, obtained from the chlorofluor hydrocarbon over the heated dioxide, is a very hygroscopic brown powder which inflames when exposed to air, and energetically decomposes water. Titanium tetrachloride, TiCl₄, forms involatile, dark violet, scales, and is obtained by passing the vapour of the tetrachloride mixed with hydrogen through a lead tube, or by heating the tetrachloride with molecular nitrogen to 200°.

It is a powerful reducing agent.

Titanium sesquisulphate, Ti₂(SO₄)₃·H₂O, obtained by concentrating the hot solution formed when the metal is dissolved in sulphuric acid, is interesting since it forms a caesium alun, Cs₂Ti(SO₄)·12H₂O. It gives the normal sulphate as a yellow, deliquescent, amorphous mass when treated with water. According to the amount of water present.

Acid solutions of titanates are not precipitated by sulphuric hydrogen; but ammonium sulphide acts on them as if it were ammonia, the sulphurated hydrogen being liberated. Titanium oxide when fused with microscopic salt in the oxidising flame yields a black which is yellowish in the heat but colourless after cooling. In the reducing flame the black becomes violet, more readily on the addition of tin; in the presence of iron it becomes blood-red. Titanium oxides when fused on charcoal yield a white, almost colourless, metallic mass. Determined in 1885 by T. E. Thorpe gave the value 47·7 (see Journ. Chem. Soc., 1885, p. 108).

**TITANOTHERIDAE** (also known as Menodontidae and Brontotheriidae), a family of large rhinoceros-like perissodactyl ungulate mammals from the Oligocene and Eocene strata of North America. The cheek-teeth are low-crowned, with the external cones of the upper molars fused into a W-like outer cusp, and the inner cusp and the paraconid and paracristid form; while in the lower teeth the crown is formed of crescentic ridges of which there are three in the last and two each in the other teeth. There is generally little gap between the canines and the premolars.

**Titanotherium**, of the Oligocene of the Dakotas and neighbouring districts, was a huge beast, with the hinder upper premolars similar in character to the molars, a pair of horn-cores, arising from the maxilla, overhanging the nose-cavity, four front and three hind toes, only twenty dorso-lumbar vertebrae, and an almost continuous and unbroken series of teeth, in which the canines are short; the dental formula being 4, 1, c. 1, p. 4, m. 3. The muzzle probably formed a snout in life, and there is presumptive evidence that these animals were very long-lived. *Brontops* seem scarcely separated from the type genus; but the name *Brontotherium* is applied to species with two pairs of incisor teeth in both jaws. The length of the largest species was about 14 ft., and the height about 8 ft. The alleged occurrence of remains of members of the group in the Balkans apparently rests on insufficient evidence.

A second group is typified by *Palaeochoepus*, of the Bridger Epoch of Wyoming; and obtained from *P. pachyodus* being an animal about the size of a tapir. The skull is smaller, the larger face than in *Titanotherium*, lacks horn-cores, while all the upper premolars are smaller than the molars, and the full series of 44 teeth was present. The limbs were relatively slender, and the brain was small. In the lower, or Wassatch, Eocene the group was represented by the still more primitive *Lambdotherium*. On the other hand, *Palaeochoepus* is connected with *Titanotherium* by means of *Telmatherium* of the upper...
TITANS—TITHES

Bridger and Washakia Eocene, a larger animal, with a longer and flatter skull, showing rudiments of horn-cores, only two pairs of lower incisors, and a general approximation in dental character to Titanotherium. Another of these titanotherid forms is Diplocoelium, from the Upper or Uinta Eocene; an animal the size of a rhinoceros, with the thick and sharp upper premolars molar-like. It was probably off the direct ancestral line of Titanotherium. These intermediate forms render the reference of the group to a distinct family—Palaeochoeridae—unnecessary.

Professor H. F. Osborn, who recognises four genera, Titanotherium, Megacerops, Symborodon and Brontotherium, in the typical section of the family, considers that each of these represents a distinct line of descent from the Palaeochoerops-like group. The whole assemblage forms one of the four main seneages taken by Parkyns-Patry, namely the Titanotherioidea.


TITANS (Gr. ῶταρεῖς), in Greek mythology, the children of Uranus and Gaea. According to Hesiod (Theog. 133), the male Titans were Oceanus, Coeus, Crius, Hyperion, Iapetus and Cronus; the female, Thea, Rheia, Themis, Mnemosyne, Phoebe and Mnemosyne. The whole has reference to the winter festival of Dionysus, a distinct line of descent from the Palaeochoerops-like group. The whole assemblage forms one of the four main seneages taken by Parkyns-Patry, namely the Titanotherioidea.

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years (Deut. xiv. 28, xxvi. 12), which the legislator directs to be stored at home, and spent in feeding the poor. Amos iv. 4, "Bring your sacrifices every morning and your tithes every three days" (not "years" as E.V.), hardly implies more than that occasions of sacrifice were three times as frequent as titheday, and so alludes to the fact that there were by old usage three annual feasts and one annual tithe. A triennial sacrificial tithe is inconceivable when it is remembered that the tithe is only an extension of the firstfruits. The triennial tithe in Deuteronomy seems to be rather an innovation necessary in the interests of the poor, when sacrificial feasts were transferred to the central sanctuary, and ceased to benefit the neighbours of the offerer, who, as stated above, had a prescriptive claim to be considered on such occasions (cf. 1 Sam. xxv. 8 sqq.; Neh. viii. 10; Luke i. 69). The priests of the sanctuaries had of old a share in the sacrificial feasts, 1 and among those who are to share in the triennial tithe Deuteronomy includes the Levites, i.e. the priests of the local sanctuaries who had lost their old perquisites by the centralization of worship. In Ezekiel as in the Law of Holiness there is no mention of tithes; he proposes to support all public worship from the proceeds of a general tax (xlv. 13) levied by the prince, the old firstfruits being allotted to the priests. In the Persian period the tithe was converted to the use of the Temple (Mal. iii. 8-10). As in Deuteronomy the phrase of the "whole tithe," the payment to the Levites (now subordinate ministers of the Temple) was perhaps still only triennial; and if even this was difficult to collect, we may be sure that the minor sacrificial tithe had very nearly disappeared. The indifference complained of in Mal. i. was in great part due to the fundamental changes in the religion of Israel, which made private altar gifts and feasts almost meaningless. On the other hand, the provision of regular support for the priests and Levites, the ministers of the public ritual, was now all important, and received special attention from Ezra and Nehemiah (Neh. x. 37 Ex. xxvii. 34, xiii. 10 sqq.). They effected it by enforcing the new law of the priestly code (Num. xviii. 21 sqq.), in which it is formally laid down that the tithe is a tribute paid to the Levites, who in turn pay a tithe of it to the priests. It is doubtful whether the system ever worked. The plain intention of the priestly code is to allow the old tithe of Deuteronomy to drop; but the harmonistic interpretation of the later scribes was to the effect that two tithes were to be paid every year, and a third tithe, for the poor, on every third year (Tob. i. 7 sqq.; Jos. Ant. iv. 8, § 22). The last change in the system was the appropriation of the Levitical tithe by the king, as was proposed in Deuteronomy "for the priest's use," and it is clear that the tradition, glaringly inconsistent with Nehemiah, ascribes it to Ezra, alleging that he deprived the Levites because so few of them were willing to return to Palestine (Mishnah, "Ma'aser Sh." v. 15; "Sota," ix. 10, and Wagensel's note). 2


**Tithes in Law.**

Tithes were generally regarded up to the 17th century as existing merely as a share in the support of the Church ever since the earliest days of Christianity. 1 The tithe offered to Yahweh may have originally been consumed—in worship or in representative part—on the altar, but in the rituals preserved to us the offering is symbolical, the deity ceding his tithe to the priest, so that from quite early times the tithe helped to support the priesthood who like the poor had a customary share guaranteed him. 2 A cattle tithe is demanded in Lev. xxvii. 32, and spoken of in 2 Chron. xxxi. 6. It is doubtful if this was ever acknowledged in practice. See Kuenen, Godsdiens, ii. 269 sqq., and Wellhausen, Prophezeiung, v. 1, § 2 (Eng. trans., p. 155 sqq.), who argue that the passage in Leviticus is a later addition. The tendency of the Pharisees was to pay tithe on everything, and to make a self-righteous boast of this (Matt. xxiii. 23; Luke xviii. 12). The Mishna (Ma'aser, p. 1) says "everything that is eaten and is watched over and grows out of the ground is liable to tithe." 3

History, as Selden showed in his learned and exhaustive treatise (History of Tithes 1618), does not bear out this view. 4 In the words of Hallam, "the slow and gradual manner in which parochial churches became independent appears to be of itself a sufficient answer to those who ascribe a great antiquity to the universal payment of tithes." 5

Long before the 8th century payment of tithes was enjoined by ecclesiastical writers and by councils of the Church; but the earliest authentic example of anything like a law of the state enforcing payment appears to occur in the Capitularies of Charlemagne at the end of the 8th or the beginning of the 9th century. Tithes were by that enactment to be applied to the maintenance of the bishop and clergy, the poor, 6 and the fabric of the Church. In course of time the principle of payment of tithes was extended far beyond its original intention. Thus they became transferable to laymen and salable like ordinary property, in spite of the injunctions of the third Lateran Council, and they became payable out of sources of income which were not originally titheable. The canon law contains numerous and minute provisions on the subject of tithes. The Decretum forbade their alienation to lay proprietors, denounced excommunication against those who refused to pay, and based the right of the Church upon scriptural precedents. 7 The decretals contained provisions as to what was and what was not tithable property, as to those privileged from payment as to sale or hypothecation to laymen, as to priority over state taxes, &c. 8 Various questions which arose later were settled by Boniface VIII. 9 The Council of Trent enjoined due payment of tithes, and exhorted those who withheld them. 10

In England the earliest example of legal recognition of tithes is, according to Selden, a decree of a synod in 786. 11 Other examples before the conquest occur in the Poedus Alfredi et Guthrunti and the laws of Athelstan, Edgar and Canute. 12

A full discussion of their origin and history is to be found in Lord Selby's Ancient Poets and Folklore. Among more recent works on Tithes (1888); the History of the Law of Tithes in England, by G. Edwardes Jones; and the Sacred Tenet, Ancient and Modern, by H. Lansdell (1906). (J. W.)

Tithes in England may be best dealt with in two chronological divisions—tithes under the system existing previously to the Commutation Acts and tithes under the system then introduced.

1. Whether or not, as it is said, before the Council of Lateran in 1150, a man could have given his tithes to any church or monastery that he pleased, at any rate since that time, with the division of dioceses into parishes, they were a common right belonging to the church within whose parish they arise, although by prescription they may belong elsewhere. The general rule was said to be that all lands within a parish are subject to tithes, and a layman was not allowed to prescribe generally that his lands were exempt; but he had to show a special exemption, and no length of possession was regarded in law in view of the maxim nullum tempus occurrat ecclesiæ, although equity did take account of it. The tithes in places extra-parochial, e.g. forest lands, belong to the Crown, although by canon law they were to be disposed of by the bishop; but by custom a parson or vicar might be entitled to them. The tithes of titheable cattle pasturing in any waste or common ground, wherever the parish is not certainly known, were made payable to the parish of the place where the cattle dwell by a statute of Edward VI. Tithes were classified according to their nature as praelical, or

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1 It was his denial of the divine right of tithes that brought down the wrath of the Star Chamber upon the author. He was forced to retract an opinion too liberal for the time. (See Selden.)

2 Hallam, Middle Ages, ii. 205.

3 See Dante, Par. xii. 93, "decimas quae sunt pauperum Dei."

4 Pt. ii. 16, 7.

5 Estrov. Comm. bk. iii. 7.

6 Sess. xxv. 12.

7 C. viii. § 2; Tithes had to be made by Æthelwulf in 855, to which the general payment of tithes in England has been commonly traced, appears not to rest on satisfactory evidence.
arising immediately from the ground, e.g. grain of all sorts, hay, wood and the like; mixed, or arising from things immediately nourished by the ground, e.g. colts, lambs, eggs and the like; or personal, namely, of profits arising from the honest labour and industry of men, had existed, given part against another gain, e.g. fishing, mills and the like; or according to value, as great, e.g. corn, hay and wood; or little, which embraced all others. Of common right tithes were only payable of such things as yield a yearly increase by the act of God, and generally only once a year. They were not payable of the following, except by custom: things of the substance of the earth, such as coals, minerals, turf and the like; things ferae naturae, such as fish, deer and the like; things tame, such as fowls, hounds or fish kept for pleasure or curiosity; barren land, until it is converted into arable or meadow land, and, has been so for seven years; forest land, if in the hands of the king or his lessee, unless disafforested; a park which is dispaarked; or glebe land in the hands of the parson or vicar, which was mutually exempted from payment by the one to the other, but not if in the hands of the vicar's lessee. Another exception to the incidence of tithes were abbey lands. These were exempted generally by Pope Pascal II. while in the hands of their owners, but the privilege was restricted by Pope Adrian IV. in the time of Henry II. to the three religious orders of Cistercians, Templars and Hospitalers (to whom, as leading on the profession of the religious order, they might have been actually so or not, were presumed to be exempt; and a further exemption was created by parsonages coming into the same hands as tithable lands, which lasted so as such union continued.

A further exemption from tithes was given by an act of 1832 (2 & 3 Will. IV. c. 100), which fixed a period of prescription against claims of tithes by laymen or corporations aggregate, of thirty years during which there had been no payment of tithes or a mode of apportionment of the ground, in the absence of contrary evidence, and in any case of sixty years against exceptions sole, of sixty years or the tenures of two successive incumbents and three years after the entry of a third. The tithes which came into lay hands by the dissolution of the religious houses and the previous suppression of alien priories by Henry V. became in all respects incorporeal freehold property. Under the Limitation Act of 1832 twenty years of adverse possession of an estate in tithes gave a good title, except as against spiritual or ecclesiastical corporations sole whose right to recover tithes was limited, if at all, to a period of two incumbencies and sixty years after their ordination.

Tithes were generally recovered by a writ against the owner of the tithable property usually brought in the ecclesiastical courts (questions of title to tithes being reserved to the temporal courts), the jurisdiction of which in this respect was confirmed by the statutes Circumspecte agatis (13 Edw. I.), Articuli cleri (6 Edw. II.), and others of Henry VIII. and Edward VI., and was enforced by ecclesiastical censures and the writ De excommunica capiendo; and an act 2 & 3 Edw. VI. made any person refusing to set out tithes liable to pay double the value in the ecclesiastical court or treble in a common law court. Tithes of small amount or due from Quakers could be recovered by summary proceedings before justices under statutes ranging from William III. to Victoria. Tithes could also be sued for in equity, especially the equity side of the exchequer. A custom also sprang up, and was common at the time of the Commutation Acts, for a tithe-owner to accept a fixed sum of money or fixed quantity of the goods tithable in place of the actual tithes, known as a modus de capitatione, whether in respect of a whole parish or only of particular lands within it; and this modus was fixed for in the negotiable condition of the land, and could also file bills of sale to establish a modus against a tithe-owner. In the City of London there were customary tithes; in other towns and places there were compositions for tithes which were confirmed by local acts of parliament; and according to a return presented to the House of Commons in 1831, there were passed between 1757 and 1830 no less than 2000 local acts containing clauses for the commutation of tithes. Enclosure Acts often gave a portion of the lands enclosed to the spiritual or lay rector and exempted the rest from tithes; and in other local acts a similar arrangement was made. Exception, however, where made under parliamentary authority, no composition for tithes, although made between the landowner and the parson or vicar with the consent of the patron and ordinary, bound a succeeding incumbent, the statute 15 Eliz. c. 10 prohibiting any parson or vicar from making any conveyance of (inter alia) tithes, being parcel of the possessions of their churches, to any persons, except leases for twenty-one years or three lives.

2. The principle of the Tithes Commutation Acts 1836-1839 was to make the tax upon ground the tithes which had been only partial or temporary (in most cases), After the and to "substitute a corn rent (known as a tithe rent charge), permanent in quantity and payable in money, but fluctuating for all, whether payable under a modus or composition or not, which may have heretofore belonged either to ecclesiastical or lay persons" (Phillimore, Eccles. Law, li. 1161).

Commissioners (now the board of agriculture) are appointed to execute the acts; a rent charge on all lands liable to tithes at the time of the passing of the first act is substituted for those tithes, the extent of which is fixed either by the respective parishes, or by a parochial agreement, or, failing that, by compulsory award confirmed by the commissioners; and the value of the tithes is fixed in the latter case by their average value in the particular parish during the seven years preceding Christmas 1835, without deduction for parochial or county and other rates, charges and assessments falling on tithes, the rent charge being liable to all the charges to which tithes were liable. The rent charge is apportioned on all the lands liable in the parish, and such apportionment may be altered or a new one made; and the value of the rent charge is fixed at the value at the time of confirmation of the apportionment, or as a greater number of the tithe owners agreed, the average price of a bushel of wheat, barley and oats as the same would have purchased at the prices so ascertained by the advertisement (of prices of corn) to be published immediately after the passing of the act 6 & 7 Will. IV. for the years one before the passing of the act, the average price of wheat, one-third part in the purchase of barley, and the remaining third part in the purchase of oats; and the respective quantities of wheat, barley and oats so ascertained shall be stated in the draft of every apportionment. The price at which the conversion from money into corn is to be made at the time of confirmation of such apportionment, according to the provisions of the said act, are 7s. 6d. for a barrel of wheat, 3s. 11d. for a bushel of barley and 2s. 9d. for a bushel of oats (7 Will. IV. and 1 Vict. c. 69); the average price of the bushel of each grain is now computed by substituting for the "advertisement" above the statement of the average price of a bushel of each grain at the average price of the imperial bushel of British corn fixed under the Corn Returns Act 1882; and thus the value of the statutory amount of corn is now fixed for each year at the beginning thereof at the average price of the three components of corn for the previous year in the United Kingdom. The exact apportionment in value may be gathered from the fact that for 1902 the price of the wheat bushel is thus fixed at 35s. 10½d., that of the barley bushel at 35s. 0½d. and that of the oats bushel at 25s. 10½d.

As already indicated above, certain lands are exempt from payment of tithes while in the occupation of their owners, either by reason of their having been parcel of the possessions of any privileged ecclesiastical corporation or by reason of the tenure of ancient demesne and exempt whilst in the tenure, occupation or manorship of the Crown, its tenants, farmers and lessees or under-tenants, although they are subject to tithes when alienated or occupied by subjects of another realm; and in all cases in which the tenure of such owners, a fixed rent charge may be substituted for any contingent rent charge imposed on them (2 & 3 Vict. c. 62; 3 & 4 Vict. c. 15; now repealed except as to tithes not commuted). In certain cases where commutation of tithes for rent charge is, the ordinary
way was impracticable, e.g. in the case of Llanmas lands or in the case of common lands, power was given to charge a fixed sum or rate per head of the cattle there pasturing, with an exception in the case of Llanmas lands which for seven years before Christmas 1835 had paid a fixed rate. As a result of this, a common landlord, respecting a common appurtenant on the allotment made in respect of the lands to which such right of common attached (2 & 3 Vic. c. 62; 3 & 4 Vict. c. 151; 9 & 10 Vict. c. 73). By an act of 1860 (25 & 26 Vict. c. 93) a gross rate was levied upon the landholders; certain rights were charged for at a fixed sum per head; a gross rent charge made payable in respect of the tithes of a gated or stinted pasture rated to the undivided hereditament, and certain other charges, &c., were imposed in the method prescribed by the other Tithe Acts; a rent charge on commons may be commuted for part of the land or redeemed, if the landowners and persons liable for tithe so agree; and upon expiry of the commutation period, the occupier may be paid out of any tithe fund from the lands allotted. These rent charges are not subject to the Tithe Act of 1891. This act of 1860 also gave power to convert the corn rents established under local acts into rent charges.

In the case of hop-gounds, orchards, fruit-plantations and gardens power was given to the commissioners to value them separately, according to the average rate of composition for the particular land, and to fix an extraordinary charge for tithes thereof, the former for such lands going out of cultivation, the latter for such as were there afterwards cultivated: lands subject to the latter were exempted during the first three years of cultivation; and such lands were only subject to it if situated in a parish in which an extraordinary charge had been distinguished at the time of commutation (6 & 7 Will. IV. c. 71; 2 & 3 Vic. c. 62; & 4 Vict. c. 151; 24 & 25 Vict. c. 93; 36 & 37 Vict. c. 73). Such an extraordinary charge shall be levied on any such grounds so newly cultivated in future; the capital value of the existing charges was assessed, and the interest of the landowners was payable in advance in addition to all the other charges until its redemption, and in recoverable in the same way as ordinary rent charge and exempt from all rates, charges and assessments; the charge was redeemable at any time after the expiration of twenty years, and not recoverable by order of the county court, whatever its amount may be: if the land is occupied by the owner, the order is executed by the same means as those prescribed in the Tithe Acts; but if it is not, then by a receiver being appointed for the rents and profits of the land: neither landlord nor occupier is personally liable for payment; and appeal lies to the High Court on points of law; and a remission of rent charge may be claimed when its amount exceeds two-thirds of the annual value of the land. The act does not apply to the particular kinds of rent charges mentioned above.

The Tithe Acts do not apply to the city of London, which has always had its own peculiar customary payment regulated by episcopal constitutions of 1 Hen. III. and 13 Ric. II. and statutes of Henry VIII., confirming a decree of the privy council, under which the rate of tithes was fixed at 16d. for every 10s. rent, and at 2s. 9d. for every 20s. rent of houses, shops and the like by the year. Provision was made by statute after the fire of London for certain annual tithes to be paid in parishes whose churches had been destroyed, and there have been local acts from time to time with regard to particular parishes therein.


### Tithing

**Tithing** (for tithe, tenth; Lat. decima), formerly a unit of local administration in England. In some districts the men who were bound to be in frankpledge (q.v.) were grouped in associations of ten, twelve or more individuals called tithings. When a person who was accused of any crime was not forthcoming, inquiry was made whether he was in frankpledge; if he were not, and had no right of exemption, the township was amerced, but if he were in a tithing, then it was upon the tithing that the amercement fell. Each tithing was divided into ten districts normally identical with the township which discharged the duties of the frankpledge. Some townships, however, contained more than one tithing. There are also indications that in the ancient kingdom of Mercia the tithing was originally a district and not a mere association of persons; but in Northumbria it is doubtful whether the system of frankpledge and tithing, either personal or territorial, was ever established. If, as seems likely, the territorial tithing is older than the personal, each territorial hundred (q.v.) was probably divided into ten tithings.

**Tithonus,** in Greek legend, according to Homer son of Laomedon, king of Troy and husband of Eos (the morning). In the Homeric Hymn to Aphrodite, Eos is said to have carried him off because of his great beauty. She entreated Zeus that he might live for ever; this was granted, but she forgot to ask
for immortal youth for him. He became a hideous old man; Eos then shut him up in a chamber; his voice "flowed on unceasingly, but his limbs were helpless. A later development is the change of Tithonus into a grasshopper, after Eos had been obliged to wrap him like a child in swaddling-clothes and to put him to sleep in a kind of cradle. He was probably associated with the Trojan royal house, since the inhabitants of the original home of the legend (probably central or northern Greece) looked upon the East, the land of the morning, as the home of Eos. In some versions she is said to have carried him away still farther East, to the land of Ethiopia near the ocean streams; this is euhemeristically referred by Diodorus Siculus to an expedition undertaken against Ethiopia by Titonus, son of Laomedon.

It is probable that Tithonus was originally a sun-god; the scholar on Itiad, xi. 5, who calls him Titon, identifies him with Apollo, and there are many points of resemblance between him and the sun-god Helios. The story is generally regarded as an allegorical representation of the fresh morning sun dried up by the heat of the advancing day. Possibly it is merely intended as a warning to mortals not to unite with immortals, lest they incur the jealousy and wrath of the gods.

See Homer, Itiad, xi, x. 237; Hymn in Venerem, 219 sqq., with Allen and Silva's notes; Apollodorus ii. 13. 4; Diod. Siculus iv. 75.; Horace, Odes, i. 16. 30; Propertius iii. 18; O. Gruppe, Griechische Mythologie, l. 374, n. 16, who attributes a Miletian origin to the story.

In the 15th century "La Divina." The country of Cadore, in the Friuli, barren and poor, is watered by the Piave torrent poured forth from the Carnic Alps, and is at no great distance from Tirol. Titian, therefore, was not in any sense a Venetian of the lagoons and Adriatic, but was native to a country, and a range of association, perception and observation, of a directly different kind. Venice and the Alpine Friuli are as remote from the birth of Titian; and Cadore, having to choose between Venetian and imperial allegiance, declared for the former. Approaching the castle of Cadore from the village of Sotto Castello, one passes on the right a cottage of humble pretensions, inscribed as Titian's birthplace; the precise locality is named Arsenale. The near mountain—all this range of hills being of dolomite formation—is called Marmarolo. At the neighbouring village of Vallo was fought in Titian's lifetime the battle of Cadore, a Venetian victory which he recorded in a painting. In the 15th century this was the haunt of turkeys' feather-courts, and the court also of Cadore. He was called Guecello; and this name descended in 1321 to the podestà (or mayor) of Cadore, of the same stock to which the painter belonged. Titian, one of a family of four, and son of Gregorio Vecelli, a distinguished councillor and soldier, and of his wife Lucia, was born in 1477. So it has very generally been stated; but of late years a subsequent date, 1485–1490, has been suggested, so as to make Titian, at the time of his death, not so singularly long-lived a man. As to this interesting point one should remember that Vasari in one passage (at variance with some others) says that Titian was born in 1469; but according to this dating to Philip II. in 1571, he is to be counted a fifty-five-year-old man. It is to be said that Titian, when a child, painted upon the wall of the Casa Sampieri, with flower-juice, a Madonna and Infant with a boy-angel; but modern connoisseurs say that the picture is a common work, of a date later than Titian's decease. He was still a child when sent by his parents to Venice, to an uncle's house. There he was placed under an art teacher, who may perhaps have been Sebastiano Zuccato, a mosaicist and painter now forgotten. He next became a pupil of Gentile Bellini, whom he left after a while, because the master considered him too offhand in work. Here he had the opportunity of studying many fine antiques. His last instructor was Giovanni Bellini; but Titian was not altogether satisfied with his tutoring. The youth was a contemporary of Giorgione and Palma Vecchio; when his period of pupilage expired, he is surmised to have entered into a sort of partnership with Giorgione. A fresco of "Hercules" on the Morosini Palace is said to have been one of his earliest works; others were the "Virgin and Child," in the Vienna Belvedere, and the "Visitation of Mary and Elizabeth" (from the convent of S. Maria dell' Orto and in the Venetian Academy. In 1507–1508 Giorgione was commissioned by the state to execute frescoes on the re-erected Fondaco de' Tedeschi. Titian and Morto da Feltre worked along with him, and some fragments of Titian's paintings, which are reputed to have surpassed Giorgione's, are still discernible. According to one account, Giorgione was nettled at this superiority, and denied Titian admittance to his house thenceforth. Stories of jealousies between painters are rife in all regions, and in none more than in the Venetian—various statements of this kind applying to Titian himself. One should not accept nor reject them uncritically; counter-evidence of some weight can be cited for Vecelli's vindication in relation to Moreni, Correggio, Lotto and Coello. Towards 1511, after the cessation of the League of Cambridge—which had endeavoured to shatter the power of the Venetian republic, and had at any rate succeeded in clipping the wings of the lion of St. Mark—Vecelli went to Padua, and painted in the Scuola di S. Antonio a series of frescoes, which continue to be an object of high curiosity to the students of his genius, although they cannot be matched against his finest achievements in oil-painting. Another fresco, dated 1523, is "St Christopher carrying the Infant Christ," at the foot of the steps in the ducal palace of Venice. From Padua Titian in 1523 returned to Venice; and in 1553 he obtained a brother's patent in the Fondaco de' Tedeschi (state-warehouse for the German merchants), termed "La Sanseria" or "Senseria" (a privilege much coveted by rising or rising artists), and became superintendent of the government works, being especially charged to complete the paintings left unfinished by Giovanni Bellini in the hall of the great council in the ducal palace. He set up an atelier on the Grand Canal, at S. Samuele—the precise site is unknown—and many of the finest works of Titian were executed by his pupils, of Bellini, that he came into actual enjoyment of his patent, at the same date an arrangement for painting was entered into with Titian alone, to the exclusion of other artists who had heretofore been associated with him. The patent yielded him a good annuity—120 crowns—and exempted him from certain taxes—he being bound in return to paint likenesses of the successive doges of his time at the fixed price of eight crowns each. The actual number which he executed was five. Titian, it may be well to note as a landmark in this all but centenarian life of painting. Another fresco, dated 1531, is "The Assumption of the Madonna," on the wall of the church of the Frari, one of his most world-renowned masterpieces, the "Assumption of the Madonna," now in the Venetian Academy. It excited a vast sensation, being indeed the most extraordinary piece of colourist execution on a great scale which Italy had yet seen. The signoria took note of the facts and did not fail to observe that Titian was neglecting his work in the hall of the great council. The doge now at the height of his fame; and towards 1521, following the production of a figure of "St Sebastian" for the papal legate in Brescia (a work of which there are numerous replicas), purchasers became extremely urgent for his productions. In 1525, after some irregular living and a consequent fever, he married a lady of whom only the Christian name, Cecilia, has come down to us; he hereby legitimized their first child, Pomponio, and two (or perhaps three) others followed. Towards 1526 he became acquainted, and soon exceedingly intimate, with Pietro Aretino, the literary brave, of influence and audacity hitherto unexampled, who figures so strangely in the chronicles of the time. Titian sent a portrait of him to Gonzaga, duke of Mantua. A great affliction befell him in August 1530 in the death of his wife. He then, with his three children—one of them being the infant Lavinia, whose birth had been fatal to the mother—removed to a new home and got his son Orsa to
come from Cadore and take charge of the household. The pension, difficult now to find, is in the Birli Grande, then a fashionable suburb, being in the extreme end of Venice, on the sea, with beautiful gardens and a look-out towards Murano. In 1552 he painted in Bologna a portrait of the emperor Charles V., and was created a count palatine and knight of the Golden Spur, his children also being made nobles of the empire—for a painter, honours of an unexampled kind.

The Venetian government, dissatisfied at Titian's neglect of the work for the ducal palace, ordered him in 1558 to refund the money which he had received for time unoccupied; and Foppone, his formidable rival of recent years, was installed in his studio. This was a year or two after the death of Titian, who had meanwhile applied himself diligently to painting in the hall the battle of Cadore, was reinstated. This great picture, which was burned with several others in 1577, represented in life-size the moment at which the Venetian captain, D'Alviano, fought the enemy, with horses and men crashing down into the stream. Fontana's engraving, and a sketch by Titian himself in the gallery of the Uffizi in Florence, record the energetic composition. As a matter of professional and worldly success, his position from about this time may be regarded as his. That he was more than a painter is more than evident in his relations with Raphael, Michelangelo, and at a later date Rubens. In 1540 he received a pension from D'Alvino, marquis del Vasto, and an annuity of 200 crowns (which was afterwards doubled) from Charles V. on the treasury of Milan. Another source of profit—for he was always sufficiently keen after money—was a contract, obtained in 1542, for supplying grain to Cadore, which he visited with regularity almost every year, and where he was both generous and influential. This reminds us of Shakespeare and his relations to his birthplace, Stratford-on-Avon; and indeed the great Venetian and the still greater Englishman had something of the same inspiration and performance, and in the personal tendency of each to look after practical success and "the main chance" rather than to work out aspirations and pursue ideals. Titian had a favourite villa on the neighbouring Manza Hill, from which (it may be inferred) he made his chief observations of landscape form and effect. The so-called "Titian's mill," constantly discernible in his studies, is at Collolonto, near Belluno (see R. F. Heath's Life of Titian, p. 3). A visit was paid to Rome in 1546, when he obtained the freedom of the city, his immediate predecessor in that honour having been Michelangelo in 1537. He could at the same time have succeeded the painter Fra Sebastiano in his lucrative office of the plombo, and he made no scruple of becoming a friar for the purpose; but this project lapsed through his being summoned away from Venice in 1547 to paint Charles V. and others, in Augsburg. He was there again in 1559, and executed the portrait of Philip II., which was sent to England and proved a potent auxiliary in the suit of the prince for the hand of Queen Mary. In the preceding year Vecelli had advanced his daughter Lavinia, the beautiful girl whom he loved deeply and painted various times, to Cenello Sarcinelli of Serravalle; she had succeeded her aunt Ora, now deceased, as the manager of the household, which, with the lordly income that Titian made by this time, was placed on a corresponding footing. The marriage took place in 1554. She died in childbirth in 1560. The years 1551 and 1552 were among those in which Titian worked least assiduously—a circumstance which need excite no surprise in the case of a man aged about seventy-five. He was at the Council of Trent towards 1555, of which his admirable picture or finished sketch in the Louvre bears record. He was never in Spain, notwithstanding the many statements which have been made in the affirmative. Titian's friend Arcinio died suddenly in 1556, and another close intimate, the sculptor and architect Jacopo Sansovino, in 1570. With his European fame, and many sources of wealth, Vecelli is the last man one would suppose to have been under the necessity of writing querulous and dunning letters for payment, especially when the defaulter addressed was lord of Spain and of the American Indies; yet he had constantly to complain that his pictures remained unpaid for and his pensions in arrear, and in the very year of his death (February) he recites the many pictures which he has within the preceding twenty years without receiving their price. In fact, the ground for thinking that all his pensions and privileges, large as they were nominally, brought in but precarious returns. It has been pointed out that in the summer of 1566 (when he was elected into the Florentine Academy) he made an official declaration of his income, and put down the various items apparently below their value, not naming at all his salary or pensions. Possibly there was but too much reason for the omission.

In September 1565 Titian went to Cadore and designed the decorations for the church at Pieve, partly executed by his pupil, the former in the palace of the prince of the ancient family Morosini. In 1568 the Franciscans of the church of Santa Maria del Rosario (now in S. Salvatore, Venice), inscribed "Titianus fecit," by way of protest (it is said) against the disparagement of some persons who cavilled at the veteran's failing handicraft. He continued to accept commissions to the last. He had selected as the place for his burial the chapel of the Crucifix in the church of the Frari; and, in return for a grave, he offered the Franciscans a picture of the "Pieta," representing himself and his son Orazio before the Saviour, another figure in the composition being a sibyl. This work he nearly finished; but some part of it was subsequently (and by himself) added, so that the young Titian is involved in his native Pieve. Titian was ninety-nine years of age (more or less) when the plague, 1 which was then raging in Venice, seized him, and carried him off on the 27th of August 1576. He was buried in the church of the Frari, as at first intended, and his "Pieta" was finished by Palma Giovane. He lies near his own famous painting, the "Madonna di Casa Pesaro." No memorial marked his grave, until by Austrian command Canova executed the monument so well known to sightseers. Immediately after Titian's own death, his son and pictorial assistant Orazio died of the same epidemic. His sumptuous mansion was plundered by the plague, thieves, who prowled about, scarce controlled.

Titian was a man of correct features and handsome person, with aristocratic gifts of penetrating observation and self-possessed composure—a Venetian presence worthy to pair with any of those "most potent, grave and reverend signors" whom his pencil has transmitted to posterity. He was highly distinguished, courteous and winning in society, personally unassuming, and a fine speaker, enjoying (as is said by Vasari, who saw him in the spring of 1566) health and prosperity unequalled. The numerous heads currently named Titian's Mistress might dispose us to regard the painter as a man of love and pleasure; but all this is not only refuted in every statement of his life, but that these titles are mere fancy-names, and no inference one way or the other can be drawn from them. He gave splendid entertainments at his palace; and for the coming of Henry III. of France passed through Venice on his way from Paris to his imperial chair, he called on Titian with a train of nobles, and the painter presented him as a gift with all the pictures of which he inquired. He was a man of much learning and accomplishment, like Leonardo da Vinci and Michelangelo; his one great and supreme endowment was that of painting.

Ever since Titian rose into celebrity the general verdict has been that he is the greatest of painters, considered technically. In the first place neither the method of fresco painting nor work of the colossal scale to which fresco painting ministers is here in question; Titian, as province is that of oil painting, and of painting in a scale which, though often large and grand, is not colossal either in dimension or in inspiration. Titian may properly be regarded as the greatest manipulator of paint in relation to colour, tone, nuance, richness, texture, surface and harmony, and with a view to the production of a pictorial whole conveying to the eye a true, dignified and beautiful impression of its general subject-matter and of the objects of sense which form its constituent parts. Titian, as province is that of the essentially natural scheme of composition, another and essentially in painting, nor can one forecast the time in which he will be deposed. For the complex of qualities which we sum up in the words colour, handling and general force and harmony of effect, he stands unapproached. Though items in Titian's work may be superseded—indeed, not to speak of creative invention—some painters, one in one respect and another in another, may indisputably be preferred to him. It is impossible to point to that one work of the Venetian school of which the first masterpieces are due to the two Bellini, to Carpaccio; and, with more fully developed suavity of manner, to Giorgione. Pre-eminent inventive power or subtlety

1 Out of a total population of 190,000 there perished at this time 50,000.
of intellect he never evinced. Even in energy of action and more especially in majesty or influence of composition the palm is not his; it is (so far as concerns the Venetian school) assignable to Tintoretto. Titian is a painter who by wondrous magic of genius and feeling, he puts in touch with the eye, and through the eye the feelings—sometimes the mind.

Titian's pictures abound with memories of his home-country and of the region which led from the hill-summits of Cadore to the quiet vale of the Po. His palette is that of the poet. All his painting is fresh, he exhibits an appreciation of mountains, mainly those of a turreted type, exemplified in the Dolomites. Indeed he gave to landscape great form and character. Titian's early landscapes exhibit the objects of nature and their control over the sentiments and imagination with a force that had never before been approached. The earliest Italian picture expressly designated as "landscape" was one of the "Vestali" which he painted in 1565, and his fame was immense, even when we allow for the abnormal length of his professional career. In Italy, England and elsewhere more than a thousand pictures figure as Titian's; of these about 250 may be regarded as dubious or spurious. There are, for instance, the portraits in the National Gallery, London, 18 in the Louvre, 16 in the Piti, 18 in the Uffizi, 7 in the Naples Museum, 8 in the Venetian Academy (besides the series in the private meeting-hall) and 41 in the Museum. In the National Gallery, other works used to be assigned to Titian, but are now regarded rather as examples of his school.

Naturally a good deal of attention has been given by artists, critics and collectors to the study of Titian's landscapes to obtain such astonishing results in colour and surface. The idiosyncrasy of this research is but meagre; the secret seems to be not so much in these qualities as in the skill with which he worked with the brush dipped in a brown solution, and then altered and worked up as his intention developed. The later paintings were touched off rapidly, telling well from a distant view. He himself avowed that "he knew no better art in the world than to paint in art; and in his very last days he said—certainly with the modesty of genius, perhaps also with some of the tenacity of age—that he was then beginning to understand what painting meant. In his old age he entered the garment of colour rests mainly upon red and green, in the later ones upon deep yellow and blue. The pigments which he used were nothing unusual; indeed they were both fresh and cheap. Palladium. He was to possess them as well as the reds; and the copper, he was to use them in his final operations he had often more with finger than with brush. It has been said, and probably with truth, that he tried to emulate Palma Vecchio in softness as well as Giorgione in richness. Michelangelo's verdict after inspecting the picture of "Christ in the Main of Gold," executed in 1546, has often been quoted. He said, "That man would have had no equal if art had done as much for him as nature." He was thinking principally of severity and majesty of thoughtfulness, for he added, "Pity that in Venice they don't learn how to draw well." As a draughtsman of the human figure Titian was not only competent but good and fine, and he is reported to have said that he could draw a human figure in any position that he felt not a little short of the standard of Michelangelo, and even of other leading Florentines. He was wont to paint in a nude figure with Venetian red, supplemented by a little lake in the contour and sometimes augmented by. some artificial contour. His other works bear evidence to manipulate white, black and red, and that the carnations cannot be done in a first painting, but by replicating various tints and mingling the colours. He invented a "method of succession in the stroke of colour as applied to draperies—working on the principle (in which Giorgione may perhaps have forestalled him) that red comes forward to the eye, yellow retains the rays of light, and blue assimilates to shadow. In his subject-pictures the figures are not very numerous, and the attitudes are mostly reserved; even in bacchanals, or battles the athletic display has more of facility than of fury. His architectural scenes were sometimes executed by other persons, especially of the celebrated family of Giambono; and the passionate ardour of early sundown, was much affected by Titian in the lighting of his pictures. Generally it may be said that he took great pains in completing his works, although the temper of his using the brush, a hard-harsh hand he had little liking for teaching, partly from distaste of the trouble, and partly (if we are to believe biographers) from jealousy. He was quite willing, however, to take to a workshop when the work was going out of doors he would leave his studio open, so that the pupils had a clandestine opportunity of copying his works, and if the copies proved of salable quality he would buy them cheap, touch them up.

Titian's family relations appear to have been happy, except as regards his eldest son, Pomponio. This youth, at the age of six, was launched upon the ecclesiastical career; but he proved wasteful and prodigal, was turned off by the church, and at last obtained the transfer to a nephew of a benefice destined for Pomponio. The fortune which he left was, after his decease, squandered by the tissued prodigal. The other son, Orazio, born towards 1528, who (as we have seen) assisted Titian professionally, became a portrait-painter of mark—some of his likenesses, almost comparable with Titian's own, being often confounded with his by owners and connoisseurs. He executed an important picture in the year 1605, the "Entombment of Christ," which, if not of the same time which might have been bestowed upon painting. Several other artists of the Vecelli family followed, in the wake of Titian. Francesco Vecelli, his elder brother, was initiated into the art of painting probably by his father (but chronology will hardly admit of this), and painted in the church of S. Vito in Cadore a picture of the titular saint armed. This was a mark of dedication, and a very profane and carnal practice; so Francesco was diverted from painting to soldiering, and afterwards to mercantile life. Marco Vecelli, called Marco di Tiziano, Titian's nephew, born in 1545, was constantly with him in his old age. The celebrated painter died in a hospital in 1620, and in 1621 his brother Francesco. Marco called Tiziano (or Tizellino) painted early in the 17th century. From a different branch of the family came Fabrizio di Fettore, a painter who died in 1586. His brother Cesare, who also left some pictures, is well known by his book of engraved costumes "Arbini antichi e moderni." Tommaso Vecelli, also a painter, died in 1620. There was another relative, Girolamo Dante, who, being a scholar and assistant of Titian, was called Girolamo di Tiziano. Vincenzo Correr was probably his pupil. He was found it difficult to distinguish from originals. Apart from members of his family, the scholars of Titian were not numerous; Paris Bordone and Giovanni Battista Tintoretto were counted the most important. Francesco Torelli (Theotocopuli) was employed by the master to engrave from his works. It is said that Titian himself engraved on copper and on wood, but this may well be questioned.

We have seen that Titian was a prodigal in his expenditure of his individual works, taking them in approximate order of time, and merely dividing portraits from other pictures. Details already given indicate that he did not exhibit any extreme precocity; the earliest works which we proceed to mention may date towards 1505. In the chapel of S. Rocco, Venice, is his "Christ Carrying the Cross," now greatly dilapidated; it was an object of so much popular devotion as to produce offerings with which it is now enveloped. The first exhibition of his works in the scuolo is his "Man of Sorrows." The nobly beautiful picture in the Villa Borghese in Rome, commonly named "Divine and Human Love" (by some, "Artless and Sated Love"), bears some resemblance to the "Christ and the Pharisais," but the sitter that goes that Titian was enamoured of Palma's daughter; but nothing distinct on this point is forthcoming. The "Triste Money" ("Christ and the Pharies"), now in the Dresden Gallery, dated towards 1508; Titian is said to have painted this highly finished yet not yet "niggling" picture in order to prove to some Germans that the effect of detail could be produced without those extreme minutiae which mark the style of Albert Dürer. The St. Mark in the church of the Salute—the evangelist enthroned, along with SS. Sebastian, Roch, Cosmo and Damian—a picture much in the style of Giorgione, belongs to 1512. Towards 1518 was painted, also in the same class of work, the "St. George and the Dragon," now in Turin. The picture of Christ, holding the guides of a shepherd on a reed-pipe, two sleeping children, a cupid, an old man with two skulls, and a second shepherd in the distance—one of the most poetically impressive among all Titian's works—was painted in 1512. For another figure of "St. John the Baptist" in the Moldor Museum, showing a statue of Venus, two nymphs, numerous cupids hunting a hare, and other figures. Two of the pictures in the National Gallery, London—the "Holy Family and St Catherine" and the "Noli me tangere"—were going on at much the same time as the great "Assumption of the Madonna." In 1521 Vecelli finished a painting which had long been due to Duke Alphonso of Ferrara, probably the "Bacchanal," with Ariadne doing over her wine-cup, which is now in Madrid. The famous "Bacchus and Ariadne," in the National Gallery was produced for the same patron in 1523. The "Flora of the Uffizi," the "Venus of Parnassus," the "Christ in the Cornfield," and the "Manner of Water Gallery may date a year or so earlier. Another work of 1533 is the stupendous "Entombment of Christ" in the Louvre, whose depth of colour and of shadow stands as the pictorial equivalent of individual facial expression: the same composition, a less admirable work, appears in the Manfrini Gallery. The Louvre picture comes from the Gonzaga collection and from the gallery of Charles I. It is said to have been purchased for the church of SS. Giovanni e Paolo; for this work he bore off the prize in competition with Palma Vecchio and Pordenone. Of all his pictures this was the most dear to him from the action, while it 18 the style of his in the same year. It showed the influence of Michelangelo, who was in Venice while Vecelli was engaged upon it. A calamitous fire destroyed it in 1807; the copy of it which was taken to Naples was sold, and another one to the National Gallery in London. To 1531 belongs also the "Madonna del Coniglio" (Louvre), painted for Gonzaga; and 1536 the "Venus of Florence"; to 1538 the portraits of the "Twelve Caesars" for Gonzaga; and to 1539 the "Presentation of the Virgin in the Temple"—one of the

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conspicuous examples in the Venetian Academy, yet not of the first interest or importance. About 1540 were done the forcible but rather unsupervised paintings for S. Spirito, Venice, now in the church of the same name. Among them are the "Abraham and the Two Sacrifices," and "David and Goliath"; in 1543 the "Ecce Homo" of the Vienna Gallery, where Aretho figures as Pilate. The "Venus and Cupid," of Florence, the "Venus" of Madrid and the "Supper of Emmaus" in London are among the most important works of this period. In 1544 Titian was summoned to Augsburg in 1547. In 1554 he sent to Philip II. in England a second "Danac" and a "Venus and Adonis." About the same year he painted "St. Charles," at Brussels, in which he himself termed it, "Last Judgment," which represented the emperor, with his family and others, all in shrouds, praying to the Godhead; Moses and various other personages are also portrayed. This painting, which was continued and not fixed until the film of death closed on them. Later pictures, from 1558 onwards, are the "Martyrdom of St. Lawrence," "Christ Crowned with Thorns" (Louvre), Diana and Actaeon, "Diana and Actaeon" (1561), "The Magdalen" (also "The Magdalen of St. Jerome") in the Brera Palace, the "Venus of Medici" in the Uffizi, "Diana in the Garden," and "Europa"—the last six for Philip II.; of the two Diana subjects there are duplicates in London and in Vienna. Philip, it will be observed, was equally a master of nudes and titans with sanctities. The "Jupiter and Antiope," now much restored, is commonly called "La Vénus d’Hano," having at first been in the Pardo Palace. The "Magdalen" here spoken of (1561) seems to have been the first picture to turn the work of Titian, and it is a dulae letters, said that it was the most popular picture he had ever painted. In 1563 Vecelli offered to Philip II. his "Last Supper," which had been in hand for six years; it was cut down in the Escorial to suit a smaller space. A later preparatory work was more noticeable in carefully grouping. The "St Jerome" of the Brera Gallery in Milan, a work of wonderful energy, spirit and force, especially for a more than occasion; it is impossible to say whether the laurel that marked it as a replica of the in Escorial. One of the master’s latest pictures (1574-1575) is in Madrid, and commemorates the "Battle of Lepanto"; it is a work of failing power—but still the power of a Titian. The "Death of Seneca" (Louvre) was bought by the king of France, and is in the Louvre. In Berlin, has a head of the Empress Marie Theresa, and a portrait of her daughter. In the Dresden Gallery, with a jewelled casket in Lord Cowper’s collection; the Cornelio Family (Alnwick Castle); "L’Homme au Gant" (Louvre), an unknown personage, youthful and handsome, the now in the National Gallery, London. Antiope duchess of Urbino, Francesco duke of Urbino, Caterina Cornaro queen of Cyprus (these four are in the Uffizi); Charles V. on horseback (Madrid); Cardinal Bebomo (Naples), discovered in an uncovered—condition in 1878, very unlike the portrait in the Barberini Gallery. The female portraits done by Titian are few, and are almost invariably of women of exalted rank. Of Ariosto, with whom Titian was intimate, there are probably only "having been nothing approaching to a romantic friendship between them, the painter is said to have done three portraits. Much uncertainty, however, besets this matter. One of the three appears as a woodcut in an edited version of Ariosto’s work. Formerly in the Hall, corresponds with the woodcut likeness, and is signed "Titianus F."—a work of admirable beauty; it is now in the National Gallery of London. It is difficult, however, to reconcile the features here with those of the portrait in the Hall (1637). "Ariosto" at the National Gallery is also in the gallery another and singularly beautiful portrait which used to be called "Ariosto" by Titian, then was assumed to be "Ennomus" by Van Noort. Titian, but not as representing a poet. Authorities.—For English readers, the Life and Times of Titian by Crowe and Cavalcaselle (1877) superseded all previous works, such as the earlier work of Sir Hubert in London History, 1859. There is now also the translation (1904) of the monumental German work (1900) by George Gronau, which may be regarded as taking the first place of all. Claude Phillips has brought out two valuable books on Titian. "Titian in the Early Period" and "Titian in the Late," which should be consulted on controversial details. Josiah Gilbert’s book, Cadore, or Titian’s Country (1865), supplies many interesting sides. R. W. Symonds’ monograph (1885) is founded mainly on Crowe and Cavalcaselle and comes of course to form a very convenient compendium.

(W. M. R.)

TITLE (O. Fr. title, mod. titre, from Lat. titulus), an inscription prefixed to a book or other writing, designating the name by which it is to be known, and in many cases indicating the scope of the book or some idea of the nature of its contents. Further, the term is extended to the descriptive heading or caption to a document, such as a deed or other instrument, or to a bill or act of parliament. Another general meaning is that of an appellation of rank (see Titles of Honour, and the articles Emperor, King, Prince, Majesty, Highness, Duke, &c.). In law title is equivalent to the right of ownership. The instruments in writing forming the evidence of title to land are the title-deeds (see Conveyancing; Land Registration). In ecclesiastical usage, the word "title" (titulus) are used of certain churches in Rome to which districts were attached their history being of importance in the evolution of the Roman cardinalate (see Cardinal). It was also used, as now, for a condition precedent to ordination; in the early Roman Church an appointment to officiate in a particular church; this was extended gradually from the idea of locality to that of evidence of means of support. In the Church of England the candidate must have "supernumeraries," or other canons have by their function"; for deacon’s orders he must have a nomination to a curacy, and for priest’s orders either that or a presentation to a living. A fellowship or chaplaincy at the University of Oxford or Cambridge is also a sufficient "title."
companies of the United States; but the pamphlet seems to have been forgotten. The first company actually to undertake the guarantee of real estate titles was formed in Philadelphia, Pennsylvania, in 1876. It differed from the Prussian Mortgage Insurance Company (whence the word "title") in that its business is run by a dealer in, and custodian and guarantor of, mortgages) in which its main business was the issue of a policy of guarantee on a transfer of title to land. The advantages of its method were immediately recognized. Corporations of this kind were established in Washington, Baltimore, Boston and New York, in the order named, and subsequently in nearly every considerable city in the United States.

In order to be independent of the inaccurate and clumsy methods of the public record offices, title guarantee companies generally compile in their own office a copy or digest of all the real estate records of the locality in which they have established a branch for this purpose a staff of skilled clerks. To make the necessary examination of a title prior to the issuing of a guarantee, they require copious documentation and must be experienced real estate lawyers. By these means a title can be examined and guaranteed in a week, whereas thirty or forty days was formerly required. This has done much to make real estate available capital, for individual and corporate lenders on mortgage accept the guarantee of the companies as the best evidence of title, and loans can be had without the delay that once prevailed.

The expense of maintaining the staff of clerks and lawyers is greatly offset by the saving on the gross charges on titles guaranteed. Strictly speaking, the risks outstanding are also large, running up to $100,000,000 a year for a single company in New York City; but in practice the instances in which the losses are very small, not exceeding 2% of the gross charges on titles guaranteed, in that the obligations should scarcely be called risks. In spite of the office expenses, the charges for first bringing a piece of land under the guarantee, and for renewals, are usually very moderate, amounting each time of examination and opinion by counsel, amounting to about one-half of 1% on the value of the property or on the amount of the mortgage; and when once the guarantee has been issued, it is re-issued on a subsequent sale or mortgage on short notice for a small fee.

(T. H. K.)

**TITLES OF HONOUR.** "Those various names of greatness or eminency, which are the most distinguishing titles of civil dignity" (John Selden, *Titles of Honer*, 3rd ed., 1672). This definition covers, if we understand "civil" in its proper and widest sense, all titles, whether official or honorary, civil or military, temporal or ecclesiastical, of which men have been invested with the powers and attributes which are possessed by those who hold titles of honour. In this use of the word, we now understand by titles of honour what Selden calls "honorary titles," i.e. distinctive designations implying rank and dignity, not office or vocation. The broader definition would cover all titles, including those of military and ecclesiastical rank, of municipal office and of university degrees. The narrower definition, which it is proposed to adopt for the purposes of this article, would cover only what in the United Kingdom are known as the "titled classes," which embraces only those whose titles are meaningless save as a mark of rank. In this category it is, however, necessary to include, somewhat illogically, the highest titles of all—those of "kings," which are no more than others were in the habit of paying to the office expenses,

Throughout the eighteenth century various subtile hypotheses were advanced alleging that the titles of all the sovereigns of Europe were derived from certain Roman dignitaries, or from the Roman and the Frankish Emperors. In the French Revolution, the abolition of all aristocratic titles has been proposed as a means of abolishing all distinction of titles, and the restoration of a commonality of all the persons in the society. This was the object of the *pamphlet* of 1792, "Les titres de noblesse," which gave rise to the *Dictionnaire de la Noblesse* (1793). In the French Revolution, the abolition of all aristocratic titles has been proposed as a means of abolishing all distinction of titles, and the restoration of a commonality of all the persons in the society. This was the object of the *pamphlet* of 1792, "Les titres de noblesse," which gave rise to the *Dictionnaire de la Noblesse* (1793).

1 Many proper names are but primitive titles in disguise: e.g. Henry (q.v.) = "ruler of the home," or Walter = "lord of power."
devising new forms. It was not until the 17th century that they became fixed, under the influence mainly of the newly organized international diplomatic service (see DIPLOMACY). But meanwhile they had developed from the simplicity of the early feudal age into a Byzantine pomposity, the exuberance of which bored even the ceremonious court of Spain into a free use of the pruning knife. Honorary styles are, for the rest, now mere stereotyped formulas; the words that compose them have— to use Emerson's phrase—" polarized " and deprived of meaning. Not otherwise could a German journalist, late in the 19th century, have recorded, without exciting surprise, that " to-day their All-highest majesties went to church to confirm the baptism of their highest blood. "

The title "sir" is the English equivalent of the Latin term "sirius," a rare form of the word "sire," now more common in the form "sheriff." Other noble titles are generally of Latin origin, like earls, viscounts, and barons, though "knight," also of Latin origin, has developed somewhat in the English language to mean "man of honor." Titles are also used to denote the rank of officers in the army, navy, or air force. The word "major," for example, comes from the Latin "marius," meaning "soldier," and "general" comes from the Latin "generalis," meaning "leading." Titles are also used to denote the rank of officers in the army, navy, or air force. The word "major," for example, comes from the Latin "marius," meaning "soldier," and "general" comes from the Latin "generalis," meaning "leading." Titles are also used to denote the rank of officers in the army, navy, or air force. The word "major," for example, comes from the Latin "marius," meaning "soldier," and "general" comes from the Latin "generalis," meaning "leading." Titles are also used to denote the rank of officers in the army, navy, or air force. The word "major," for example, comes from the Latin "marius," meaning "soldier," and "general" comes from the Latin "generalis," meaning "leading." Titles are also used to denote the rank of officers in the army, navy, or air force. The word "major," for example, comes from the Latin "marius," meaning "soldier," and "general" comes from the Latin "generalis," meaning "leading." Titles are also used to denote the rank of officers in the army, navy, or air force. The word "major," for example, comes from the Latin "marius," meaning "soldier," and "general" comes from the Latin "generalis," meaning "leading." Titles are also used to denote the rank of officers in the army, navy, or air force. The word "major," for example, comes from the Latin "marius," meaning "soldier," and "general" comes from the Latin "generalis," meaning "leading." Titles are also used to denote the rank of officers in the army, navy, or air force. The word "major," for example, comes from the Latin "marius," meaning "soldier," and "general" comes from the Latin "generalis," meaning "leading."
pequely aristocratic virtue ascribed by Lord Palmerston to the most Noble Order of the Garter: "There is no damned merit about it;" it has the crowning quality that it must needs be the monopoly of the few. Hereditary titles sink in value, indeed, just in proportion as they become common. In the United Kingdom their value has been kept up by the rule of primogeniture: there can be only one hearer of such a title in a single generation. In France custom distributes the various titles of a family among all the sons, the eldest son, for instance, of a duke inheriting his dukedom, the second son his marquisate, the third son his barony, and so on, until the title pass to all the sons in each successive generation, though in Prussia the rule of primogeniture has been introduced in the case of certain new creations (e.g. Fürst, prince). The result is that equivalent titles vary enormously in social significance in different countries. An attempt has been made to estimate the extent of this variation in the case of individual titles in articles devoted to them. Here we need only illustrate the argument by one striking example. The Russian title of "prince" (knyaz) implies undoubted descent from the great regal houses of Russia, Poland and Lithuania; but the title descends to all male children, none of whom is entitled to represent it par excellence. There may be three or four hundred princes bearing the same distinguished name; of these some may be great nobles, but others are not seldom found in quite humble capacities—waiters or dressykh drivers. The title in itself has little social value.

In the countries east of the marches of the old Empire, i.e. Hungary and the Slav lands, existing titles are partly developed from the native tradition (feudal in Hungary, Bohemia and Poland; autocratic and Oriental in Russia and the lands of the Balkan peninsula), partly borrowed from the West, like that of graf (count) in Hungary and graaf in Russia. Just as in autocratic Russia the sole indigenous title of honour (knyaz) is associated with royal descent, so in the Mahomedan East there are, outside the reigning families, no hereditary titles, except that of sheriff, already mentioned. In India the hereditary styles of certain great Mahomedan nobles are exceptions that prove the rule; they represent reigning families whose raj has been absorbed in the imperial government, and they are still reigning princes in the sense in which the heads of German mediatised principalities and of the Austro-Hungarian Empire are styled "Hereditary Monarch," but the titles of Oriental princes follow much the same gradation as those of the West. As caliph (g.v.), or vicar of the Prophet, the Ottoman sultan is in Islam the equivalent of the pope in Roman Catholic Christendom; his imperial dignity is signified by the Persian title of padishah (lord king), his function as leader of a militant religion by the style of "commander of the faithful" (see AMIR). Shah is in Persia the equivalent of king; the style of shah-in-shah, king of kings, recalls the days of the Persian "great king" familiar in the Old Testament. Khan (prince) and amir (commander, lord) are other Eastern sovereign titles. Pasha and bey, originally exclusively military titles, are now used also as civilian titles of honour, but they are not hereditary. When the pashalik of Egypt was made hereditary the situation was ultimately regularized by bestowing on the pasha the Persian title of khedive (g.v.). In the Far East, Japan has adopted a system of titles, based on her ancient feudal hierarchy, which closely corresponds to that of Europe (see JAPAN). China, on the other hand, stands apart in the curious custom of bestowing titles on the ancestors of persons to be honoured, and in making them hereditary only for a limited number of generations (see CHINA: Social Customs). In Europe such ennuminous titles are rendered only in the case of knighthood (see CANNONIZATION).

Of ecclesiastical titles of honour it can only be said that they tend to an even greater exaggeration than those bestowed on secular dignities. The swelling styles of the Eastern patriarchs are relics of the days when Rome, Constantinople, Antioch, Alexandria and Jerusalem were vying with each other for precedence (see CHURCH HISTORY and PATRIARCH). The style

The designation barin (boyarin, boyar) is not, properly speaking, a title, but the equivalent of "gentleman."
of the bishop of Rome, who alone in the Western Church retains the name of pope, includes the old Roman titles of pontificis maximus and pater patriae, and always in his signatures the proudly humble phrase "slave of the slaves of God" (serves servorum Dei), based on Matt. xx. 27 (see PONTIFEX). Of ecclesiastical titles those expressing orders and no more—priest, deacon, sub-deacon—and the rest—are never honorary (Prior[p] John, q.v., is a shadowy medieval exception). Those expressing office, whether in the Church at large (patriarch, archbishop, &c.) or in the papal court (e.g. protonotary), are often merely honorary. That of bishop even became for a time, after the Reformation, a title borne by certain secular princes (see Bishop). "Cardinal," which with the predicate Eminence (q.v.) is now reserved for the princes of the Roman Church, was at one time the honorary style of the chief clergy of great cathedrals generally (see CARDINAL). "Abbot," the official title of the head of the monastery, has also in several languages (e.g. Icelandic), besides this secular title, an ecclesiastical one (see ARCHDEACON). For the honorary styles of the clergy in the English-speaking countries, see the articles REVEREND, VICAR, RECTOR, CANON, DEAN. As for the archdeacon, it is only in the Church of England that he can be still defined as "one who performs archi-deaconal functions"; elsewhere, if he exists at all, he is purely titular (see ARCHDEACON).

Among titles of honour, finally, may be reckoned honorary degrees bestowed by universities, the pope, and in England by the archbishop of Canterbury. Any degree may be bestowed hono-re causa. The University of Oxford and Cambridge thus regularly below the degree of D.D. (doctor of divinity) on those of their alumni who become bishops. It is also the custom to bestow honorary degrees at the yearly "Commemora-tion" (generally D.C.L., doctor of civil law, at Oxford; L.L.D., doctor of laws, at Cambridge) on a selected list of eminent personages. The right of the archbishop of Canterbury to confer degrees honoris causa, known as "Lambeth degrees," is supposed to be derived from one of his powers as legatus natus of the pope, which survived the Reformation. An attempt was made by some of the Swiss reformers of the 16th century to abolish degrees. They were certainly "popish" in origin, and others besides Herbert Spencer have objected to them as misleading, since they are by no means necessarily a hallmark of learning. They tend, however, to multiply rather than to decrease in number, and in England some criticism has been aroused by the growing custom in certain quarters of assuming degrees (notably that of D.D.) granted corruptly, or for wholly insufficient reasons, by certain so-called "universities," notably in the United States. For a list of the degrees of the principal universities and their hoods, see UNIVERSITIES, ad fin.

The history of many peerage and other titles is outlined in the articles on historic families in this work. For British peerage titles the standard work is G. E. C. (okayne)'s Complete Peerage (1st ed., 8 vols., 1887; new ed., vol. i., 1910). For baronets and others see the manuals of Burke's and Debrett. The standard authority for the royal houses and "high nobility" of Europe is the Almanach de Gotha, published yearly. See also the article NOBILITY, and for further references the authorities attached to those on individual titles, e.g. COUNCIL.

TITMOUSE (O. Eng. missa and passa, Ger. Maus, Sweed. med, Du. mees, Fr. mésange), the name long in use for several species of small European birds, which are further distinguished from one another by some characteristic appellation. These go to make up the genus Parus of Linnaeus, and with a large number of other genera form the Passerine family Paridae. Titmice are usually non-migratory, and the genus Parus occupies most of the globe except South America and the Australian region east of Lombok and Flores.

1 The prefix "fit" by heedless writers often used alone, though equally proper to the titlark (see PRTT), is perhaps cognate with the Greek titos, which originally meant a small chirping bird (Ann. Nat. Hist., ser. i. p. 237). The term is still in use in Iceland Titling—"the English or at least Scottish titling. It is by false analogy that the plural of titmouse is made titmice; it should be titmouses. A nickname is very often added, as with many other familiar English birds, and in this case it is "tom."

Among the more common European and English forms the first to be mentioned is that called, from its comparatively large size, the coal-titmouse, T. ater. The coal-titmouse, but not the oxyee, conspicuous by its black head, white cheeks and yellow breast, down which runs a black line, while in spring the cock makes himself heard by a loud voice that resembles the noise of a brass instrument. It is widely distributed over the British Islands and over nearly the whole of Europe and northern Asia. The next is the blue titmouse, bluecap or nun, P. coeruleus, so called because of the last of the series of changes it undergoes. It is widely distributed over Europe and Asia Minor. It is not very strictly to make any description needless. A third common species, but not so numerous as either of the foregoing, is the coal-titmouse, P. ater, distinguished by its black cap, white cheeks and white nape. The last species treated is a species of the后者, in which the difference observable between the races inhabiting the scanty remnants of the ancient Scottish forests and that which occurs throughout the rest of Great Britain is too insignificant to warrant the formation of a new species, or even a distinct race; the bird, in other words, being either only, or at least the western portion of the pack, hardly either of which colours are to be seen in the same parts of more southern examples, which last have been described as forming a distinct species, P. brunnicaucus. But it is to be feared that the denizens of the old Scot shrub-woods are nearly midway in coloration between the dingy southern birds and those which prevail over the greater part of the continent of Europe. It would therefore seem unreasonable to speak of two species only; there should be either three or one, and the latter alternative is to be preferred, provided the existence of the local races be duly recognized. Much the same thing may be said of the blue titmouse, in which the differences are much more noticeable, especially in the "Norridkarls," P. bicalensis, P. camchatkanus and others, whose names denote its local variations in northern Asia, while no great violence is exer-cised if these be tacked on T. ater, with several geographical races which inhabit North America. A fifth British species, the rare crested titmouse, P. cristatus, only found in limited districts in Scotland, though common enough, especially in pine-woods, in the interior of Europe.

In addition to species of Parus, North America possesses two peculiar genera of tits—Psaltriparus and Auroiparus. During the greater part of the year the various species of the genus Parus associate in the same family parties, the leader regularly being the breeding pair. The nearest always placed in a hollow stump, and consist of a mass of moss, feathers and hair, the last being worked almost into a kind of felt. Thereon the eggs, often to the number of eight or nine, are laid, and these have a translucent white shell, freckled or spotted with rust-colour. The first plumage of the young closely resembles that of the parents; but, so far as is known, it has always a yellower tinge, very apparent on the parts, if there be such, which in the adult are white. Few birds are more restless in disposition. Most of the European species and some of the North Americans become familiar, haunting the gardens, and serving as useful agents by getting themselves of such scraps of food, about the nature of which they are not particular, as they can get.2 By gardeners every titmouse is generally regarded as an enemy, for it is supposed to do infinite damage; but, as the bird lives chiefly on insects, this impression is wholly false, for the birds destroyed are always found to be those to which a grub—the bird's real object—has got access, so that there is no doubt that the titmouse is a great benefactor to the horticulturist.

Akin to the genus Parus, but in many respects differing from it, is Acrisius, containing that curious-looking bird the long-tailed or bottle titmouse, with many local races or species. The bird itself, having its tail longer than its body, is unlike any other found in the northern hemisphere, while its nest is a perfect marvel of construction, being in shape nearly oval, with a small hole in one side. The exterior is sided with piece of kitchen, worked into a thin piece of moss, wool and spiders' nests, and the inside is profusely lined with soft feathers—2379 having been, says Macgillivray, counted in one. Not a single grain is left in it. It is built by the penduline titmouse, Aegithalos pendulinus, of the south of Europe, which differs, however, not merely in composition, but in being suspended to a bough, while the former is nearly always placed between two or more branches.

The so-called bearded titmouse, Parus brunnicus, has habits wholly unlike those of any of the foregoing, and is now placed in a

2 The signification of this name is obscure. It may perhaps be correlated with a Swedish name for the bird—Talgse, the name generally given to the whole genus, there being little trouble providing a pleasing spectacle by adopting the plan, practised by the late A. E. Knox, of hanging a lump of suet or tallow by a short string to the end of a flexible rod stuck aslant into the ground close to the nest, and then observing the results. From the abundance of some kind finds the dainty, and once found visits are made to it until every morsel is picked off. The attitudes of the birds as they cling to the swinging lure are very diverting, and none but a titmouse can succeed in keeping a foothold upon it.
a separate Passerine family—Panuridae. It was formerly found in many parts of England, especially in the eastern counties, where it bore the name of reed-pleasant; but through the draining of many of the reed-beds and the capacity of collectors, it now exists in few localities. It is a beautiful little bird, of a bright tawny colour, variegated with black and white, while the cock is further distinguished by a bluish grey head and a black tuft of feathers on the back. It lives in reed beds and samphire beds, and is said to reed seeds and the smaller kinds of fresh-water mollusces, which it finds among the reed-beds it seldom quits.

The general affinities of the Passeridae seem to lie rather with the Sittidae (see Nuthatch) and the tree-creepers. (A. N.)

TITUS, one of the companions of St Paul, was of Greek origin (Gal. ii. 3), and was perhaps a native of Asia Minor. He appears to have been among the apostle's earliest converts, being first mentioned (Gal. ii. 1) as having accompanied Paul and Barnabas to Jerusalem (cf. Acts xv. 2) "to represent the success of the Pauline gospel outside Judaism." Here the conservative section demanded that he should be circumcised; but Paul successfully opposed this (see PAUL). Subsequently he came into close connexion with the Achaean churches and especially with Corinth, bearing letters from Paul and being charged with promoting the proposed collection for poor Christians in Judea. In these matters he proved himself a trusty lieutenant, winning the esteem of the Corinthians by his zeal and disinterestedness. The liberality which a generation later was recognized by Clement of Rome as a traditional virtue of the Corinthian Church owed its inception to Titus. In the epistle with which his name is associated he is represented (Titus i. 5) as having been left by Paul in Crete to "set in order the things that are wanting, and ordain elders in every city." He is expected afterwards to join Paul at Nicopolis (iii. 12). In 2 Tim. iv. 10 he is spoken of as having gone (perhaps on a mission) to Dalmatia. Tradition, obviously resting on the Epistle to Titus, has it that he died in Crete as bishop at an advanced age; another line connects him with Venice. Attempts to make him the author of the "We" sections in Acts and to include him in the seventy disciples are futile. There is more to be said for the suggestion that he was the brother of St Luke.

See A. Souter and E. P. Boys-Smith in The Expository Times, xviii. 285, 335, 386.

TITUS, THE EPISTLE TO, in the New Testament, an epistle which purports to have been written by Paul to Titus (1:1-4), while the former is absent, perhaps on a mission to Dalmatia. Tradition, obviously resting on the Epistle to Titus, has it that he died in Crete as bishop at an advanced age; another line connects him with Venice. Attempts to make him the author of the "We" sections in Acts and to include him in the seventy disciples are futile. There is more to be said for the suggestion that he was the brother of St Luke.

The origin of Christian missions in Crete is obscure. A strong Jewish element existed among the population (cf. i. 13 seq., iii. 9), which explains the particular hue of the local heresies as well as, perhaps, the initial efforts of a Christian propaganda (cf. Acts xi. 11). The geographical situation of the island also favoured an early introduction of the new faith. "Crete was a great wintering place" for vessels (cf. Acts xxvii. 12 seq.) working their slow way to Rome along the southern coast of the Mediterranean, so that the possibility of Jewish Christian evangelists having reached it before long is to be granted freely.

1 The common names given to this bird are very inapplicable that it is a pity that 'silerea' (from silere, an oster) bestowed upon it by the French is the only descriptive term.

2 On the somewhat harsh estimate of the Cretans in i. 12 see Dr J. Rendel Harris in Expositor (7th series, vol. ii. p. 305 seq.). The other features noted in the epistle, their turbulence, drunkenness and debauchery, happen to be verified in the pages of ancient writers like Polybius.


It is more difficult to determine when Paul can have visited the island and left Titus behind him. Attempts have been made to find a setting for the epistle within the apostle's life previous to his Roman imprisonment (as recorded in Acts), but by common consent it is now held that the epistle (if written by the apostle) must be later, during the period of missionary enterprise which is supposed to have followed his release from the first captivity. Like the epistles to Timothy, the Epistle to Titus thus belongs to a phase of the apostle's life for which we possess no other contemporary evidence. The second imprisonment of Paul, during which he did not enjoy freedom from Roman control, was the occasion of the second application of his hypothesis (cf. the statement in Steinmetz's Die zweiteirn. Gefaengschaft des Paulus, p. 46 seq.), which is absolutely essential to the Pauline authorship of the pastorals. It is indeed supported by several critics who reject the latter, just as it is occasionally rejected by advocates of their authenticity. But, upon the whole, such evidence from early tradition as can be adduced from the 2nd century seems no more than an expansion of Paul's language in Rom. xvi. 24, 28. The pastoral themselves never mention any mission in Spain. Spanish tradition is silent on the fact, and, in the Clementine Recognitions (i. 7, 2; ii. 22, 6) rather events it is supposed at least as fairly of Rome as of Spain. The whole problem is not without its difficulties still, after all the research lavished upon it, but the probabilities seem to converge upon the conclusion that Paul was never released from his imprisonment, and consequently that he never revisited the East.

The internal criticism of the epistle starts from i. 7-9, which is plainly an interpolation, perhaps from the margin, upon the qualifications of episcopoi. On the other hand a passage like iii. 12-13 is indubitably a Pauline fragment, and the problem for the critic is to determine whether in the epistle as a whole we have a reduced and interpolated edition of what was originally a note from the hand of Paul, or whether the epistle drew upon some Pauline tradition (connecting Titus with Crete) and material, and was afterwards rendered into a form more suitable for a pastorally homiletic or practical use. It is perhaps more and less successful upon the whole, although there is little to choose between the two. The substantially Pauline character of the epistle, for all practical purposes, is to be granted upon either hypothesis, for the author or the editor strove not unsuccessfully, upon the whole, to reproduce the Pauline spirit and tradition. The older notion that the personal data in Titus, or in the rest of the pastorals, were invented to lend verisimilitude to the writing must be given up. They are too circumstantial and artless to be the work of a writer idealizing or creating a situation. Thus, in the present epistle, a passage like iii. 12-13 is palpably genuine. But it is another question whether we can be absolutely certain that the writer is Paul (cf. iii. 1-7, 15, by Hesse; i. 1, 4, iii. 15, by von Soeden; i. 1-6?, iii. 1-7, by McGregor), in order to reconstruct a more or less independent note that Paul's own words might have been used.

It seems improbable that Titus or any of the pastorals is directed against any one phase of contemporary heresy. The prohibition of marriage (1 Tim. iv. 3) was common to Marcion and Apelles, while the rule against the eating of food offered to idols (1 Tim. v. 21) was one of the most insistent of the Clementine Banished (Clement i. 24, 3, by Haer. i. 28, 1) and to Saturninus of Antioch in Syria (ibid. i. 24, 3), the latter being also credited with having been the first to introduce a dualism into humanity, which made God send his Saviour to destroy the evil and redeem the good, both classes having been formed by the angels (cf. Titus ii. 11; 1 Tim. iv. 10). The exhaustive discussions on this point (cf. Bourquin, pp. 55 seq.) have led most scholars to the conclusion that no one system of 2nd-century gnosticicism is before the writer's mind. He is maintaining Paul's role. He makes the apostle prophesy, vaguely of course, the evil tendencies which were to come upon the church; but the internal evidence,

W. E. Bowser, Professor Bartlet (Apostolic Age, pp. 178 seq.; cf. also article on PAUL), Lisco (Vinea sanctuarum, 1900) and Laughlin are the only recent exceptions, and their conjectural schemes are more or less largely of a destructive character. The ostracism of Titus (cf. Luke xiv. 26) is an historical fact, and any dispersion of them over a term of years. They stand or fall together, as critics of all schools are practically agreed. The impossibility of placing them within the period of Acts is best known by the works of Bretschneider (Martyrium) and Petzinger (Geschichte der christlichen Missionen, 1884). The historical site for iii. 12-13, as well as for the tradition which forms the setting of the epistle, is probably to be sought in the neighborhood of Acts xx. 3 (so Krenkel). Clement gives the scene near Miletus after 2 Cor. xii. 15 and iv. 19 of Romans (in A.D. 59).

6 Essenism, blended with Ebionitism, is the plausible conjecture of Schleiermacher, Neander and Mangold, but the Essenae do not seem to have been professed by the earliest Christians.

7 Asocism was bound up with the gnostic depreciation of the body. By a natural recoil it produced licentiousness of conduct which the pastorals hotly denounce.
Titus (Roman Emperor)—Titus Tituri

The Epp. of Paul written after he became a Prisoner (New York, 1887); Plummer, Epistles (1893); Bourquin, Étude critique sur les Paul (Paris, 1890); Harnack, Die Chronologie, 30 seq., 710-712; Moffatt, Encyc. Bib., 5059-5056, and W. Lock (Hastings’s Dict. Bible, vol. iv.).

Tituri, Flavius Sabinus Vespasianus, Roman emperor from a.d. 79-81, son of the emperor Vespasian, was born on the 20th of December a.d. 40 (or 41). He was educated in the Jewish colony and thoroughly instructed in all the Jewish lore; he could speak Greek fluently and composed verses; he was a proficient in music; he could write shorthand, and imitate handwriting so skillfully that he used to say that he might have been a most successful forger. He was handsome and commanding, and had a vigorous frame, well trained in all the exercises of a soldier. As a young man he served with credit in Germany and in Britain. Soon he had the command of a legion, and joined his father in Syria, where he took an active part in the Jewish War. In 68 he was sent by his father to congratulate the newly proclaimed emperor, Galba; but, hearing of Galba’s death and of the general confusion in Rome, he had the revelation of the apotheosis of his father, and, in the meantime consulted the oracle of the Paphian Venus and received a favourable answer. In the following year Vespasian, having been proclaimed emperor, returned to Italy, and left Tituri to carry on the siege of Jerusalem, which was captured on the 8th of September 70. On his return to Rome, Tituri and his father celebrated a magnificent triumph, which has been immortalized by the so-called Arch of Tituri. He was now formally associated with his father in the government, with the title of Caesar, and during the nine remaining years of Vespasian’s reign he was in fact emperor. He was anything but popular; he had the character of a Germanic statesman, a humane and benevolent ruler, and a wise and just judge. His connexion with Berenice, the sister of the Agrippa of the Acts of the Apostles, also created a scandal; both brother and sister followed Tituri to Rome, and were allowed to reside in the imperial palace. Public opinion was outraged, and Tituri, though he had promised Berenice marriage, felt obliged to send her back to the East. Vespasian died in 79, leaving his son a safe throne and a well-filled treasury. The forebodings of the people were agreeably disappointed, for Tituri put an end to prosecutions for high treason, and the delatores (informers) were scourged and expelled from the city. He, however, did not follow the path of absolutism, in order that he might keep his hands free from blood. He refused his brother Domitian, who more than once plotted against his life, and having let a day pass without bestowing a present, he exclaimed, “I have lost a day.”

Tituri, like his father, spent money in adding to the magnificence of Rome. The Flavian amphitheatre (latter called the Colosseum) was completed and dedicated in his reign, with combatants of gladiators, shows of wild beasts, and representations of some of the great Greek naval battles. He gave the city splendid baths, which surpassed those of Agrippa and of Nero, and supplied the mob with every kind of luxury.

During his reign, in 79, occurred the eruption of Vesuvius which destroyed Herculanum and Pompeii. The emperor visited the scenes and contributed liberally to the relief of the distressed inhabitants. During his absence a fire raged for three days at Rome, in which the new temple of Jupiter Capitolinus, the library of Augustus, and other public buildings were burnt; then followed a pestilence, and Tituri again assisted freely with his purse. Italy and the Roman world were peaceful during his reign. The only fighting was in Britain under Agricola, who died the year 80 carried the Roman arms as far as the Tay. This general was, according to Schenkel’s Biblia-Lexicon, iv. 393-402; Sabatier’s article in Encyc. des sciences religieuses, x. 250-259; J. R. Boiss.

1 Clemen (Paulus i. 148) distinguishes broadly between the errors of 2 Tim. and those controverted in the other two epistles. The former, he argues, are in the last resort libertinism and anti-Semitism. They are of the age of the Jewish church. (Tituri 1. 10; 2 Tim. iii. 16; 1 Tim. i. 7, &c.) The errors developed speculative and practical theories on the basis of the Old Testament law, which proved extremely seductive to many Churchmen. The general resurrection was purely spiritual (Lightfoot); this, however, is probably no more than an interesting coincidence, and all attempts to identify the deceased with the ressurrector are abandoned by Ellicott.

2 Tim. ii. 18. Paul’s teaching about the believer being already risen with Christ gave a welcome handle to the later Gnostics. The passage in John v. 25-29 seems a correction of the possible inferences which might be drawn from such teaching in Paul and in the Fourth Gospel itself. 

3 Cf. Von Dobschütz, Christian Life in the Primitive Church (pp. 261 seq.).
the latter, who had become Roman matrons, intervened and prevailed upon the combatants to cease fighting. A formal treaty was then arranged between the Romans and Sabines, whereby Romulus and Tatius were to be joint and equal rulers of the Roman people. Rome was to retain its name and each citizen was to be called a Roman, but as a community they were to be called Quirites (q.v.); the Sabines were to be incorporated in the state and admitted into the tribes and curies. After this arrangement had lasted for five years it came to an end by the death of Tatius, who was killed out of revenge by the inhabitants of Lavinium. According to Mommsen, the story of his death, (for which see Plutarch) look: like an historical version of the abolition of blood-revenge. Tatius, who in some respects resembles Remus, is not an historical personage, but the eponymous hero of the religious college called Sodales Tittii. As to this body Tacitus expresses two different opinions, representing two different traditions: that it was introduced either by Tatius himself to preserve the Sabine cult in Rome; or by Romulus in honour of Tatius, at whose grave its members were bound to offer a yearly sacrifice. The sodales fell into abeyance at the end of the republic, but were revived by Augustus at the beginning of the 2nd century A.D. Augustus himself and the emperor Claudius belonged to the college, and all its members were of senatorial rank. Varro derives the name from the Titaniuves which were used by the priests in certain auguries.

See Livy i. 10-14; Tacitus, Annals, i. 54, Hist. ii. 95; Dion. Halic. ii. 36-52; Plutarch, Romulus, 19-24; Marquardt, Römische Staatsverwaltung (1855) iii. 446; Schweger, Römische Geschichte, Okt. ii. 544-55.

TITUSVILLE, a city of Crawford county, Pennsylvania, U.S.A., on the Oil Creek, about 42 m. S. by E. of Erie. Pop. (1900), 82,344, of whom 1573 were foreign-born; (1910 census) 82,953. Titusville is served by the Dunkirk, Allegheny Valley & Pittsburg, and the Pennsylvania railways. It has the Benson Memorial library (1904), and in Woodlawn Cemetery there is a monument (erected by Henry H. Rogers in 1902) to Colonel Edwin L. Drake (1819-1860), who here sank the first oil well (69 ft. deep) in America in August 1859 and who is buried here. Titusville was the principal centre in Pennsylvania of the opposition to the Standard Oil Company; but after 1875, when John D. archbold (b. 1828), a leader of the independents, became a director of the Standard, few of the Titusville opera took independent action. It was in the Titusville district that the natural gas industry of Pennsylvania was first established about 1872. There are various manufactures, and in 1905 the value of the factory products was $3,740,800. The first settlement was made here in 1766 by Samuel Kerr and Jonathan Titus (in whose honour the place was named). Titusville was incorporated as a borough in 1847 and was chartered as a city in 1866. On the 5th of June 1892 Oil Creek rose suddenly, overflowed its banks and wrecked many oil mills along the bottom-lands. A large part of the water was covered with oil, which soon caught fire. About 60 persons were drowned or burned to death, and about a quarter of the city was destroyed.

TIVERTON, a market town and municipal borough in the Tiverton parliamentary division of Devonshire, England, situated amid beautiful scenery at the confluence of the Loman and Exe, 187 m. W. by S. of London by the Great Western railway. Pop. (1901), 10,352. The upper town is built on high ground along the left bank of the Exe, and a bridge leads to the lower town, named West Exe. St Peter's church, originally consecrated to a chapel by Leozic, bishop of Exeter, in 1071, is a beautiful Perpendicular building. Its high tower has four stages, each adorned with grotesques; and Greenway's chapel, built in 1517 by John Greenway, a wool merchant of Tiverton, is ornamented with figures minutely carved in stone. Of the original Norman fabric only a doorway remains. Within are some fine carvings, brasses and monuments. Of the castle, founded about 1105 by Richard de Redvers, the banqueting-hall, a tower, the chapel and a 14th-century gateway remain. After serving as the home of the Redvers and Courtenay families, earls of Devon, until the 16th century, the castle was dismantled by Fairfax. Partly rebuilt, it is used as a dwelling-house; while in its gardens an annual race-meeting is held in August. Blundell's grammar school, founded under the will of Peter Blundell, a rich cloth merchant, in 1604, has modern buildings outside the town in Tudor style; and, among others, scholarships at Balliol College, Oxford, and Sidney Sussex College, Cambridge. The number of boys is about 320. The Chilcott Free School was established in 1611, and the Bluecoat Charity School, dating from 1714, was reorganized in 1876 to give secondary education to boys and girls. After the decline of its woollen trade Tiverton became noted for the lace manufacture introduced by John Heathcoat (1783-1861), inventor of the bobbin net frame. There are also breweries, flour-mills, and a large trade in farm produce and livestock. Amicia, countess of Devon, brought a stream of water from Norwood, 5 m. distant. This system was improved in the 19th century. Hannah Cowley, the dramatist (1743-1809), Richard Cosway, the miniature painter (b. 1742) and John Cross, an artist of some celebrity (b. 1819), were natives of Tiverton. The town is governed by a mayor, 6 aldermen and 18 councillors. Area, 17,650 acres.

Tiverton (Tuverton, Totivert) exhibits traces of very early settlement, and is mentioned under the name of Tuyford in the will of King Alfred. In the Domesday survey it appears as a royal manor containing two mills, but it was bestowed by Henry I. on Richard de Redvers, and in 1245 appears as a mesne borough under Baldwin de Redvers, who in that year obtained a grant of a Monday market and a three days' fair at the feast of St James. In 1275 Amicia, countess of Devon, claimed to hold fairs at Tiverton in the festas of St Andrew and St Giles, and at the translation of St Thomas the Martyr. In 1618 the borough received its first charter of incorporation from James I., instituting a governing body of a mayor, 12 chief burgesses, and 12 assistant burgesses, with a recorder, deputy-recorder, town-clerk and two serjeants-at-mace; a court of record every fortnight on Tuesday; and fairs at Michaelmas and on the second Tuesday after Trinity Sunday, which were kept up until within the last fifty years. The borough also sent two representatives to parliament until disfranchised by the Reform Act of 1885. Cromwell in 1655 changed the market day from Monday to Tuesday. Fresh barriers to incorporation from James I., in 1689 and from George I. in 1724 left the style and constitution of the governing body unchanged. Tiverton was an important centre of the woollen trade in the 16th century, and Risdon, writing in 1608, describes it as thronged with rich clothiers, and the Monday market famous for its kersels, known as "Tiverton kersels," while as late as the reign of George II. the town had 50 fulling-mills; but about this time the industry began to decay, and is now extinct.

See Victoria County History: Devonshire; M. Dunsford, Historical Memoirs of the Town and Parish of Tiverton (Exeter, 1790); W. Harding, History of Tiverton (1845-1847).

TIVOLI (anc. Titus, q.v.), a town and episcopal see of the province of Rome, Italy, 18 m. E.N.E. of Rome by road and tramway, 243 m. by rail, 760 ft. above sea-level. Pop. (1901), 11,610 (town), 12,881 (commune). Tivoli lies on the west of the Sabine Mountains, where the river Anio issues from them, upon a limestone rock above the river. The town on one side overlooks the Campagna di Roma and Rome itself, on the other the deep gorge of the Anio, with its lofty falls, and the environs are very beautiful. The location of the town and its buildings are described under the heading of Tivoli. The Villa d'Estate, begun in 1540 by F. Ligorio for Cardinal Ippolito d'Este the younger (the cardinal of Ferrara), has the finest example of a Renaissance garden in Italy; it was erected on a steep slope, with many terraces, and embellished with numerous fountains, fantastically decorated in stucco, which once formed the background to the splendid collection of ancient statuary formed by the cardinal, but now dispersed (see F. S. Sieni, La Villa d'Este in Tivoli, Rome, 1902; T. Ashby, in Archaeologia, vol. lvi.). The villa contains damaged frescoes by the brothers Zuccari. The register of the see of
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Tivoli has documents dating from the 10th century relating to the landed property of the see (L. Brusca, Regesto della chiesa di Tivoli, Rome, 1883), and the municipal archives date from 1450. The castle was erected in 1460 by Pius II. on the site of the amphitheatre, which is now a prison. In November 1826 the flood of the Aniene led to a change in its course, and threatened to carry away the town. A new channel, consisting of two parallel tunnels (the Traverco Gregoriano) 290 and 330 yds. long, was therefore made to the north-east in 1826-1835 by Folchi, and on emerging from these the river has a fall of 35 ft. Farther north-west are smaller falls (the cascatelle) of that portion of the river which is carried through the town and serves for industrial purposes. Five miles west are the sulphur baths of Acque Albule, which were known to the ancients, and are now frequented by over 40,000 persons annually. The temperature of the water is 75°F. The falls in the river afford electric power for lighting Rome and driving its trams, as well as for driving several factories in Tivoli itself. Tivoli is also the centre of an agricultural district, and its olive trees are especially fine.

TLAXCALA, an inland state of Mexico, bounded N.E. and S. by Puebla, and W. by the state of Mexico. Area 1905 sq. m. Pop. (1900), 172,315. TLAXCALA lies on the great central plateau of Mexico and has a mean altitude of about 7000 ft. Several mountains rise in the west and south, culminating in the volcanic peak of Malinalco or Malinatin (14,036 ft). The state has three railway lines crossing its territory. The capital is TLAXCALA and the principal towns are Chiautempan (about 9000), Calpulapan, San Antonio, TLAXCALO, Huamantla and Barron-Escandon (Apizaco). The state nearly coincides with the ancient Indian republic founded in the 13th century by a branch of the Nahua Indian race, who migrated from the western shores of Lake Texcoco. Though surrounded on all sides by the great Aztec Empire, the tiny republic maintained its independence until the arrival of the Spaniards. The TLAXCALO, or Tarascans, after a bitter resistance to Cortés in 1519, acknowledged the authority of the Spaniards and contributed largely to their final success. The present inhabitants are chiefly of this original stock, and retain their language and many ancient customs.

TLEMÇEN, a town of Algeria, the capital of an arrondissement in the department of Oran, near the frontier of Morocco, 68 m. by road and 102 by rail S.W. of Oran. It stands 2500 ft. above the sea, on the north slope of the Lella Setta hills, which rise to a height of over 4000 ft. It is the chief town of a wide district comprising 12,500 square miles, composed of flat, woody and Algerian oynx; and has a population of (1900) 24,060. From Tlemçen the railway is continued westward to the Moroccan frontier at Lalla Maghnia, a distance of 44 m. Among the cities famous in the annals of Arab-Berber, or Moorish, art and civilization, Tlemçen takes high rank. In architectural merits its monuments, though not so extensive, are worthy of comparison with those of Granada. The older walls and towers—there were three ancient lines of fortifications—are in great part destroyed, but a wall built by the French encircles the town.

The various quarters are grouped around the principal mosque—

the Jewish to the south-west, the Moorish to the south-east, that of the merchants to the north-west, while the new town with the civic buildings lies to the north-west. Of the sixty-four mosques which existed at the period of the French conquest, several have disappeared. The great mosque (Jamaa-el-Kebir) has a brick minaret 122 ft. high, with a colonnade on three sides and a central pavilion with mosaic of the various colored design; a fountain of alabaster, and a fountain known as Algerian oynx—stands in the alabaster-paved inner court; and 72 columns support the arches of the interior. This mosque was built by Sultan Ali 14th century, and is finely ornamented with arabesques. The mosque of Sidi Ahmed, however, is more magnificent. B. A. 1298, now transformed into a museum of antiquities, has two series of arches, which encircle the central dome of the former palace; the arches are either of marble or of black marble, and are ornamented with figures of great beauty and richness; the delicately-carved cedar ceiling bears traces of polychromatic painting. The exterior has been much altered by the French. The principal arch of the former palace is the epigraph of Boabdil, the last king of Granada, who died at Tlemcen in 1494, and the standard cubit-measure—in marble—used in the Ksaria, beaing date A.D. 728 (1328). The mosque of the Sacred Jami (the mosque of the French) encircles the walls outside the walls of the town. It has eight magnificent columns of Algerian oynx, with richly sculptured capitals. The ceiling of cedar is richly carved, and there is a fine colonnade on each side of the court. The minaret is decorated with mosaics. The military authorities occupy the Meshuur or citadel, built in 1145, which separates the Jewish and Moorish quarters and was formerly the palace and commonly called the Black Sultan. The ruins of a small building, dating from the 14th century, and the battlemented wall, flanked by two towers, remain of its former magnificence. The vast basin (zabri) under the old walls, now dry (720 ft. in length, 490 in width and 10 in depth) was formerly for water. It was fortified in the 13th century, and period barracks of the spahis occupied all that remains of the Ksaria, the place of residence of European merchants from Pisa, Genoa, Catalonia and Provence. The barracks have been cleared away, but the ground is covered with the remains of the fortifications. The ancient college (medressa) where many learned Arabs taught—of whom Ibn Khaldun, author of a History of the Berbers, may be reckoned among the most distinguished—has been turned into a French is a fine building in the Byzantine style. Besides the large trade carried on there are native manufactories of cloth, carpets and leather goods. A special manufacture is that of red shawls, woven throughout the department of Oran by Jewish women when in mourning.

In the immediate neighbourhood of the modern Tlemçen are numerous remains of the fortifications of Agadir (vide infra), and the ruins of the palace of the former Sultan Ali. The palace was built in the 14th century, and is one of the finest in the town. From the 14th century, the lower part of which is built of large hewn stones from the Roman Pomparia. More noteworthy, however, are the ruins of Sidi Bu Medin and of Mansura. Sidi Bu Medin (more properly El Eubbad) is a little over a mile south-east of Tlemçen. It was founded A.D. 1337 by Ali V., the first of the Beni-Marin (Marinide) sultans who ruled Tlemçen, and was called the Black Sultan. The ruins of a small building, conjectured to be a palace of Sultan Ali, which commands a beautiful view, were excavated in 1881. The zoubba or tomb of Sidi Bu Medin, near the palace, is held in great veneration by the Arabs. In the palace are covered arabesques, and the famous Mekteb El-Mulk Lillah, "the kingdom is God's," is repeated again and again. The saint himself was born at Seville A.D. 1126, and died near Tlemçen in 1192; his tomb is near the palace, and the place is called El Medjir, from him. The adjacent mosque is a beautiful specimen of Moorish art. The large double doors of cedar wood, covered with bronze showing a geometric interlaced pattern, have been compared with those of the Alhambra and the Baths of Caracalla in Rome. They are columns into five aisles. Delicate lacework extends from the spring of the arches to the roof. The tile mosaics are believed to have come from Morocco. The medressa is a building resembling the mosque.

Mansura, which is about 11 m. west of Tlemçen, owes its founda-

tion to the attempts of the Beni-Marin rulers of Morocco to extend their sovereignty. The Amir Abu Yakub Yusuf besieged Tlemçen in the early years of the 14th century. The siege lasted eight years, and Yusuf turned his camp into a walled city. The siege being raised, El Mansura (the victorious), as the new city was called, was abandoned. It was reoccupied when El Mansura had been taken. On the revolt of the Marinides in 1359 Mansura was finally deserted. Besides the walls and towers, and the minaret of the mosque, little remains of Mansura, of which Ibn Khaldun has left a graphic and eloquent description. It is said that one side and parts of two other sides have perished, is one of the finest mosques in existence. It is 125 ft. high, and is divided into three stories. The grounds are encircled by columns into thirteen aisles. Excavations made by the French brought to light some of these columns, which are now in the museums of modern Algiers.

History.—A Roman town, Pomaria, occupied a site east of the present town. It derived its name from the abundance and
luxuriance of the apple, pear and other fruit trees in the neighbourhood. The Roman town was ruined in the period following the Vandal invasion, and at the time of the Arab conquest appears to have been deserted. Many inscriptions of the Christian era have been found, some as late even as the 7th century. The site was purchased from the Zenata Berbers, in the 9th century, by Idris-ibn-Abdallah, who began the building of a new city named Agadir (Berber, the fortress). Idris, founder of the Idrisite dynasty of Fez, left his brother Sulaiman in possession of Agadir, and the city was ruled by the Beni-Suleiman until 931, when it fell into the hands of the Fatimites. From the Fatimites it passed into the possession of the Beni-Yala, of the Beni-Irfen branch of the Zenata Berbers, who held it as vassals of the Omayyad rulers of Spain. In 1050 the Almoravide sovereign Yusuf ibn Tashfin, after besieging and sacking Agadir, built a new town on the site of his camp. The new town, called Tagrart, became the commercial quarter, whilst Agadir remained the royal residence. The two towns when united received the name of Tlemcen. The Almoravides reigned sixty-five years when, after holding Agadir four years against the enemy, they were overcome by the Almohades, who massacred the inhabitants, rebuilt, enlarged and repeopled the ruined town, and built a wall (1161) surrounding the double town. In 1248 Tlemcen was captured by Abu Yahia Yarmorasen (Ghamarasen) who was the Sultan of the Sultanate of Tlemcen.

The Sultanate of Tlemcen.

It was during the 13th century that the Sultanate of Tlemcen began to play a part of importance among the principal powers of the time. In 1282, founded the dynasty of the Abd-el-Wahid, who ruled the greater part of what now constitutes Algeria. Under their sway Tlemcen flourished exceedingly. The presence of Jews and Christians was encouraged and the Christians possessed a church. The bazaar of the Franks (kissaria) was a large walled enclosure, the gates of which were closed at sunset. As many as 5000 Christians lived peacefully in Tlemcen, and the Sultan included in his army a Christian bodyguard. In 1337 the power of the Abd-el-Wahid was temporarily extinguished by Sultan Abu Bakr of Morocco. They left some remembrances of the period of their ascendancy, which lasted twenty-two years. Once more, under the Abd-el-Wahid, now known as the Beni-Zeiyun, from 1359 to 1553, Tlemcen enjoyed prosperity. It had a population reputed to number 125,000, an extensive trade, a brilliant court and a powerful army. The Spanish occupation of Oran (1509) struck a fatal blow at the European commerce of the town. The Beni-Zeiyun, after the capture of Algiers in 1516 by the corsair Barbarossa (q.v.) gradually lost their territory to the Turks, while Tlemcen itself for forty years became tributary to the Spanish governor of Oran. In 1528 the town was held for a short time by Arouj Barbarossa, but Arouj was killed in a fight with the Spaniards. It is said that, while master of the town, Arouj caused twenty-two of the Zeiyun princes to be drowned in the sabri. In 1553 the Turks under Salah Rais, pasha of Algiers, captured Tlemcen and the Sultanate of Tagrart, as it was still frequently called, came to an end. Under the Turks the town ceased to be of any importance. When the French entered Algeria the sultans of Morocco were disputing the possession of Tlemcen with the Kulagis, who fought first for themselves and afterward for Fez, but in 1548 the latter drove them out. In 1578 the Moors retired, sought to re-establish the ancient empire of Tlemcen, but he retreated before General Clausel in 1836. The treaty of the Tafna (1837) gave Tlemcen to Abd-el-Kader, but, while being renewed in 1842, Tlemcen was definitely occupied by the French, under whom it has prospered.

The commune of Tlemcen, which includes a number of villages near the city, had a population (1906) of 39,757, and the arrondissement, which includes nine communes, 149,467.

See Les Monuments arabes de Tlemcen, by William Marçais and Georges Marçais (Paris, 1903). This accurate and finely-illustrated work, one of the publications of the Service des monuments historiques de l'Afrique, cites the principal works dealing with Tlemcen and gives a critical estimate of their value.

TOAD—TOBACCO

TOAD, a name commonly applied, in contradistinction to "frog," to tailless batrachians of stout build, with more or less wartly skin. Thus, of the two closely related discoglossid genera Bombinator and Discoglossus, the former is called a toad and the latter a frog. But the true toads are the Bufonidae, arcerous batrachians with dilated processes to the sacral vertebra and without any teeth in the jaws. The type of the family is our common toad, Bufo vulgaris, and round it cluster a large number of species of the same genus, and the smaller genera Europemphi, Pseudophryne, Nectophryne, Nectes, Notaden, Myobatrachus, Rhinophrynus and Cophophryne. That the shape of the body is not a safe guide in judging of the batrachians is shown by certain species, such as Bufo saurinus, which in its slender form and extremely long limbs surpasses the typical frogs, whilst on the other hand, some true frogs (Rana), adapted to burrowing habits, are absolutely toad-like. The Bufonidae include terrestrial, burrowing, thoroughly aquatic and arboreal types; Rhinophrynus, of Mexico, may be described as an ant-eater.

The genus Bufo embraces about 100 species, and is represented in nearly every part of the world except the Australian region and Madagascar. Two species are found in the British Isles: the common toad, Bufo vulgaris, and the natterjack, Bufo calamita. The former is found almost everywhere; the second, which differs in its shorter limbs with nearly free toes (which are so short that the toad never hops but proceeds in a flutter), is limited to a strip along the middle of the back, in localities there, in the south-west of England, and the west of Ireland; it is further remarkable for the very loud croak of the males, produced by a large vocal bladder on the throat which, when inflated, is larger than the head. Toads lay their eggs in long strings, forming double lines in straight, jelly-like tubes.

A small toad, Pseudophryne vivipara, recently discovered in German East Africa, has proved to be viviparous, this being the only such instance known among tailless batrachians.

TOAST, the popular name for fungi which more or less resemble mushrooms, but are either poisonous or worthless as food.

TOAST, a slice of bread scorched brown on the two surfaces by the heat of a fire. The word was borrowed from the O. Fr. toste, Lat. torrere, tostum, to scorch, burn. It was formerly the custom to have pieces of toast floating in many kinds of liquor, especially when drunk hot. It is said to be from this custom that the word is used of the calling upon a company to drink the health of some person, institution or cause (see Health). TOAST, the name (see below) for the leaves of several species of Nicotiana (nat. ord. Solanaceae), variously prepared for use as a narcotic. While it is principally manufactured for smoking, a large amount is also prepared for chewing, and, to a more limited extent, it is taken in the form of snuff. Under one or other of these forms the use of tobacco is more widely spread than in that of any other narcotic or stimulant.

History.—Although the fact has been controverted, there cannot be a doubt that the knowledge of tobacco and its uses came to the rest of the world from America. In November 1492 a party sent out by Columbus from the vessels of his first voyage, a Spanish expedition in the service of the King of Spain, returned to Spain after a voyage which they said that they had seen people who carried a lighted firebrand to kindle fire, and perfumed themselves with certain herbs which they carried along with them. The habit of snuff-taking was observed and described by Ramon Pané, a Franciscan who accompanied Columbus on his second voyage (1494-1496), and the practice of tobacco-chewing was first seen by the Spaniards on the coast of South America in 1502. As the continent of America was opened up and explored, it became evident that the consumption of tobacco, especially by smoking, was a universal and immediate usage, in many cases bound up with the most significant and solemn tribal ceremonies.

The term tobacco appears not to have been a commonly used original name for the plant, and it has come to us from a peculiar instrument used for inhaling its smoke by the inhabitants of
Hispaniola (San Domingo). The instrument, described by Oviedo (Historia de las Indias Occidentales, Salamanca, 1535), consisted of a small hollow wooden tube, shaped like a Y, the two points of which being inserted in the nose of the smoker, the other end was held into the smoke of burning tobacco, and thus the fumes were inhaled. This apparatus the natives called "tabaco"; but it must be said that the smoking pipe of the continental tribes was entirely different from the imperfect tabaco of the Caribbees. Benzonzi, on the other hand, whose Travels in America (1542-1556) were published in 1565, says that the Mexican name of the herb was "tabaco.

The tobacco plant itself was first brought to Europe in 1565 by Francisco Fernandes, a physician who had been sent by Philip II. of Spain to investigate the products of Mexico. By the French ambassador to Portugal, Jean Nicot, seeds were sent from the Peninsula to the queen, Catherine de' Medici. The services rendered by Nicot in spreading a knowledge of the plant have been commemorated in the scientific name of the genus Nicotiana. At first the plant was supposed to possess almost miraculous healing powers, and was designated "herba panacea," "herba santa," "sana sancta Indorum"; "divine tobacco" it is called by Spenser, and our holy herb nicotian by William Lilly. While the plant came to Europe through Spain, the habit of smoking was initiated and spread through English example. Ralph Lane, the first governor of Virginia, and Sir Francis Drake brought with them in 1586, from that first American possession of the English crown, the implements and materials of tobacco smoking, which they handed over to Sir Walter Raleigh. Lane is credited with having been the first English smoker, and through the influence and example of the illustrious Raleigh, who "took a pipe of tobacco a little before he went to the scaffold," the habit became rooted among Elizabethan courtiers. During the 17th century the indulgence in tobacco spread with marvellous rapidity throughout all nations, and that in the face of the most resolute opposition of statesmen and priests, the "counterblaste" of a great monarch, penal enactments of the most severe description, the knout, excommunication and capital punishment.

Botany.—There are about fifty species of Nicotiana, nearly all of which are natives of America. Few, however, are of economic importance. The great bulk of the tobacco supply is derived from

in length, while the upper are semi-amplexical and of variable outline. The seeds are brown in colour, with a rough surface, of minute size, and exceedingly numerous; as many as 1,000,000 may be produced by a single plant. The whole of the green parts of the plant are covered with long soft hairs which exude a viscid juice, giving the surface a moist glutinous feeling. The hairs are multicellular, and of two kinds, one branching and ending in a fine point, while the other, unbranched, terminates in a clump of small cells. Stomata occur on both surfaces of the leaves and, with a peculiar hair structure render the microscopic appearance of the plant highly characteristic.

From this species the tobaccos of Cuba, the United States, the Philippine Islands and the Latao of Turkey are derived, and it is also largely cultivated in India; the variety macrophylla is the source of the Maryland tobaccos. N. peracca, Persian tobacco, the source of the famous Shiraz tobacco, is regarded as only a variety of N. tabacum, and an introduction from America. East Indian, or Green, tobacco is the product of another species, N. rustica, a smaller plant with a much-branched stem and greenish-yellow flowers with a short, broad tube. It is a native of Mexico, and now widely cultivated in southern Germany, Hungary and the East Indies.

Cultivation.—Tobacco is cultivated in localities scattered over almost the whole world, ranging as far north as Quebec, Stockholm and the southern shores of Lake Baikal in one hemisphere, and as far south as Chile, the Cape of Good Hope and Victoria in the other. Whilst, however, the plant adapts itself to a great variety of climatic conditions and will grow on almost all kinds of soil, the quality and quality of the produce are profoundly affected by variations in these two factors. Very slight differences in climate appear to cause very great differences in the quality of the tobacco, and ordinary meteorological records are of little use in determining the suitability or not of a region for a particular kind of leaf; this essential point must be determined by experiment. In general, tropical and semi-tropical conditions as to temperature, with a comparatively dry climate, give the best results.

Given suitable climatic conditions, the type of tobacco produced is determined mainly by the soil, and particularly by its mechanical or physical condition. Speaking generally, clay soils retentive of moisture produce heavy-cropping tobaccos which cure to a dark red-brown colour. Sandy soils produce tobacco with a thin leaf, curing to a yellow or bright red colour. In the same locality, i.e., under the same climatic conditions, quite different kinds of tobacco may be produced in direct relation to the character of the soil. Thus the bright yellow tobacco used for cigarettes, &c., is largely produced in Virginia and North Carolina on a loose porous sand, which must be at least a foot deep, and contains usually about 8% of clay; this sand is underlain by a clay subsoil, and, as Mr Milton Whitney points out in Tobacco Soils (U.S.A. Dept of Agriculture, Farmers' Bulletin, No. 83), this clay is the same as that on which the heavy manufacturing and export tobacco is grown. Where the clay is exposed on the surface the heavy type of tobacco is produced, and bright tobacco where the clay is covered from 2 to 8 inches by a clump of sand. Tobacco soils should be well drained and contain a large percentage of humus.

Tobacco being cultivated over such a large area of the world, under very varying climatic conditions, and by many different races of mankind, the methods employed in its production naturally differ very considerably. As the United States of America produce more tobacco than any other country it will be best to deal generally with conditions there and to refer to marked differences in dealing with production in other countries.

The seed is sown in nursery beds, and the plants set out in the field later. Tobacco seeds are very small, and it is estimated that about 300,000 to 400,000 seeds go to the ounce. Allowing for those which fail to germinate (perhaps 25%), loss in transplanting, weak and back-enderd plants, &c., one ounce of seed should yield about 40,000 plants.

The greatest possible care is bestowed on the preparation of the
seed bed—it must have good, very rich soil in fine tilth, be protected from winds, and yet well exposed to sunlight; the southern or southern-westerly exposition is open in the passage. Tobacco is planted in rows six inches apart. Hot beds are made when necessary. A bed with an area of about 50 sq. yds. is advisable for 1 oz. of seed. To destroy the seeds, exc., of weeds, and the larve of insect pests, a fire is often lighted, kept from the bed by a little reticule of earth, and then allowed to burn thoroughly steamed. After this treatment the upper 2 or 3 in. of soil are well pulverized, and fertilizers added, usually, to prevent reinfesting. Tobacco seed is sown in rows, 6 in. apart, in a breadth of 1 ft. minimum, leaving about 1 ft. open. The seed is sown so that the furrow is not visible when the seed is sown. The seed is set so; it is usually thinned with a relatively large quantity of fine ashes, sand or meal, to facilitate thin and even sowing, and the surface of the bed is afterwards lighted, which makes a broad and considerate bed. The seed is usually sown at 4 in. interval. The seed is sown at the depth of 1 in. A light covering of cloth or muslin, raised on short sticks, is often stretched over the bed. Great care is necessary in handling the seed, for the handling of the young and delicate seedlings, which are ready for transplanting in about 3 weeks from the time after sowing. They must be well hardened off before being set out in the open.

The land for their reception must be thoroughly well tilled and manured. If moist, ridges are formed about 3 to 4 ft. apart; the distance apart in the rows varies greatly with various types of tobacco: 6 ft. is the normal for ordinary manufacturing and smoking tobaccos, 1 to 1½ ft. for Cuba and Sumatra types. Cigar tobaccos become coarse if planted too widely. An acre of tobacco planted 3 ft. by 15 in. will contain 11,000 plants and 3 ft. by 6 in. by 15 in., 10,000 plants. During hot, dry weather or during light rains, the plants must be handled very carefully; machines are now available which can set out and water plants over from two to six acres in a working day.

The crop reaches about another sixty days to mature, i.e. about 120 days in all from the date the seed was sown. During this period, until the plants begin to ripen, the tillth is maintained and weeds checked first by horse cultivators or horsecars, and, as the plants increase in size, by hand labour. When the plants show signs of flowering they are "topped" to prevent seed formation, the terminal buds being removed, and only a certain number of leaves at the base of each plant are left to ripen. This operation is and been an experienced judgment to decide when it should be done; the number of leaves to be left varies with the variety and vigour of the plant, the nature of the soil, climate, seasons and particular use for which the tobacco is intended. In the product which is called "topped" is of little value. In the U.S.A., in the cigar tobacco district, fifteen to twenty leaves are often left on each plant, and of manufacturing tobacco no less than twelve leaves. As one result of the "topping," the suckers are usually formed; these also must be removed, although, e.g. in Florida, vigorous suckers are sometimes allowed to remain when the plant is cut, and produce a "sucker crop." Inferior in character to the first or principal crop, but still serviceable.

The leaves now ripen, indicated by a change from a dark to lighter green, and by the appearance of yellow spots. Ripening is complete in about 35 days after topping or about 155 days after sowing. A light frost, if it is well borne, does not injure the leaves. A heavy frost, if it is allowed to happen, may destroy the foliage of the tobacco. The next step is to remove the harvested crop to the drying-shed. Primed leaves are placed at once in shallow baskets or boxes, and when under cover are strung on string or on wire and hung up on laths in the barn. Cut plants are allowed to wilt, or become leafy, before removal from the field, to prevent injury to the turgid leaves. These cut plants may be laid in rows on the ground to wilt, or spitted on long rods or laths supported on trefoils, or placed on spears or drying racks. When sufficiently wilted they are hauled to the barn and hung up there on the same laths on which they were placed in the field.

Artificial shading under development of quite recent years is that of growing some valuable cigar tobaccos under artificial shade. Sumatra produced the best cigar wrappers of the world, and efforts to cultivate Sumatra tobacco in Florida under artificial shade failed so not successful. It was noticed, however, that if the tobacco was grown under the shade of trees the character of the leaf was improved, its size increased, and yield was greater. Both supported on posts, was then retorted to with eminently satisfactory results. The U.S.A. Department of Agriculture, in cooperation with local growers, devoted a great deal of attention and the results were encouraging. Tobacco is now produced in Florida and Connecticut. The yield of leaf is much increased, the plants are protected from the weather, and the enhanced value of the crop much more than repays the very slight additional cost involved. Tobacco is produced in many other fields. So successful have the results been that American-grown tobacco of the Sumatra type is now exported even to Cuba.

Important changes take place in the tobacco leaf from the time it is cut until the finished product is ready for consumption. These may be all placed under curing, but it is usual to measure 1. Curing: (1) Curing proper; (2) fermentation; and (3) ageing.

Sun-curing, now but little practised in the United States, is the simplest method. The wilted tobacco is suspended on racks in the open air, and the air is allowed to dry the leaves without the leaves being in contact with earth. This method is only used in a portion of Virginia and Kentucky, where the tobacco is light and of a particular quality and cured in the open air. The sun preferable, if necessary cured in a barn in which fires may be required during wet weather. This method is employed in a portion of Virginia and Kentucky, where the tobacco is light and of a particular quality and cured in the open air. The sun preferable, if necessary.

In air curing the tobacco is hung in a barn in which there is a free circulation of air during dry weather. Artificial heat may be resorted to in bad weather; in the manufacture of cigarettes and cigars, the tobacco is sometimes cured in this way. The process takes about six weeks.

In flue curing the tobacco is hung in the barn, and, after it has become of a rich yellow colour, slow fires, producing a gradual increase in temperature, are allowed to warm the room, and the leaves are turned, and kept warm for four or five days. The firing must be repeated at intervals as the leaves become soft again. A considerable portion of the tobacco exported to England and Africa is fire-cured.

Flue curing, also known as the Virginian cure, is a set outside the barn, and the heat led in iron pipes or flues, into the building are under the suspended tobacco, which is placed there quite fresh from the field. The temperature is raised, during three to five days, from about 90° F. to 140° F. for primed leaves, or 160° to 175° F. for tobacco on the stalk. The process, which requires great judgment, is then allowed to cool down; a light yellow leaf so largely used for pipe tobacco, cigarettes and chewing tobacco. The name of this method, known as the Kentucky cure, large barns are used, the temperature is not raised above 150° F., and the process occupies from forty to sixty days. As the leaf after curing is brittle and cannot be handled without crumbling to powder. The contents of the barn are therefore left till moist weather occurs, and then by the admission of atmospheric air the leaf blades absorb moisture and become soft and pliant. In this condition the leaves are stripped from the stems and sorted into qualities, such as "hogs," or lower leaves, "firsts" and "seconds."

The leaves are piled up on the barn floor, or hung from six to twelve leaves. Each bundle is tied round with twine, and in this condition the tobacco is ready for bulking for fermentation.

Fermentation, whether in bundles, hands or separate leaves, is piled up or bulked on the floor in a barn into a solid stack to the height of 5 or 6 ft. Within this stack a process of fermentation is quickly set up, and the temperature of the mass rises steeply. Great care is now taken to prevent overheating and to secure the uniform fermentation of all the tobacco. The pile is from time to time taken down and rebuilt, the tobacco from the top going to the bottom and that exposed at the edges being turned in to the centre. From in three to five weeks the fermentation should be sufficiently carried out, and the leaves then have a nice uniform brownish colour, but if the temperature is allowed to mount higher than when light leaves are required. Fermentation is essentially a chemical process due apparently to the presence of enzymes, developed in the leaf, and the exact causes are not understood as far as to forward that fermentation is due to the activity of bacteria, distinct types occurring in various tobaccos, but the balance of evidence seems to point to the assumption that it is possible to inoculate a poor tobacco with, say, the special bacteria present in Cuban tobacco, and so give the product the aroma and other good qualities of the more valuable tobacco. When fermentation is completed the tobacco is graded, an operation carried out very carefully in the case of the better cigar tobaccos, and packed for export, cigar tobacco in bales, and other kinds in hogheads. It is then kept at a moderate and fairly uniform temperature in a warehouse. When, however, there is no marked outward change, the tobacco becomes more mellow. Two years are usually required for ageing, but some tobaccos are kept for four or five years before being used.

An artificial aroma is sometimes given to tobaccos, especially for the "fillers" of cigars, by saucing or treating the leaves with a solution containing an infusion of fine quality tobacco stems, raw, sun-dried and various herbs, essential oils, and essential oils, essence of valerian, powdered cloves, cinnamon and liqueur.

Pests and Diseases.—Tobacco, like other cultivated plants, is not free from attack by various pests and diseases, but fortunately those less destructive than the "wilt" have removed. Of the comparatively trivial incidents do more harm to a relatively delicate plant like the tobacco than to more robust plants.

1. Botrytis allii (firsts or "butter".) is a small active beetle, the larvae of which attack the roots, while the adult beetles cut holes in the leaves. The latter is the more serious, as in addition to the actual damage done by the beetle the holes afford entrance to fungal parasites, such as Alternaria and Stemphylium, and the larva or caterpillars of species of Protopiura. These comparatively large and voracious animals, when abundant, do great damage by eating the leaves. Other caterpillars, "badworms"(Heliolohis spp.),
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attack the buds or burrow into the seed-pods. Seedling plants of tobacco, when young, are prone to be attacked by thrips and the caterpillars of species of Peridroma and Agrotis. " Plant bugs," which suck the juice of the leaves, have been recorded as serious enemies in some parts of the world. Recently, shade-grown tobacco in the northern part of Syria, on one of the best tobacco soils, was attacked by sucking insects known as thrips, which produce " white veins " in the leaf. White vein may also be induced by other causes besides the attack of thrips.

Dried tobacco is liable to be attacked and ruined by the " cigarette beetle," a cosmopolitan insect of very varied tastes, feeding not only on dried tobacco of all kinds, including snuff, but also on rice, wheat, oat, and corn. It is only as a pest attacking tobacco specimens. Other beetles, such as the rice weevil (Calandra oryzae), also attack dried tobacco.

The fungoid diseases of tobacco are comparatively important; the principal ones are caused by the relatively common white rust and mildew, and the cause is known, for example, " Mosaic disease " is the name given to a condition in which the leaves are more or less sharply differenti- ated in light and dark green patches. This matter has been fully investigated by Mr. A. F. Woods (Bureau Bulletin No. 18, Bureau of Plant Industry, U.S. Department of Agriculture), who attributes it to no specific parasite but to a disturbance of the normal physiological activity in the cells.

"Frog's eye," or " leaf spot," denotes the occurrence of small white specks on the leaf. This disease is probably bacterial in origin. Wind and hail may break plants or damage leaves, especially if reduction for purposes. The provision of wind breaks is the only effective remedy.

Diseases which occur in curing are important. Excessive heating causes the spots to become dry and the leaf may become dark and decay. Various names are given, such as " pole burn," " sole sweat," " house burn. " The disease is caused by raising the temperature above 110° F., and results in the leaf becoming yellow and dead. The leaf blight (Botrytis sp.), occurs in wet weather. Too rapid drying of the outer tissue of the leaf leads to the formation of " white veins," which injure leaves required for wrapper purposes, otherwise it is not important. Another defect arising during curing and fermentation is the efflorescence of salts on the surface, a phenomenon known as " saltpetre; " light brushing and spraying with a weak solution of acid will remove this condition.

Improvement by Selection. — Careful examination of a large number of individuals of one variety growing under similar conditions reveals differences in such characters as number of leaves per plant, the size and shape of leaves, leaf size, colour, degree of maturity, mildness, durability, and resistance to disease. Other tests show variability in burning quality, elasticity of leaf, texture, taste, &c. The United States Department of Agriculture has closely investigated this important question and the results obtained are brought together by Messrs. H. D. Shamel and W. W. Cobey in Tobacco Breeding (Bulletin 96, Bureau of Plant Industry, 1907). No crop, it is pointed out, respects selection or breeding too badly. A leaf is valuable if it becomes mature rapidly, as regards both yield and quality, if neglected. The variations are classified as: (1) Variation in type due to crossing, change of soil and climate, especially, for example, when seed from the Virginian produces tobacco resembling Sumatran tobacco. (2) Variation within the type, due to natural tendency to vary, local conditions and maturity of seed. When Cuban tobaccos were first introduced into Florida, the type broke up, but by carefully selecting the best plants, and allowing only those to perpetate which were of the type wanted, the type was obtained. The tobacco flower is fortunately perfectly self-fertile, and by enclosing the flowers of selected plants in paper bags, so as to exclude all possibility of hybridization, progeny true to the type of the mother plant can be obtained.

No attempt should ever be made to raise large crops of tobacco from imported seed, but only a small crop, and the seed of the selected plants should be used for future propagation. In selection work the grower must keep definitely in view the special market requirements for the kinds of tobacco he is producing. Thus for wrapper tobaccos, amongst other points a broad, rounded leaf, with a long middle rib is essential; a narrow pointed leaf is much more desirable than a narrow pointed leaf which yields perhaps only four. Plants may be found growing side by side, the one with broad leaves, the other with narrow, but by selection the broad type can be perpetuated and gradually improved.

Hybridization can also be readily controlled in the case of tobaccos, and in this connexion it is useful to note that, if pollen is desired of a certain type, a small artificial flower is made up and placed in the plant for several weeks if kept perfectly dry, and so can readily be sent by post from one place to another. Another favourable feature is the fact that a single capsule contains from 4000 to 8000 seeds, and one tobacco plant may easily produce from 500,000 to 1,000,000 seeds, &c.

Production.

United States. — Tobacco cultivation dates in the States from the very early years of the 17th century, when it was taken up in Virginia. A general description has already been given of the methods of cultivation and preparation. In 1906 the total area under tobacco in twenty-five states was 796,999 acres, and the production 682,428,530 lb., valued at about $13,500,000. The States producing over 100,000 acres and valued over $1,000,000 are: Kentucky, $4,885,400; Ohio, $1,706,600; North Carolina, $1,396,153; Wisconsin, $1,342,600; Virginia, $1,206,309; Pennsylvania, $1,079,550; Connecticut, $838,184; Tennessee, $511,035; Maryland, $466,393; and Missouri, $317,051. The average yield per acre in the States as a whole in 1906 was 857-2 lb. New Hampshire had the highest average, 1785 lb per acre, and New Mexico the lowest, 208 lb. acre.

The successful production of cigarette tobaccos from Cuban and Sumatran seed was a development of the late 19th century. Perique tobacco is worthy of special notice. This famous tobacco is produced only at Grand Points in Louisiana. Great care is given to the cultivation, and damp atmospheric conditions are desirable during the ripening stages. The leaves, when stripped from the stalk, are made into rolls and subjected to great pressure, which is known to have a choking effect to all loose dry pressed juice. To the chemical changes, mainly oxidation, which go on in this juice while it is exposed to the air, the characteristic aroma and flavour of Perique tobacco are mainly due.

Cuba. — Tobacco is the second industry of the country, the value of the crop being surpassed only by that of sugar. The cultivation is formerly a monopoly of the Spanish crown, but from 1817 onward no tax, usually heavy, has been the only restriction. The superiority of Cuban tobaccos in flavour and aroma, especially for cigar fillers, has long been recognized, but exactly to what conditions these qualities are due is not fully known. The "Vuelta Abajo" from Pinar del Rio, is perhaps the best cigar leaf of the world. The other tobacco-producing provinces in order of importance are Cuba, Puerto Rico, and the island of Hispaniola (called " Granada " by the Spaniards) and Jamaica.

Mexico is an important tobacco-producing country, and Mexican leaf is extensively used in the manufacture of coarse Havana cigars. Mexican tobacco approximates more or less closely to that of Cuba, and is cultivated and prepared in very similar ways.

France. — Tobacco cultivation is an important industry, and the home-grown is used extensively for smoking purposes. In 1905, 33,750 planters cultivated 39,439 acres, and the total crop amounted to 61,614,900 lb., of the approximate value of $2,000,000. The variety grown is usually of the Virginia type, and the leaf is coarse, dark and heavy, and suited to the manufacture of plug and snuff.

Germany. — The chief tobacco-producing divisions are Baden and Austria, the former producing medium size, heavy, and is mainly used in the manufacture of cigars.

Hungary produces tobacco of a rich, dark brown colour, useful for cigars, and also a small, bright yellow leaf, of value as a cigarette and pipe tobacco.

Russia. — In northern Russia the produce is mainly a large, coarse, heavy, dark leaf, of use only for the manufacture of plug and snuff. In southern and Asiatic Russia good tobacco of the Turkish type is produced.

Italy produces two principal types, a dark, heavy Virginia tobacco on the heavy soils of northern Italy, and a Turkish type tobacco on the sandy soils of the southern part of that country.

Syria. — The distinctive Latakia tobacco is produced in the province of Saida in northern Syria. The leaf is subjected to the smoke produced by burning in the green condition leafy branches of species of evergreen oaks (Quercus spp.). The process of fumigation lasts from seven to nine months, and during it the tobacco acquires its black colour and peculiar flavour.

Greece.—Greek tobacco from Turkish seed and closely resembles Turkish tobacco in character and uses. Egyptian cigarettes are to a great extent made from Grecian tobacco. Paper is a monopoly in Greece, and Grecian cigarette manufacturers, to escape the monopoly, have transferred their business to Egypt, where they make cigarettes from Grecian tobaccos by the aid of Greek workmen.

Turkey.—Tobacco is an important crop in Turkey, where its cultivation and cigarette trade is controlled by the Regie Compagnie interessée des tabacs de l'Empire Ottoman, and Narquileh tobacco (called "tunuki" by the Turks) is the most valuable. The leaf is grown up in various parts of the world, e.g. South Africa, and to maintain the standard of the produce fresh supplies of seed were obtained annually from Turkey. To guard against this competition, the export of tobacco seed from Turkey was prohibited in 1907. The
method of cultivation in Turkey is simple, and the plants are set out close together. For the best qualities the leaves are pruned, air-cured, or exposed to the sun, subjected to a lengthy fermentation, and then put in piles to mild fermentation. High prices are obtained for the best Turkish tobaccos. Thus in 1906 from Cavalla and Xanthi 11,000 tons were turned over for a value of about £1,010,000, the range of the various qualities per kilo ranging from 20 to 60 l. being-

<table>
<thead>
<tr>
<th>Quality</th>
<th>Price Range per Kilogram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghienbek</td>
<td>10s. 6d. to 16s. od.</td>
</tr>
<tr>
<td>Kir</td>
<td>4s. 6d. to 6s. od.</td>
</tr>
<tr>
<td>Persucian</td>
<td>2s. 11d. to 3s. 9d.</td>
</tr>
<tr>
<td>Dragash</td>
<td>2s. 6d. to 2s. 9d.</td>
</tr>
<tr>
<td>Inferior brands</td>
<td>6s. 7d. to 2s. od.</td>
</tr>
</tbody>
</table>

The exports mainly to Austria-Hungary, Rumania, Italy, Egypt, the United Kingdom and the United States. In 1906 the production of tobacco amounted to 56,072,000 lb, yielding a profit to the government of some £3,500,000. The produce is usually leaf of considerable size, of medium colour and suited only for cigarette and pipe smoking.

China.—The cultivation is widespread throughout Southern China. The picked leaves are usually either prepared for market by simple exposure to sun for a few days, or in addition are sprinkled with groundnut oil and sometimes other materials also, which result in an increase of strength.

Sumatra.—The tobaccos of Sumatra are especially valued for cutters or wrappers, being of light texture, light brown colour, thin and elastic. They do not, however, possess the aroma essential for cigar-fillers. The industry is of quite recent origin, dating only from 1882. The famous tobacco region, about 15 miles from Buitenzorg, the eastern coast of the island, extends nearly on the equator, and has a very uniform and high temperature and a very high rainfall. The soil is mainly of volcanic origin. Delicate, strong, mild and smooth tobaccos at Sumatra.

The estates are usually very large, and are divided up into fields which are cultivated in rotation, each field being given several years' rest after producing one crop. The tobacco is air-cured, fires being applied during curing, and the process of curing occupies four or five weeks. The fermentation is very carefully controlled, and to obtain the desired light colour the temperature is kept comparatively low. The leaves are graded with the most careful care and attention. The output is about 176 lb each. The high quality of Sumatra tobacco is due in part to the local conditions of soil and climate, and perhaps to an even greater degree to the thoroughness of its stage in its cultivation and curing. The work is done by Chinese coolies under European—chiefly Dutch—supervision. The commercial success of some of the companies has been very striking, dividends as high as 111% having been paid.

Java and Borneo tobacco is very similar to that of Sumatra.

The Philippine Islands.—Tobacco is extensively cultivated in the plains and on the rich alluvial deposits along the sides of rivers. During recent years a considerable amount of tobacco has been grown in the Philippine Islands. The quantities are small, but they are apparently to deterioration in quality. The exports of manufactured tobacco, such as Manila cheroots, find their principal market in India, British India, Australia and the United Kingdom, whilst the principal tobacco used in the home market is Spanish.

British Empire.—Tobacco is grown for local use in many parts of India, but the principal centres of its cultivation on a commercial scale are Madras, Mysore and Assam, where it is extensively cultivated and processed and is grown on a large scale.

Tobacco is produced in Queensland, New South Wales and Victoria. Efforts are being made to develop the industry. New Zealand has attempted to produce tobacco as a commercial crop, but the effort was abandoned several years ago.

In the West Indies tobacco is grown on a limited scale on most of the British islands, but only in Jamaica is there a definite industry. An expert, Mr. W. Chambers, recently reported on Jamaica tobacco as quite of good quality and flavour but often of a heavy nature. The industry there was, however, really for making wrappers to be excelled by any tobacco in the world.

In the British African possessions the outlook for tobacco cultivation is in several instances favourable. Rhodesian-grown Turkish tobaccos have been eagerly accepted by English smokers, and the yield of tobacco from the Transvaal, Natal and Cape Colony have also industries of considerable local importance. Tobacco cultivation has made considerable progress in Nyasaland (British Central Africa). In 1909 there were 69 acres under this crop, the yield being

4480 lb of the value of £13. In 1907 the acreage had increased to 2330, the yield to 413,316 lb, and the value to £6889. Flue-cured bright tobacco is principally produced, but sun-cured is also exported, and in 1906-1907 experiments with Turkish tobacco gave encouraging results.

Canada produces in Ontario and Quebec coarse Virginia type tobacco.

Chemistry.

The constituents of tobacco, as of all other vegetable matter, can be grouped under three heads: water, mineral acids and bases (which pass into the ash on combustion) and organic substances.

The following analyses of upper leaves made at the Connecticut station, New York, and reported in Report No. 54, Office of Experiment Stations, U.S. Department of Agriculture, indicate the more important constituents and also the changes which take place during fermentation.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Unfermented</th>
<th>Fermented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>23.5%</td>
<td>23.4%</td>
</tr>
<tr>
<td>Ash</td>
<td>15.8%</td>
<td>15.7%</td>
</tr>
<tr>
<td>Nicotine</td>
<td>1.8%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Nitric acid (NO₃)</td>
<td>1.8%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Ammonia (NH₄)</td>
<td>0.6%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Other nitrogenous matters</td>
<td>12.1%</td>
<td>13.1%</td>
</tr>
<tr>
<td>Fibre</td>
<td>7.0%</td>
<td>8.7%</td>
</tr>
<tr>
<td>Starch</td>
<td>3.2%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Nitrogen free extract</td>
<td>29.3%</td>
<td>27.8%</td>
</tr>
<tr>
<td>Ether extract</td>
<td>3.9%</td>
<td>4.2%</td>
</tr>
</tbody>
</table>

Nicotine (C₄H₄N₂) is a volatile alkaloid which appears to be present only in the plants of the genus Nicotiana (see Nicotine).

Manufacture.

In the manufacture of tobacco for smoking, we have to do with the leaf, which has been fermented by air-drying in pipes, embracing cut smoking mixtures, cakes, or plug, or roll or spun tobacco. Under this heading come also the cigar and cigarette manufacture.

The raw material in the warehouses is of various qualities: some are strong and tough and are packed in bales of about 176 lb each. Other samples are mild and fine, with aromatic and pleasant flavour, but devoid of strength. By a proper mixing and blending the manufacturer is enabled to prepare the smoking mixture which is desirable for his purpose; but certain of the rough, bitter qualities cannot be manufactured without a preliminary treatment by which their intense disagreeable taste is modified. The storing of such tobacco for a lengthened period matures and improves its quality, and the same result may be artificially hastened by macerating the leaves in water acidulated with hydrochloric acid, and washing them out with pure water. The most efficient means, however, of improving the quality of the leaf is by renewed fermentation artificially induced by moisture and heat.

The manufacturer having prepared his mixture of leaves, proceeds to damp them, pure water alone being used in the United Kingdom, occasionally with the addition of a little spirit of vitriol in Spain.

The "sauces" are employed, which consist of mixtures of aromatic substances, sugar, liqueur, common salt and sulphate of soda, &c., dissolved in water. The primary object is to render the leaves soft and pliant; the use of the sauces is to improve the flavour and burning qualities of the leaves used. When uniformly dampened, the leaves are separately opened out and smoothed, the midrib, if not already removed, is torn out, except when "bird's-eye" cut is to be made, in which mixture the midrib gives the peculiar "bird's-eye" appearance. The prepared tobacco, while still moist and pliant, is pressed between cylinders into a light cake, and cut into fine uniform shreds by a machine analogous to the chaff-cutter. The cut tobacco is now roasted, partly with the view of driving off moisture and bringing the material into a condition for keeping, but also partly to improve its smoking quality. The roasting is most simply effected by spreading it on heated slabs, on which it is constantly turned, or a roasting machine is used, consisting of a revolving drum in which the tobacco is rotated, gradually passing from one end to the other, and all the time under the influence of a current of heated air. The increase in favour of packet tobaccos has brought about the invention of elaborate packing machines.

Roll Tobacco.

Rolls are made by taking a small bundle of the dampened tobacco, each bundle being called a "cover." The material is supplied to the twisting machine by an attendant, and formed into a cord of uniform thickness, twisted and wound on a drum by mechanism which is very similar to that used in rope-making. The drum is turned by means of a foot pedal, and is divided into a number of compartments, each containing tobacco leaves being called "covers." The leaves are placed on the drum, and by being cooked or stoved in moist heat for about
twenty-four hours, are piled between plates in an hydraulic press, and subjected to great pressure for a month or six weeks, during which period the tobacco is dried. This is done to extract an aqueous exudation of juice results from the severe pressure. The juice is collected for use as a shee-dip.

During the process of manufacture, snuff is made by enveloping the desired amount of fillers within covering leaves of a fine bright colour. The packages are placed in moulds, and submitted to powerful pressure in an hydraulic press, by which they are moulded into a particular shape. Tobacco is pressed in to fill each pack. This is done to add a large quantity of vegetable matter to the tobacco used for smoking and chewing; for the latter purpose the cake is frequently sweetened with liqueur, and sold as honey-dew or sweet cavendish.

Cigar-making is the finest and most delicately flavoured qualities of tobacco are generally selected. A cigar consists of a core of central mass of fillers enveloped in an inner and an outer covering; this latter is made from the leaves of the cigar plant. The fillers or inner contents of the cigar must be of uniform quality, and so packed and distributed in a longitudinal direction that the tobacco may burn uniformly and the smoke can be freely drawn from end to end. For the binder whole leaf of the same quality as the fillers is used, but for the wrapper only selected leaves of the finest quality and colour, free from all injury, are employed. The covers are carefully cut to the proper size and shape with a sharp knife, and, after being cramped and smoothed out, are placed together in a pile. In making cigars by the hand, the operator rolls together a sufficient quantity of material to form the filling of one cigar, and envelopes it in her thumb and forefinger of the right hand. This quantity is wrapped in the inner cover, an oblong piece of leaf the length of the cigar to be made, and of width sufficient to enclose the whole material. The cigar is then rolled in the hand to consolidate the tobacco and fix it into proper shape, after which it is wrapped in the outer cover, a shaped piece made to enclose the whole in a spiral manner, beginning at the thick end of the cigar and working down to the pointed end, where it is dexterously finished by twisting to a close formation. The finished cigars are either spread out in the sunlight to be dried, or exposed to a gentle heat. They are then sorted into qualities according to their colour, price, and weight, in boxes, in which they are stored before sale. Machinery is now employed for forming and moulding the fillings of the cheaper grades of cigars.

Havana cigars are, as regards form, classification, method of production and known by the names carried by the wrapper of all classes of the goods. Genuine ("legitimas") Havana cigars are such only as are made in the island; and the cigars made in Europe and elsewhere from genuine Cuban tobacco are classed as "havana." Other brands of home manufacture contain a proportion of Cuban tobacco; and very good cigars may be made in which the name only of that highly-prized leaf is employed. When we come to the inferior classes of cigars, it can only be said that they may be made from any kind of leaf, the more ambitious imitations being treated with various spices designed to give them a Havana flavour. The highest class of Cuban-made cigars, called "havana," are purely of Vuelta Abajo tobacco. Being rolled when it is just half dry, and consequently never dashed with water at all. Next comes the "regalas," similarly made of the best Vuelta Abajo tobacco; and it is only the lower qualities, "ordinary," "select," "candados," and some others, that are made from Vuelta Abajo tobacco, but also with very inferior tobacco, the so-called "veguitas," being exceedingly high-priced. The cigars, when dry, are carefully sorted according to strength, which is estimated by the appearance of a scale. A strong cigar has reddish colorado claro, maduro or oscuro. They are pressed into the cigar boxes for sale, and branded with the name or trade mark of their makers. Cheroots differ from ordinary cigars only in shape, being either in the form of a truncated cone, or of uniform thickness throughout, but always having both ends open and sharply cut across. Cheroots come principally from Manilla, but there are now large quantities imported into the United Kingdom from the East Indie Islands and Burmah.

Cigarettes consist of small rolls of fine cut tobacco wrapped in a covering of thin tough paper specially made for such use. Originally the paper was formed by hand, but now they are very largely made by automatic machinery. The machines cut the paper, gum its edge, measure out the proper quantity of tobacco, wrap it up, make the gummed edge adhere, and roll the ends. In other machines a roll of narrow paper, the size in width equal to the circumference of the cigarette, is converted into a long tube, filled with tobacco, and automatically cut off into proper lengths. Such machines can make several hundred cigarettes per minute. Cigarettes made by hand are of inferior quality, but those made by machine are of high quality. The tobacco leaves are selected and hand-cut, and the paper tubes are filled by hand.

The manufacture of snuff is the most complex, tedious and difficult undertaking of the tobacco manufacture, but it is now of but little importance. The tobacco best suited for snuff-making is thick flaky leaf of a dark colour, but scraps and waste pieces are used. Special preparation is made of the material used for snuff, and the midrifs of leaves are largely used. The material is moistened with a solution of common salt and placed in very high fermentation for some weeks. Various flavouring materials, such as liquorice, tonka beans (Dipterix odorata) and other ingredients are added, the natures of which are often trade secrets.

Fiscal Restrictions.

In nearly all civilized countries the cultivation of tobacco and its manufactures are conducted under state supervision, and are an important source of public revenue. In some, for instance, France, Austria-Hungary and Italy, the cultivation is a state monopoly, and in other countries the crop is subject to heavy excise duties. Since the advent of Charles II. the growth of tobacco in Great Britain has been practically prohibited, the original enactment to that effect having been passed to encourage trade with the young colony of Virginia. In 1885 experiments were conducted, under certain restrictions, and the plant was grown in Norfolk, King's Lynn, and other counties with sufficient success to prove the entire practicability of raising tobacco as a commercial crop in England. In more recent years tobacco has been grown in Ireland, but up to 1910 it had been found impracticable to obtain from the government sufficient relaxation from fiscal restrictions to encourage the home cultivation, though in 1907 the prospect of licences being issued was held out.

Statistics.

The following table, taken from the Year Book of the U.S. Department of Agriculture, 1906, indicates the crops of tobacco in 1905 in the regions mentioned, so far as figures are available.

<table>
<thead>
<tr>
<th>Region</th>
<th>Production (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>721,459,000</td>
</tr>
<tr>
<td>South America</td>
<td>108,575,000</td>
</tr>
<tr>
<td>Europe</td>
<td>630,133,000</td>
</tr>
<tr>
<td>Asia</td>
<td>661,163,000</td>
</tr>
<tr>
<td>Africa</td>
<td>23,346,000</td>
</tr>
<tr>
<td>Australia</td>
<td>1,468,000</td>
</tr>
</tbody>
</table>

Total 2,175,193,000

The estimated value of the world's annual crop is approximately 1,400,000,000.

Consumption of Tobacco.—The comparative consumption of tobacco in various countries is best appreciated by expressing it in pounds per head of the population. The following table gives the Atlas of the World's Commerce: Belgium 6-21 lb, United States 5-40 lb, Germany 3-44 lb, Austria 3-02 lb, Australasia 2-20 lb, Canada 1-54 lb, Hungary 2-42 lb, France 2-16 lb, United Kingdom 1-05 lb, Russia 1-10 lb.

The literature of tobacco is very extensive. William Bragg of Birmingham published in 1880 a revised index of the subject, Bibliotheca tabaciana, extending to 248 quarto pages. From such a mass of authorities it would be vain here to make selections, but mention may be made of Fairholt's capital gossiping work, Tobacco, its History and Associations (2nd ed., 1876). As modern investigators work their way upon the lines of their predecessors, there is a valuable and interesting work, Geschichte des Tabaks (1856) and Wagner's Tabakultur, Tabak- und Zigaretten-Fabrikation (1884). In the foregoing account various passages from the article by J. Paxton and W. Dittmar, in the 9th ed. of the Encyc. Brit., have been utilized.

TOBAGO, an island in the British West Indies, 20 m. N.E. of Trinidad, in 11° 15' N. and 60° 40' W. Pop. 18,751. It is 26 m. long and 73 m. broad, and has an area of 114 sq. m. or 73,113 acres, of which about 10,000 are under cultivation. It consists of a single mountain mass (volcanic in origin), 18 m. in length, and rising in the centre to a height of 1800 ft. A great part of the island is clothed with dense forest, in which many valuable hardwood trees are found. The higher lands form part of what is known as the "Rain Preserve," where, in order to attract and preserve the rainfall, the trees are never allowed to be felled. The average temperature is 81° F. and the yearly rainfall is 66 in. The rainy season lasts from June to December, with a short interval in September. The valleys and rivers are not much utilized for horticulture and sheep-farming, which are growing industries. The soil is fine sandy loam, suited to sugar, cotton, sugar, coffee, cocoa, tobacco and nutmegs, all of which are exported; pimento (allspice) grows wild in the greatest profusion. The schools are conducted by various denominations, assisted by government grants. The island is divided into seven parishes. Scarborough (pop. 756), the capital, is on the south coast, 8 m. from its south-western point. It stands at the foot of a hill 425 ft. high, on which is situated Fort King George, now without a garrison. There is a lighthouse at Baedlet Point. Tobago, properly Tobacco, was discovered in 1498 by Columbus, who.
TOBIN—TOBIT, THE BOOK OF

1041

named it Assumption, and the British flag was first planted in
1580. It afterwards passed into the hands of the Dutch and
then of the French, and was finally ceded to the British in 1814.
Until 1889 it formed part of the colony of the Windward Islands,
but in that year it was joined to Trinidad, its legal and fiscal
arrangements, however, being kept distinct. Ten years later
it became one of the wards of Trinidad, under a warden and
magistrate; its revenue, expenditure and debt were merged
into those of the united colony, and Trinidadian law, with very
few exceptions, was made binding in Tobago.

TOBIN, JOHN (1770-1804), English dramatist, was born at
Salisbury on the 28th of January 1770, the son of a merchant.
He was educated at Bristol Grammar School, and practised
in London as a solicitor. From 1789 he devoted all his spare
time to writing for the stage. He submitted no fewer
than thirteen plays before, in 1803, he got an unimportant farce
staged. In 1804, having just submitted his fourteenth play,
romantic blank verse drama entitled The Honey Moon, to
the Drury Lane management, he came to the conclusion that it was
useless to continue playwriting and left London to recruit his
health. The news that his play had been accepted came too
late. He had long had a tendency to consumption, and was
ordered to winter in the West Indies. He left England on the
7th of December 1804, but died on the first day of the voyage.
In the following year The Honey Moon was produced at Drury
Lane, and proved a great success. Several of Tobin's earlier
plays were subsequently produced, of which The School for
Arts, a comedy, was probably the most successful.

See also The Memoirs of John Tobin, with a selection from his
unpublished writings, by Miss Benger (London, 1820).

TOBIT, THE BOOK OF, one of the books of the Old Testa-
ment Apocrypha. It is a good specimen of the religious novel, a
form of literature invented by the Jews. The romance may be
read in a beautiful dress in the Revised Version of the English
Apocrypha. It was never admitted into the Jewish canon, but
it was admitted into the Christian Canon at the Council of
Carthage (A.D. 397). In the Roman Church it still forms a part
of the Bible, but by the Church of England it is relegated to
the position of those other books which "the Church doth read
for example of life and instruction of manners, but yet doth it not
apply them to establish any doctrine" (art. vi.). Some verses
(Tob. iv. 7-9), however, are read in the oratory; and Tobias and
Sarah once occupied the position now held by Abraham and
Sarah in the marriage service.

The Book of Tobit has reached us in Greek, Latin, Syriac,
Aramaic and Hebrew versions; of these the Hebrew are the
latest, and need not be considered. Of the Greek there are
three forms. One is in the Vatican and Alexandrian MSS.; another
in the Sinaitic. Both these texts and both the Vatican and
Sinaitic Scribes' Segments, of the former denoted by B, and the latter
by Ν. B is the common text, which is followed in the English
Apocrypha. Nevertheless Ν is fuller, except in ch. iv., and
more intelligible; it is also more Semitic than B. The two
must have behind them a common original, for they throw light
upon one another, and the full meaning of a passage is sometimes
only to be got from a combination of both. The fullness of Ν
often runs into superfluities, which are retrenched in B. The
third Greek text is only a partial one (vi. 9—xii. 8). It may
derive from a study of Codices 44, 106, 107 in Holmes and
Parsons, which survive from the 3rd Century, and which was
probably used by St. Jerome in the Vulgate. The Itala was
published by Pierre Sabatier at Paris in 1751, and is reproduced in the
Book of Tobit by Neu-
bauer (Clarendon Press, 1878). It agrees very fairly with Ν,
except in the matter of proper names. Jerome's version is
from the Aramaic, or, as it used to be called, the Chaldee. It
cost the saint one day's work. He describes in his preface the
method of its production. He procured the services of a man
who was familiar with Chaldee and Hebrew. This man trans-
lated to him out of Chaldee into Hebrew, while Jerome dictated
to a shorthand writer his own translation into Latin. The work
was done at the request of two Christian bishops, Chromatius
and Heliodorus. Jerome does not mention the Itala, but it is
plain that he was indebted to it. The Syriac text is said to be
based on a Greek version. It was only in 1878 that the Aramaic
version was brought to light, being published by Adolph Neu-
bauer from a unique MS. in the Bodleian Library. It agrees
with Ν and the Itala, but resembles the Vulgate in having
nothing in the first person. According to Neubauer, it is the
very text which was used by Jerome, after allowance has been
made for the arbitrary methods of the Rabbis and of Jerome
himself. But the Aramaic version has Greek birthmarks (see
especially p. 7, line 18), which other scholars than its editor
have thought decisive against its originality. It was held by
Robertson Smith (after Nöldeke) to be "in the highest degree
probable that the Greek text is original." But the Greek text
appears to be itself a translation from some Semitic source.
Was this source Hebrew or Aramaic? The forms Νυδμ and
'Almugelies in xiv. 4, 15 of Ν show that, at least, that chapter is
drawn from Aramaic, not from Hebrew. But that chapter does
not appear in all the versions, and so may be later than the
rest.

With regard to the date of composition there is the widest
difference of opinion. Ewald refers it to the end of the Persian
period, about 320 B.C. (an opinion which Westcott declared to be
"almost certainly correct"); Kohut thinks that the book was
composed in Persia under the Sassanid Dynasty, about a.d. 250.
But Tobit is already quoted as "scripture" by Clement of
Alexandria (Strom. vii. 33), and it is probably later. The

The date of this document is uncertain; but in Irenæus (i. 28, § 5) in his refutation of the Kaballistic
heresy of the Ophites, we find Tobias figuring as a prophet, on
the same level as Haggai. Earlier still the Book of Tobit is
quoted, though not by name, in the Epistle of Polycarp to the
Philippianas (x. 2; Tob. iv. 10. Cf. Prov. xii. 5; Ecclus. xix. 12).
Now the martyrdom of Polycarp is assigned by C. H. Turner
to the year a.d. 156. We seem to have even a quotation by St.
Paul from the Book of Tobit (1 Tim. vi. 7; Tob. iv. 9), in
which the identity amid difference seems to show that the
Apostle is drawing, not from the Greek, but from the Semitic
original. Josephus displays no knowledge of the work, but he
may have been annotated by the same prejudice as the Pharisees
of St Jerome's day, whose displeasure, that father tells us, he
told in face to giving to Latin readers a book which was against
their canon. (Preface to Tobit.) Internal evidence shows that
the writer of the 14th chapter lived after the building of the
Second Temple, which was "not as the first." In iv. 5 and 6 of
that chapter Tobit is made to predict a glorious building of
the Temple, and this is ascribed to the Pharisees. This is the
conversion of all the Gentiles. Such a passage might well
have been penned when the idea of Herod's Temple was already
in the air. If so, this chapter may be supposed to have been
written a little before 10 B.C., while the bulk of the work may
have been indefinitely earlier.

As to the place of composition Persia, Egypt and Palestine
have each had advocates. One thing only appears fairly certain,
namely, that the Greek versions were composed in Egypt. This
conclusion could, we think, be established by an examination
of the language, especially of some technical terms, final
conclusion. But the tale itself conveys us back to Persia. It has
what Moultlen called an "Iranian background." The evil
demon Asmodeus (q.v.) is the Persian Atshima Daeva. Raphael,
"one of the seven holy angels, which present the prayers of
the saints, and go in before the glory of the Holy One," resembles
the protecting spirit Saroash. And the dog, the companion of
Srosha, is there too. For Tobit differs from all other books of
the Bible in containing the only polite reference to the dog.
Tobias's dog indeed does nothing but accompany his young
master on his journey to Ecbatana and back. But he is there
as the companion and guide of man, which is Aram, Tobit's
totally different one; and which is Aram, Tobit's
allegorical guide, not to be set up for the light of the world. It
is what Moultlen called an "Iranian background." The evil
demon Asmodeus (q.v.) is the Persian Atshima Daeva. Raphael,
"one of the seven holy angels, which present the prayers of
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master on his journey to Ecbatana and back. But he is there
as the companion and guide of man, which is Aram, Tobit's
Even in the more Semitic of the two Greek versions, the dog has evidently been found an offence. Mention of it is suggested only in tablets in 4. ὅ Κύριος is made to go behind Tobias, instead of ὅ κατοι.

The motive of the story has been variously regarded as a desire to insist upon the duty of tithe-paying, upon that of almsgiving, and upon that of burying the dead. The Midrash given by Neubauer has no doubts on this point, as the story is immediately followed by the remark—"Behold we learn how greatly is the power of alms and tithes!" But the third motive is equally apparent. Accordingly some have insisted that the story must have been composed at some period when Jewish dead were left unburied, either by the plague of Antiochus Epiphanes (a Macc. 1, 59), or in that of Hadrian, in the turmoil of Bar-Cochbehaz.

If our choice were limited to these two periods, we should certainly prefer the former. For the book carries within itself signs of early date. It contains no Messianic expectation nor any reference to a future life. The last fact is obscured by the Vulgate. Even in the Itala the word "uterum" is added in xix. after "soluturavi vita."

A new interest has been added recently to the study of Tobit by the publication of the Wisdom of Job (in the "Bible".) In the Book of Tobit Ahiqar is represented as the prime minister of Seneca. The name, however, is nowhere claimed by Tobit as his nephew. There is a desire manifested in the book to bring Tobit and Ahiqar together.


TOBOGGANING—TOBOLSK

TOBOGGANING, the sport of sliding down snow-covered hills and artificial ice-shutes on the toboggan, a sled from 3 ft. to 8 ft. long and 2 ft. to 3 ft. wide, formed of strips of wood from ½ in. to ½ in. in width, fitted together and curved up at the front. The toboggan is not so well fitted for use on roads that are not steep or very smooth as is the sled provided with runners, but is generally used on open hills, or upon artificial courses (chutes), which are very popular in Canada. For "Tobogganing," as known in the Engadine winter resorts, see TOBOLLING.

TOBOLSK, a government of western Siberia, having the Arctic Ocean on the N., the governments of Archangels, Vologda, Perm and Orenburg on the W., the provinces of Akkumol and Semipalatinsk on the S., and the governments of Tomsk and Yeniseisk on the E. It is one of the largest provinces of the Russian Empire, occupying 530,820 sq. m. The northern coast is formed by the Yalmal or Yenamal peninsula, separating the Bay of Kara (on the west) from the double bays of the Ob and Taz (on the east). The Pal-ho coast-ridge touches Tobolsk only at its south-eastern extremity. The Urals proper, which run south-west from the Kara Sea as far as the Töll-pads (544 ft.), and thence take a south-easterly direction, form the boundary between Tobolsk and Vologda.

The remainder of the government is lowland, but varies greatly in its different parts. In the south it assumes the character of grassy steppes or prairies, in the north of immense marshes sparsely overgrown with some small trees. A line west of the Lena and north of the Ocean are approached. The steppes, in their turn, may be subdivided into two distinct portions, the Tobol and Ishim steppe in the west and the Baranai in the east. The former, nearly 43,000 sq. m. in area, is one of the most fertile parts of the empire. One-third is under forest, and the remainder has a soil of very productive black earth, which enjoys the further advantage of being sufficiently drained. The climate is continental, with a minimum temperature of 30° to 34° F., being that of the north of Sweden and of Archangel, but the warm summer (65° to 68° in July) and the amount of light received from a bright sky combine to make vegetable development possible. Livestock, especially cattle, are of great importance. The wheat fields extends to about 55,000 sq. m. and is covered with recent deposits; but, as there is no definite slope, the surface waters accumulate in a large number of lakes and marshes. The climate is moist and the summer shorter and less hot than in the Tobol and Ishim steppes. Forests, consisting chiefly of birch, occur sporadically over its surface. The soil of this region is also very productive, being drained of rainwater by the many shallow streams. The dense woods of mosquitoes in summer are a plague to both the horse and the beast.

To the north of the regions just indicated lie the administrative districts of Tura, Tobolosk and Tura, with an area of about 110,000 sq. m.; this may be described as the Russian settlers Mal. It contains throughout of impenetrable forests and quaking quagmires—the dreadful arman, which are altogether impenetrable 50 m. from the scattered settlements. Gigantic cedar-trees, larches, firs, pines, birches and maples grow very close together, and the underwood is so dense that a passage can be forced only with the hatchet, the difficulties being further increased by the abundance of decayed trees. The marsh lands, which are treacherously concealed under a swaying carpet of grassy vegetation, a kind of snow-shoe has to be used even in summer, and many can be crossed only in winter. Indeed vast areas have never been explored. Navigation lasts for nearly six months in the south. The first steamer on the Ob system was launched in 1845 and the second in 1850; since then the steam navigation has steadily developed.

The estimated population in 1905 was 1,656,700, and is practically all Russian, except for some 42,000 Tatars in the south, 16,000 Ostyaks, 4,500 Samoyedes, and 4,500 Voguls. There are, moreover, about 5,000 Germans and Finns, some Jews in the towns, and about 1,500 gipsies.

The government is divided into ten districts, the chief towns of which are Tobolsk, Berezov, Ishim, Kurgan, Sugut, Taru, Turinsk, Tyulinsk, Tyumen and Yakutsk. The standard of education is very low. The Ostyaks are in a very miserable condition, having come under heavy obligations to the Russian merchants and being compelled to hand over to them nearly all the produce of their hunting and fishing. The Tatar settlements are prosperous in character, but not so in the Tobolosk district, where their lands have been appropriated by the government. Malt, oil, butter, Samoyedes, Ostyaks and Voguls are nominally Christians. The Russians and the Tatars live mostly by agriculture. Of the total area of land regarded as suitable for cultivation (28,400,000 acres), 15,600,000 or 55% are owned by the peasant communities.

Agriculture is generally the chief occupation, and Tobolsk is fast becoming a grainary from which corn is exported to the northern regions of European Russia. The total amount of cereals produced in 1907 was 1,800,000 acres, and the principal crops are rye, wheat, oats, barley and potatoes. Flax, hemp and tobacco are cultivated in the north. Livestock breeding is carried on on a large scale. Dairy-farming is not yet the Russian farming is not yet the Russian, but it has made remarkable progress since the trans-Siberian Railway was built.

The industries are insignificant (chiefly tanning, distilling and tallow-melting). In 1900 there were 1,714,000 acres of forested land. The export of cattle, hides, tallow, corn, flour, fish and furs to Russia, both from Tobolsk and from the Kirghiz steppe, is of some importance. Spirits are sent farther east to Tomsk; while all kinds of foodstuffs, such as salted wares, flour, cereals, fruits, and fruit wines, and Ishim and Ishim are the chief centres for trade.

TOBOLSK, a town of Asiatic Russia, capital of the government of the same name, on the right bank of the Iriysh, near its confluence with the Tobol. Pop. (1900), 21,401. It is 305 m. E.N.E. from Ekaterinburg, and is no longer the capital of West
Siberia nor even an administrative centre for exiles. The kremel, or citadel, built in the reign of Peter the Great, by Swedish prisoners, in imitation of the kremel of Moscow, contains the cathedral, erected towards the end of the 17th century. Some 12 m. south-east are the ruins of the “fort of Kuchum,” the site of the capital of Siberia, Isker, before the Russian conquest. Tobolsk was founded in 1587 by Cossacks, and forms the see of the bishop of Tobolsk and Siberia.

TOBRUK (anc. Antipyrus), a settlement with small Turkish garrison on a fine natural harbour situated on the N. coast of Africa at the intersection of 32° N. Lat., with 24° E. Long. The harbour, which is small but deep, and sheltered by high ground, opens to the east. It is about 24 m. long by ½ m. wide; the depth in the centre is over 40 ft. and soundings of over 30 ft. extend to within a very short distance of the shores. It is the only safe port easily accessible to large vessels for over 1000 m., between Sfax in Tunisia and Alexandria, for, although there is safe and deep anchorage in the recess of the Gulf of Bomba, the entrance is rocky and difficult. Tobruk has long been the outlet for the trade of the oases which extend from Jarabub to Siyah, and are a stronghold of the Scussi order (see Cynecaica), and it is also the headquarters of the Libyan sponge fishery, prosecuted by Greeks. In the spring it is visited by a great number of boats, to protect which a small Hellenic warship has sometimes been despatched. But it is as a future man-of-war harbour that Tobruk is likely to be important. It has been visited both by British and Italian squadrons and has become an object of considerable solicitude to the government of Italy. By running into Tobruk and the neighbouring Gulf of Bomba the French fleet eluded British vigilance on its way to Egypt in 1798.

(D. G. H.)

TOCHI VALLEY, or Dawar, one of the chief routes into Afghanistan in the North-West Frontier Province of India. It leads from the Bannu through tribal country, and is inhabited by the Dawari (q.v.). The valley is divided into two parts, known as Upper and Lower Dawar, by a narrow pass called the Taghrai Tangi, some three m. long. Between Dawar and British territory is the low range of uninhabited hills, which skirt the Bannu district. It was by this route that Mahmud of Ghazni effected his raids into India and the remains of a road flanking the valley and of defensive positions are still to be traced. After the Waziristan Expedition of 1864 the Tochi was garrisoned by British troops; but when Lord Curzon reorganized the frontier in 1901, the British troops were withdrawn, and their place supplied by tribal militia. The chief posts are Saidig, Idak, Miranshah, Datta Khel and Sherani. The valley was the scene of action for the Tochi or Dawar Expedition under Brigadier-General Keyes in 1872, and the Tochi Expedition under General Corrie Bird in 1897.

TOCQUEVILLE, ALEXIS HENRI CHARLES MAURICE CLEREL, COMTE DE (1805-1859), was born at Verneuil on the 29th of July 1805. His family on the father's side were of good descent, and distinguished both in the law and in arms, while his mother was the granddaughter of Malesheres. Alexis de Tocqueville was brought up for the bar, or rather for the bench, and became an assistant magistrate in 1830. A year later he obtained from the government of a mission to examine prisons and penitentiaries in America, and proceeded thither with his life-long friend Gustave de Beaumont. He returned in less than two years, and published a report, but the real start of his tour was the famous De la Démocratie en Amérique, which appeared in 1835, and very soon made his reputation (3rd ed. 1840). It was thus once caught up by influential members of the Liberal party in England, which country Tocqueville soon after visited, and where he married an Englishwoman. Returning to France, he was elected a member of the Académie des sciences morales et politiques (Jan. 6, 1838), and beginning life as a country gentleman at Tocqueville, he thought to carry out the English ideal completely by standing for the chamber of deputies. But, with a scruple which illustrated his character, he refused government nomination from Molé, and was defeated. Later he was successful, and sat for several years both before and after the revolution of February, becoming in 1849 vice-president of the assembly, and for a few months minister of foreign affairs. He was a warm supporter of the Roman expeditions, but an equally warm opponent of Louis Napoleon, and after being one of the deputies who were arrested at the coup d'état he retired from public life. Twenty years after his first, he produced another book, De l'Ancien régime, which almost, if not quite, equaled its success. His health was never very strong, and in 1858 he broke a blood-vessel. He was ordered to the south, and, taking up his residence at Cannes, died there on the 16th of April 1859. He had published some minor pieces during his lifetime, and his complete works, including much unpublished correspondence, were produced after his death in uniform shape by H. G. de Beaumont (Œuvres complètes de Tocqueville, 9 vols., 1860-1865).

During the last twenty years of his life, and for perhaps half that time after his death, Tocqueville had an increasing European fame. His manner, which is partly imitated from Montesquieu, was infectious enough; and he was the first and has remained the chief writer to put the orthodox liberal ideas which governed European politics during the first half or two-thirds of the 19th century into an orderly and attractive shape. He was, moreover, as has been said, much taken up by influential persons in England—N. W. Senior, John Stuart Mill and others—and he had the great advantage of writing absolutely the first book of reasoned politics on democratic government in America. Besides, he was, if not an entirely impartial writer, neither a devotee nor an opponent of democracy. All this gave him a very great advantage which he has not yet wholly lost. At the same time he had defects which were certain to make themselves felt as time went on, even without the alteration of the centre of liberal opinion which has taken place of late years. The chief of these was a certain weakness which can hardly be described by any word more dignified than "priggishness." His correspondence with Molé, above alluded to, is an instance of this, and it was also reflected on in various epigrams by countrymen and contemporaries; one of these accuses him of having "began to think before he had begun to learn," and another declares that he avait l'air de savoir de toute hirondelle ce qu'il ne savait d'apprêter. He appears both in reading history and in conducting actual political business to have been constantly surprised and disgusted that men and nations did not behave as he expected them to behave. This excess of the deductive spirit explains at once both the merits and the defects of his two great works, which will probably remain political classics, though they are less and less likely to be used as practical guides.

See Heinrich Jacques, Alexis de Tocqueville; ein Lebens- und Geistesbild (Vienna, 1870); James Bryce, The Predictions of Tocqueville (London, 1887); and, from the French, Louis Belmont, Les Souvenirs d'Alexis de Tocqueville (1893); and Correspondance entre Alexis de Tocqueville et Arthur de Gobineau (1908).

TOCSIN, a signal of alarm given by the ringing of a bell, hence any warning or danger signal. The earliest form in English is tocksin, which was borrowed from the O. Fr. toquesin (toquer, to strike, cf. tocher and sin, mod. signe, a signal, Lat. signum). The use of "touch" and its cognate forms with the idea of giving a sound is seen in "tucket," Ital. toccato, which probably originally meant a signal given by tap of drum, but is always applied to a flourish or fanfare on a trumpet.

TOD, JAMES (1782-1835), British officer and Oriental scholar, was born on the 20th of March 1782, and went to India as a cadet in the Bengal army in 1799. He commanded the escort attached to the resident with Sindia from 1812 to 1817. In the latter year he was in charge of the Intelligence Department which largely contributed to break up the confederacy of Maratha chiefs in the Pindari War, and was of great assistance in the campaign in Rajputana. In 1818 he was appointed political agent for the states of western Rajputana, where he consolidated the chieftains, settled their mutual feudals and collected materials for "The Monuments and Antiquities of Rajasthan" (2 vols., 1829-1832). Another book of value, Travels in Western India (1830), was published posthumously. He returned from India in 1825,
was promoted lieutenant-colonel in 1826, and died in London on the 27th November 1835.

TODAS—A small pastoral tribe of Southern India, found only on the Niligiri hills. They are distinguished by their tall, well-proportioned figures, aquiline noses, long, black, wavy hair and full beards. Their colour is a light brown. Their dress consists of a single cloth, which they wear like the plaid of a Scotch highlander. The women cover the whole body with this mantle. Their sole occupation is cattle-herding and dairy-work. They practise polyandry, a woman marrying all the brothers of a family. The proportion of females to males is about three to five. Their language is a mixture of Tamil and Kanarese, and is claimed by Bishop Caldwell as a separate language of the Dravidian family. The Todas worship their dairy-buffaloes, but they have a whole pantheon of other gods. The only purely religious ceremony they have is Kona Shastra, the annual sacrifice of a male buffalo calf. Toda villages, called mands, usually consist of five buildings or huts, three of which are used as dwellings, one as a dairy and the other for sheltering the calves at night. These huts are of an oval, pent-shaped construction usually 10 ft. high, 18 ft. long and 9 ft. broad. They are built of bamboo fastened with rattan and thatched. Each hut is enclosed with various species of loose stones. The inmates of a mand are generally related and consider themselves one family.

The Todas numbered 807 in 1901.


TODHUNTER, ISAAC (1820-1884), English mathematician, son of George Todhunter, a Nonconformist minister, was born at Rye on the 23rd of November 1820. He was educated at Hastings, at which town his mother had opened a school after the death of his father in 1826. He became an assistant master at a school at Ruckham, attending the same time evening classes at the University College, London. In 1842 he obtained a mathematical scholarship and graduated as B.A. at London University, and was awarded the gold medal on the M.A. examination. About this time he became mathematical master at a school at Wimbledon. In 1844 he entered St John's College, Cambridge, where he was senior wrangler in 1845, and gained the first Smith's prize and the Burney prize; and in 1849 he was elected to a fellowship, and began his life of college lecturer and private tutor. In 1852 he was made a fellow of the Royal Society, and in 1855 a member of the Mathematical Society of London. In 1871 he gained the Adams prize and was elected to the council of the Royal Society. He was elected honorary fellow of St John's in 1874, having resigned his fellowship on his marriage in 1864. In 1880 his eyesight began to fail, and shortly afterwards he was attacked with paralysis. He died at Cambridge on the 1st of March 1884.

Works.—Treatise on the Differential Calculus and the Elements of the Calculus of Variations (1854); Treatise on Fluid Dynamics (1854); Treatise on Statics (1853, 4th ed., 1874); Treatise on the Integral Calculus (1857, 4th ed., 1874); Treatise on Plane Geometry (1858, 6th ed., 1871); Treatise on Plane Coordinate Geometry (1858, 3rd ed., 1861); Plane Trigonometry (1859, 4th ed., 1866); Spherical Trigonometry (1859); History of the Calculus of Variations (1861); Theory of Equations (1861, 2nd ed., 1875); Examples of Analytical Geometry of Three Dimensions (1868, 3rd ed., 1873); Mechanics (1867); History of the Mathematical Theory of Probability from the Time of Pascal to that of Laplace (1865); Researches in the Calculus of Variations (1871); History of the Mathematical Theories of Attraction and Figure of the Earth from Newton to Laplace (1873); Elements of the Calculus of Variations on Lagrange's and Bessel's Functions (1875); Natural Philosophy for Beginners (1877). An unfinished work, The History of the Theory of Elasticity, was edited and published posthumously in 1886 by Karl Pearson. Todhunter also published keys to the problems in his textbooks on algebra and trigonometry; and a biographical work, William Whewell, account of his writings and correspondence (1876), in addition to many original papers in scientific journals.


TODI (anc. Tuder), a town and episcopal see of the province of Perugia, Italy, 28 m. S. of Perugia by road, on a steep hill above the east bank of the Tiber, 1348 ft. above sea-level, and 866 ft. above the river. Pop. (1901), 3599 (town), 16,528 (commune). Some portions of the ancient town walls—of two enclosures, an inner and an outer, the former attributed to the original Umbrian inhabitants, the latter to the Romans—were preserved, and also remains of baths, amphitheatre, theatre, and a subterranean cell of massive masonry, with four niches. Here was found the bronze statue of Mars, now in the course of the sieges which successively surrounded the city, the temple of Mars at Rome was destroyed in the B.C. 270. The Todini were a Roman colony, with a small church and a collegiate-chapel. In 1863 the church and convent were given to the Congregation of the Sisters of Mercy.
tsar. When he recovered he was employed in strengthening the fortifications at the mouth of the Dnieper, and also those of Cronstadt. In 1836 he visited England, where his merits were well understood. In 1860 he was appointed assistant to the grand-duke Nicholas, and he became subsequently chief of the department of engineers with the full rank of general. He was given no command when war with Turkey began in 1877. It was not until after the early reverses before Plevna (56) that the soldier of Sevastopol was called to the front.

Todleben saw that it would be necessary to draw works round Osman Pasha, and cut him off from communication with the other Turkish commanders. In due time Plevna fell. Todleben then undertook the siege of the Bulgarian fortresses. After the conclusion of preliminaries of peace, he was placed in command of the whole Russian army. When the war was over he became governor of Odessa and hereditary count. But his health was broken, though for some time after 1880 he held the post of governor of Vilna, and after much suffering he died at Bad Soden near Frankfort-on-Main, on the 1st of July 1884.

His great work on the defence of Sevastopol appeared in Russian, French and German (5 vols. 1863-1872). Besides this, he wrote a letter to General Brialmont on the operations around Plevna; this was printed in the Russian engineer journal, and in German in the Archiv für gesammte Artillerie-Offiziere (1875).

See Brialmont, Le Général comte Todleben (Brussels, 1883); Rieger, "Todleben u. seines Wirkens Bedeutung für die Kriegskunst der Kolonialzeit als Quellenwerk von Geschichte des Artillerie- und Genieswesens, Vienna, 1881;" Witzel, in Internationale Revue über die gesamten Armeen und Flotten (1879); Schröder, in Archiv für Artillerie- und Ingenieur-Offiziere (Berlin, 1888); Life by Schilder (in Russian, St Petersburg, 1885-1887); Kraemer, General-Adjutant Graf Todleben (Berlin, 1885).

**TODMORDEN**, a market town and municipal borough in the Sowerby parliamentary division of the West Riding of Yorkshire, England, extending into the Middleton parliamentary division of Lancashire; 19 m. N.N.E. of Manchester, on the Lancashire & Yorkshire railway. Pop. (1901), 25,418. It lies on both sides of the river Calder, and the scenery of the valley is beautiful in spite of the numerous factories. Todmorden Hall, a picturesque old mansion of various dates, was the seat of the Radelflites, but they sold the manorial rights about the close of the 17th century. The town hall is a handsomely classical building erected in 1875; it bridges the county boundary, the Calder, enabling the magistrates to exercise jurisdiction in both counties. There is a bronze statue to John Fielden (1784-1849), to whose energy in developing the cotton manufacture the town owes much of its prosperity. The staple industry is the spinning and weaving of cotton, and there are also foundries and machine works. The municipal borough, incorporated in 1856, is under a mayor, 6 aldermen and 18 councillors. Area, 12,773 acres.

**TODDY**, T. Pennant's rendering (Gen. Birds, pp. 35, 61) through the French Todier of M. J. Brisson (Ornithologie, iv. 538) of the somewhat obscure Latin word Todus, not unhappily applied in 1756 by Patrick Browne (Cit. and Nat. Hist. Jamaica, p. 476) to a little bird remarkable for its slender legs and small feet, the "green sparrow" or "green humming-bird" of Sir H. Sloane (Voyage, ii. 306). The name, having been taken up by Brisson (loc. cit.) in 1760, was adopted by Linnaeus, and has since been recognized by ornithologists as that of a valid genus, though many species have been referred to it which are now known to have no affinity to the type, the Todus viridis of Jamaica, and accordingly have since been removed from it. The genus Todus was at one time placed among the Muscicapidae (cf. Flycatchers); but J. Murie's investigations (Proc. Zool. Society, 1872, pp. 663-686, pl. lv.) have conclusively proved that it is not passerine, and is nearly allied to the Monotisidae (cf. Motmot) and Alcedinidae (cf. Kingfisher). It being regarded as forming a distinct sub-family T odorinae of the Monotisidae peculiar to the Greater Antilles, each of which islands has its own species, all of small size, the largest, not exceeding four inches and a half in length.

Of the species already named, T. viridis, P. H. Gosse (B. Jamaica, pp. 72-80) gives an interesting account. "Always conspicuous from its bright grass-green coat and crimson-velvet gorget, it is a very tame bird; yet this seems rather the tameness of indifference than of confidence; it will allow a person to approach very near, and, if disturbed, alights on another twig a few yards distant... commonly it is seen sitting patiently on a twig, with the head drawn in, the beak peering upwards, the loose plumage puffed out, when it appears much larger than it is. It certainly has an air of stupidity when thus seen. But this abstraction is more apparent than real; if we watch it, we shall see that the odd-looking grey eyes are glancing either this way and that, and that ever and anon the bird sallies out upon a short feeble flight, snaps at something in the air, and returns to his twig to swallow it. The birds of the family also show their affinity to the kingfishers, motmots and bee-eaters by burrowing holes in the ground in which to make their nest, and therein laying eggs with a white translucent shell. The sexes differ little in plumage.

All the four species of Todus, as now restricted, present a general similarity of appearance, and possess very similar habits; and even these, by some ornithologists, might be regarded as geographical races. The Cuban form is T. multicolor; that of Haiti in T. subulatus or dominicensis; and that of Porto Rico, originally named in error T. mexicanus, has since been called hypochondriacus.

(A. N.)

**TOGGENBURG, THE**, a special name given to the upper valley of the river Thur, in the Swiss Canton of St Gall. It descends in a N.W. direction from the watershed between the Rhine and the Thur, and is enclosed N.E. by the chain of the Säntis (8216 ft.) and S.W. by that of the Kurfürsten (7576 ft.) and of the Speer (6411 ft.). It is a fertile valley of about 30 m. in length from the source of the river to Wil on the railway line between Winterthur and St Gall. The upper half is traversed by an excellent carriage road, while from Kappel there is a railway to Wil (15 m.). Its industrious population numbered 34,594 in 1900, nearly equally divided between Romanists and Protestants, mostly German-speaking. Those of the upper half are devoted to pastoral pursuits while those of the lower half are engaged in the manufacture of muslin and cotton. This valley is as yet frequented only by Swiss visitors, and retains many characteristics of sub-alpine Switzerland before the arrival of...
of the horde of tourists. At Wildhaus, the highest village (3632 ft.), the house wherein Huldreich Zwingli, the Swiss Reformer, was born in 1484, is still shown. The chief village is Lichtensteig (1387 inhab.), but those of Kirkberg (3025 inhab.) and of Wattwil (4971 inhab.) are the most populous. On the extinction of the main line of the local counts (1430), the possession of their dominions passed to the Lords of Raron (in the Wald), who sold it in 1468 to the abbot of St Gall. (W.A.B.C.)

TOGO, HEIHaICHO, Count (1847—__), Japanese admiral, was born in Kagoshima. He studied naval science and navigation in England from 1871 to 1878, and first became a prominent figure when, in 1894, as captain of the cruiser "Naniwa," he sunk the Chinese troopship "Kowshing" en route for Korea, thus precipitating war with China. When the Russo-Japanese conflict broke out in 1904, he was appointed to the command-in-chief of the Japanese fleet, and under his direction various brilliant operations took place, culminating in the battle of the battle of the Sea of Japan when the Russian fleet was annihilated. For these services he received (1907) the title of count. In 1906 he was made a member of the British Order of Merit.

TOGOLAND, a German colony on the Gulf of Guinea, West Africa. It forms part of the territory formerly distinguished as the Slave Coast and was annexed by Germany in 1884. It is bounded S. by the Atlantic, W. by the British possessions on the Gold Coast, N. by the French colony of Upper Senegal and Niger, E. by Dahomey, also a French colony. (For map see French.) Population (1902), 262,649; and in 1910 in m. in length (1° 14' E. to 5° 38' E.) but inland Togoland widens to three or four times that breadth. It contracts again at its northern boundary to about 30 m. From the coast northward the extreme breadth is 590 m. The area of the colony is some 33,700 sq. m. Pop. about 1,500,000. The white inhabitants numbered (1909) 330 of whom 300 were German. The boundary between Togo and Dahomey, by Franco-German agreement of 1897, follows the coast lagoon from Little Popo to the Mono river, ascends the middle of that river as far as 7° N., thence goes in a direct line to 9° N. and from that point in a north-westerly direction to 13° 30' W. The western boundary was settled by Anglo-German agreements of 1890 and 1899; it leaves the coast west of the town of Lome and proceeds in a zigzag line to where the Deine river joins the Volta; thence follows the Volta to its junction with the Daka and then the Daka up to the point where 9° N. cuts the river. From this point the frontier follows a north-easterly course to 11° 8' N., leaving the town of Yendi and the Chakossi territory on the German side of the boundary line. The agreement of 1899 defined the western boundary from 8° N. northward, and partitioned between the two powers a large block of territory, which by an agreement of 1899 has been annexed by the French. The northern frontier is a line drawn between the termini of the eastern and western frontiers.

Physical Features.—The coast is low and sandy and is formed by the detritus deposited by the sea current called Calena. It is perfectly straight, without harbours, and approached only through a dangerous bar. This coast strip is nowhere more than 2 m. broad. It masked a series of lagoons, of which the largest, occupying a central position, is called the Togo, Avon or Haho lagoon. It is connected by a channel running eastward parallel with the sea, with the Wolo and Libin lagoons, and with the chief lagoon in the south. Between the latter and the chief lagoon an undulating plain stretches some 50 m. The Sio and Haho, the two largest rivers of the coast region, both flow into the Togo lagoon. These rivers rise on the eastern versant of a chain of mountains which traverse the country in a south-westerly to north-easterly direction. Beginning in the south-east corner of the Gold Coast colony this range, composed of quartzites and schists, extends beyond the borders of Togoland into upper Dahomey. It has no general name in the local dialects. Called by the people the "offensive range," it presents a fairly continuous escarpment. It is most elevated in its southern portion, Mt Dabo having a height of 3133 ft., and Mt Koppo, 2950 ft. The direction of the range from 2000 and 2500 ft.; on the north-west side of the range the country is table-land some 600 to 1000 ft. high. Baumann Spitze (3215 ft.) is an isolated peak in 6° 50' N., 0° 46' E., east of the main range. The coast of the western part of the range is washed by the coast streams, drains to the Mono river. The greater part of the colony lies west and north of the chain and belongs to the basin of the Volta. The chief river traversing it is the Oti, which rises in about 12° N., enters Togoland at its north-east corner, and runs with a very sinuous course south-south-west to the coast. The river has one of the longest courses in the world, and in the distance the left bank of the Volta itself is in German territory, but its lower course wholly is in the Gold Coast colony.

The climate of Togoland is hot, humid and unhealthy. There are two wet seasons, the first lasting from March to June, the second from September to November. Apart from the coast region, seasons of drought are not uncommon. The dry wind from the south is the harmad, chiefly from March and April, and causes a red sand, causes a fall of temperature in the (European) summer.

Flora and Fauna.—Coco-nut palms, introduced about the beginning of the 19th century by the Portuguese, grow along the coast banks of the lagoons and the larger rivers. There are belts of reeds, and the coast-land is covered with low, impenetrable bush. There are considerable forests of oil palms, rubber trees and various hardwoods. The swamps and lagoons are rich in fish. The river valleys are densely wooded. On the hills the baobab and hibiscus are characteristic; on the plateau are stretches of open savanna, and park-like country with clumps of silk cotton and shea-butter trees. The fauna resembles that of other parts of West Africa; it is poor on the coast. Elephants and lions are found in the interior.

Inhabitants.—The inhabitants are negroes and negroids. In the north the people are mostly Hausa, in the west they belong to the Tahi-speaking clans, while on the coast they are members of the Ewe (Dahomey) tribes. Among the coast people there is a distinct infusion of Portuguese blood, and in all the ports are descendants of Brazilian negroes who returned to Africa after slavery. In the 19th century there were Spanish and Portuguese traders and agriculturists, in the interior they are largely pastoralists. The Hausa are often traders, travelling the country in large caravans. The inhabitants are partly Mahomedans, partly believers in fetish; comparatively few profess Christianity. As a rule the tribes are peaceful. Slave raiding has ceased, but domestic slavery in a mild form continues.

The capital of the colony is Lome (pop. about 5000) near the western frontier. It is a creation of the Germans, the site, in 1884, being occupied by a small fishing village. It is provided with a jetty; it is the terminus of the railway systems, the residence of the governor, and has churches, schools, hospitals and large business houses. The chief African traders are Hausa immigrants. Togo, which has given its name to the country, is a town on the south-eastern shores of the Togo lagoon. On the narrow spit of land between the lagoons and the sea are Bagida and Porto-Seguro—the last named one of the oldest towns on the Slave Coast and the port of Togo town—and, close to the eastern frontier, Little Lome, Aneho and a station on the German coast. About 15 m. south-west of Porto Seguro, the Anes are reported to have come from the Gold Coast by sea and to have been wrecked at this place. Little Lome dates from the 17th century or earlier. At the time of the recent epidemic of smallpox in 1903, it was in the New French colony. The streets joining these towns are named after the river Kete-Krachi; on an affluent of the Mono in 7° N. is Sagada. In the north are the large native towns of Yendi and Sannsane Mangu, both on caravan routes between Ashanti and the Niger countries.

Agriculture and Trade.—The country is rich in natural products, and its resources have been largely developed by the Germans. It was the first German colony to dispense (1903-1904) with an imperial subsidy towards its upkeep. Several firms have acquired plantations in which coffee, cocoa, cotton, kola and other tropical products are cultivated. Coco-nut palms thrive; maize, yams, bananas, tapioca and ginger are cultivated by the clergymen. Among the rare wild plants of the province are the palm oil and kernels, rubber, cotton, maize, groundnuts (Arachis), shea-butter from the Bassia pubicki (Sapotaceae), fibres of the Raphia vinifera, and the Santheveria guineensis, indigo, and kola nuts. The animals plentiful, on the plateaux and in the wild woods. The natives have several industries, including pottery, straw plaiting, smithwork and woodworking. Some of them are waling in the wood, the wood is of good quality, and dye it with indigo or other pigments; they also manufacture very handsome shawls. Cotton growing under native ownership is not extensive but small quantities were grown in 1901-1902 over 100,000 lb. of cotton grown from native, American and Egyptian seed were shipped to Bremen. In subsequent years the industry attained considerable proportions. Tobacco is grown for domestic and foreign market, and rubber is rapidly coming into importance, though little quantity is grown. Imports are mainly from Germany, exports to Germany and to other West African colonies. In 1908 the value of the imports was £425,000, of the exports £389,000.
Communications.—Good roads have been built connecting the coast towns with the principal places in the interior. A railway about 20 m. long connects Lome with Little Popo. From Lome another railway 76 m. long runs north-west to Agomé on line near Missahô. There are telegraph and telephone lines between Lome and Little Popo, and both places are in telegraphic communication with the Gold Coast and Dahomey, and thus with the international cable system. The German postal and telegraphic offices are maintained at Togoland and Hamburg, and the steamers of three French and two English lines call at Togoland ports.

Government. — The colony is administered by a governor who is advised by a nominated council of unofficial members. Revenue is derived principally from customs duties, direct taxation being slight. In 1907-1908 revenue and expenditure balanced at £103,000.

The table upside down, and the apparatus are so arranged as to which the natives are amenable. The government maintains schools at all the coast towns. Various missionary societies have also established schools. In 1909 some 10,000 native children were receiving instruction.

History.—Before its annexation by Germany the lagoons were a favourite resort of slavers, and stations were established there by Portuguese, British, French and German traders. The coast natives were dependent on the rulers of Dahomey or Porto Novo. Little Popo and Togo were capitals of small independent kingdoms. Little Popo is said to have been founded in the 17th century by refugees from Accra, who were driven out by the Akwamu. At the time that " the scramble for Africa " began, the narrow strip of coast over which the kingdom of Togo ruled was the sole district between the Gambia and the Niger inhabited by a people which the Europeans term native. At Togo Bremen merchants had trading stations, and taking advantage of this fact Dr Gustav Nachtigal, German imperial commissioner, induced the king of Togo (July 5, 1884) to place his country under German suzerainty. The claims made by Germany to large areas of the hinterland gave rise to considerable negotiation with France and Great Britain, and it was not until 1899 that the frontiers were fixed on all sides (see AFRICA, § 3). Meantime the development of the coast region had been taken in hand. On the whole the history of the colony has been one of peaceful progress, interrupted now and again, as in 1903, by severe droughts. At stated intervals the native chiefs are summoned to Lome to discuss administrative matters with the government.

See H. Klose, Togo unter deutscher Flagge (Berlin, 1899), a comprehensive survey, with bibliography; N. Seidel, Die Kiste und das Vorland der Togolosan (Berlin, 1905), and Die Einkaufsreise an der Goldküste; N. Seidel (1906): Schönhart, Volksstämme aus Togo (Dresden, 1909); R. Bütter, Die Forschungstation Bismarckburg und Adèk (1894); Das deutsche Schutzgebiet Togo (Bremen, 1894); L. Kiesow, The Geology and Geographical Vegetation, in Mittell., der geol. Gesell. in München (1905); L. Klose, "Religiöse Anschauungen und Menschentypen in Togo" in Globus 1902; P. Sprigade, Karte von Togo, scale 1:200,000, 12 sheets, also in 2 sheets of the Togoland map, 1905.

TOILET, the process or operation of dressing, also dress and its appurtenances, also applied, especially in the French form "toilette," to a particular costume worn by a lady. The word is adapted from French toilettte, a diminutive of toile, cloth, Latin tela, web, woven cloth, from root of texere, to weave; this word survives in the English "toils," net, snare.1 The earliest use of "toilet" and toilettie is for a cloth, usually of linen or other fine material spread over a table when used to hold the sewing-glass and all the other articles used in dressing, or for a small sheet or cloth thrown over the shoulders of a person while being shaved or having or his hair dressed. It was thus applied especially to the various articles collectively which form the apparatus of a toilet-table or dressing-table. Dressing-tables or toiletties were articles of domestic furniture on which the 18th century cabinet makers and ébenistes of France lavished their decorative art. The escritoire and toilettie combined which belonged to Marie Antoinette is in the Victoria and Albert Museum, South Kensington (see Furniture, Plate IV., fig. 4).

1 "Toil," labour, fatigue, weariness, must of course be distinguished from its French appellation.

TOKAJ (or Tokay), a town of Hungary, in the county of Zemplén, 148 m. E.N.E. of Budapest by rail. Pop. (1900), 5104. It is situated at the confluence of the Bodrog with the Theiss, and gives its name to the famous Tokay wine. Tokaj lies at the foot of the Hegyalja Mountains, which stretch to the north and north-west of the town, between the rivers Hernad and Bodrog, for a distance of about 60 m. as far north as Eperjes. The northern part of the range is also called Sóvar Mountains. These mountains, which have in the northern part an altitude of 2700 ft., slope down towards the south-east near Tokaj in a hilly plateau, about 1500 ft. altitude, where the vineyard region is situated. This vineyard region covers an area of about 135 sq. m., and belongs to 21 adjoining communities. The soil is of volcanic origin (trachyte). The principal places where the wine is produced are Tarczal, Tálya, Mád, Liszka, Tokaj, Tolcsva, Sárspatak, Keresztur, and Zsadány. The yearly production averages 5,000,000 gallons. It is believed that the vine was introduced into this region by colonists from Italy and Morca in 1241.

TOKAT (Armenian Estagnia, anc. Dasimon) the chief town of a sanjak of the same name in the Sivas vilayet of Asia Minor. It is situated in the Sivas-Samsun chausée, altitude 2280 ft., at the mouth of a rocky glen which opens out to the broad valley of the Tozanni Su, a tributary of the Yeshil Irmak. It rose to importance under the Seljuks. Pop. about 30,000, two-thirds Musulman. The industries are the manufacture of copper utensils and yellow leather, and the stamping of colours on white Manchester cloth. Near Tokat copper pyrites, with iron and manganese, kaolin and coal are found; but most of the copper worked here comes from the mines of Keban Maden and Arghana Maden, on the upper Euphrates and Tigris.

(T. G. H.)

TOKELAU (or Union Islands), a group of three atolls in the Pacific Ocean, about 350 m. N.E. of Samoa, belonging to Britain. Atafu consists of 63 islets, Nukunau of 93 and Fakaofo of 62. They produce little but copra. The natives are all Christians, and in type and speech are akin to the Samoans. They number about 500.

TOKEI MONEY, the term employed originally to describe the counters or "tokens" issued by traders to meet the lack of small change. It has now been appropriated by economists and officials to denote the smaller currency that circulates at a nominal value higher than its cost. It is contrasted with "standard" money, and is limited in its amount by state authority. Its power of discharging debts is also limited: in England, e.g., silver is legal tender only up to 40s., copper to 12 pence. Various substances have been utilized for the manufacture of token coinage—silver at a lower degree of fineness, copper in different alloys, and nickel. The French term monnaie artisanale has much the same meaning; so has the German Schädelmünze. A currency, restricted in amount, but with full legal tender power—such as the Indian rupees and the French 5-franc pieces—is midway between token and standard money. Representative money also bears some analogy to token coinage. (See MONEY and SEIGNORAGE.) (C. F. B.)

TOKUGAWA, the name of a Japanese family which provided the ruling dynasty of shōguns from 1603 until the revolution which restored the power of the mikado in 1867. The founder of this dynasty was leyasu Tokugawa (1542-1616), a great general and consummate politician, who was connected by descent with the Minamoto clan. The most famous of the subsequent shōguns was his grandson Ieyemitsu (from 1623 to 1650). (See JAPAN: History.)

TÓKYO (or Tōkiō, formerly called Yedo), the capital of the empire of Japan, situated in 35° 41' N. and 139° 45' E., at the head of the bay of the same name on the south-east coast of the main island. The city stands on the banks of the river Sumida, which, although pretty wide, is navigable by vessels of large tonnage owing to its shallowness. Yokohama, with which Tókyo is connected by 18 m. of railway, is practically the port of the capital. Tókyo is the centre from which several railways radiate. The trains of the Tókai-do line, starting from
the Shimabashi station, run westwards to Kobe, thence to Shimonsoski, at the western end of the main island, a distance of 700 m. The Uyeno station is the starting-point for trains to Aomori, a town 460 m. away, at the northern extremity of the island. In 1907 a central station was designed to be built south of the foreign party in 1860.

The climate is mild and healthy, and for the greater part of the year very pleasant, the seasons of spring and autumn being more especially delightful.

The area of Tókyó is about 30 sq. m. Topographically it may be divided into two parts, upland and lowland (Yamamoto and Shitamachi). There are hills varying in height from 50 to 130 ft. in the upland district; that is to say, the outskirts of the city from north to west. Lowland Tókyó, that part of the city covering the flats on both sides of the river Sumida, is intersected place to new streets and houses. Nearby Sumida, and those which span the canals, have always been distinctive features of Tókyó. The Nihon-bashi (Bridge of Japan), in the district of the same name, is by far the most famous. It is the point from which all distances in Japan are measured. The largest bridges are those named Azuma, Umay, Ryogoku, Shin-o and Eitai over the Sumida.

The streets were formerly narrow and irregular, but the principal thoroughfares have been widened under the Street Improvement Act of 1888. Electric tramcars run throughout the city carrying passengers at a uniform rate of 4 sen, which means that it is possible to travel some 10 miles for one penny. The jinrikisha, drawn by one man or sometimes two men, which were formerly the chief means of passenger conveyance, have notably decreased in number since the introduction of the tram. Tókyó has often experienced earthquakes, and more than once has suffered from severe shocks, which have hitherto prevented the erection of very large buildings. The numerous residences of the daimyōs were the chief characteristics of the old town, especially in the Kojimachi-ku. Many of these have been demodeled and government offices erected on their sites; others have given place to new streets and houses. Nearby Sumida, the centre of Kojimachi-ku, on an eminence, surrounded by moats, stood the castle of Yedo, formerly the residence of the shōguns, which was burnt down in 1873. The imperial palace was subsequently erected on this site. The palace is half European and half Japanese in its style of architecture. The Nijū-bashi is the main entrance. To the east and south of the palace the nearbourhood has undergone great changes in modern times. It was here, at the Sakurada Gate, that I Kamon-no-Kami, prime minister of the shōgun's government, was assassinated by the anti-Imperialists in 1868. Several of the old buildings stand, the offices of the royal family and the offices of the general staff. In another street, leading from the gate, are the foreign office, the supreme court, the local court and the departments of justice and the navy. The temporary buildings of the Imperial Diet, which first met in 1890, are also in this part of the capital. Adjoining the above-named buildings is the Hibiya Park, modelled on the European style, while retaining the special features of the Japanese gardeners' art. The parks have always afforded to the people their chief means of recreation. The largest and most beautiful are those in Shiba and Uyeno. Of the two, the park of the old castle of Yedo, also, are the Imperial Museum, the Imperial Library and the Zoological Gardens. The famous temple of Kwanon, the goddess of mercy, is in the Asakusa Park, in which a permanent fair is held; it is a great holiday resort of the citizens. In Kudanaka Park is the Yasukuni Temple, popularly known by the name of Shokonsa, and consecrated to the spirits of departed soldiers who fell in war. In another ground is a museum of arms, containing trophies of the wars with China and Russia.

Administration.—For administrative purposes Tókyó is divided into fifteen districts or ku, of which Kojimachi, Hongo, Koishikawa, Ushigome, Yotsuya, Akasaka, Azabu and Shiba are situated in the upland portion, while Kanda, Kiyosumishita, Shinjuku, Asakusa, Hongo and Fukuoka are in the lowland. Tókyó is divided into eight districts or gun, which, with the city proper, collectively form the Tókyó-Fu (prefecture), under the general control of one governor called Fu-Chiji. Questions affecting the interests of the whole Fu come before the Ku-kwai, or prefectural council, which is elected by a body made up of the prefect, his secretaries, and the representatives of the municipal council, of which the governor is president; while matters concerning the city alone are discussed by a Shi-kwai, or municipal assembly, and administered by a municipal council, of which the Shōchō or mayor is president. The water supply worked by the municipality. The reservoir at Yodobashi is capable of supplying water (from the river Tama) to all parts of the city; a pressure varying from 80 to 100 ft. The hydrants are fixed in all the streets for the use of the fire brigade, which has a well-disciplined and efficient personnel, and does not lack opportunities for the exhibition of its skill in a town built largely of wood. The police force is another well-trained and successful service. Both police and fire brigade are under the command of a single Keishi-sokan (inspector-general). The postal arrangements are very satisfactory, frequent deliveries being made with the utmost dispatch. The telephone system is extensive, including long-distance wires to Yokohama, Osaka and other large towns. A complete and successful system of education exists. There are many schools and for advanced students devoted to the various branches of science, mechanics and art. The imperial university of Tókyó, which consists of the colleges of law, medicine, literature, science, engineering and agriculture, is the principal institution of learning in the empire. There are several daily newspapers as well as weekly and monthly publications of all kinds. In the lowland part of the city and in the suburbs there are many factories, their number having so greatly increased in recent years that Tókyó may now be described as an industrial town.

Population.—There are no reliable data as to the population of Yedo during the shōgunate. Owing to the influx caused by the periodic visits of the daimyōs (feudal lords) with their numerous attendants, it probably exceeded 1½ million during the early part of the 19th century. The population was 845,780 in 1850; 1,207,341 in 1850; 1,339,726 in 1895; 1,497,565 in 1900, and 1,960,833 in 1905.

History.—No mention is made of Tókyó in Japanese history before the end of the 12th century. It appears to have assumed its present shape till 1457, when Ota Dokwan, a general in the service of Yuesugi Sadaoki, governor of Echigo, built a castle here. About thirty years later the town fell into the hands of Hōjō of Odawara, and on his overthrow by Hidetoshi and Ieyasu, the castle was granted to the latter, who was the founder of the shōgun house of Tokugawa. In 1590 Ieyasu made his formal entry into the castle of Yedo, the extent of which he greatly enlarged. From this date the real importance of Yedo began. The family of the Tokugawas furnished the shōguns (or tycoons) of Japan for nearly three hundred years, and these residing during that period at Yedo. At the restoration in 1868 the population of the city had increased, and the population of Yedo speedily decreased. A fresh vitality was imparted by the transfer of the court from Kiotō, and the town then received its present name Tókyó (eastern capital).

TOLAND, JOHN [christened JANUS JUNIUS] (1670-1722), English delst, was born on the 30th of November 1670, near Londonderry, Ireland. Brought up a Roman Catholic, in his sixteenth year he became a zealous Protestant. In 1687 he entered Glasgow University, and in 1690 was created M.A. by the university of Edinburgh. He then spent a short time in some Protestant families in England, and with their assistance went to Leiden University, to qualify for the B.D. degree. He spent about two years studying ecclesiastical history, chiefly under the famous scholar Friedrich Spanheim. He then went to Oxford (1694), where he acquired a reputation for great learning and "little religion," although at the time he professed to be a decided Christian. While at Oxford he began the book which made him famous—his Christianity not Mysterious (1696, anonymous; 2nd ed. in the same year, with his name; 3rd ed., 1702, including an Apology for Mr. Toland.) It gave great offence, and several replies were immediately published. The author was prosecuted by the grand jury of Middlesex, and, when he attempted to settle in Dublin at the beginning of 1697, he was denounced from the pulpit and elsewhere. His book having been condemned by the Irish parliament (Sept. 9, 1697) and an order issued for his arrest, Toland fled to England. The resemblance, both in title and in principles, of his book to Locke's Reasonableness of Christianity, led to a prompt disavowal on Locke's part of the supposed identity of opinions, and subsequently
TOLEDO, a province of central Spain, formed in 1833 from part of New Castle; bounded on the N. by Ávila and Madrid, E. by Cuenca, S. by Ciudad Real and W. by Cáceres. Pop. (1900), 376,814; area 5910 sq. m. The surface is throughout lofty, and in a great part of its extent mountainous. Towards the centre there are extensive plains or tablelands, but the whole of the south and southwestern part of the province is mountainous, with hills which separate the waters of the Tago and Duero from those of the Guadiana on the south. These mountains are of no great height; until late in the 19th century they were densely covered with forests. Toledo is well watered by the Tago (q.v.) and its numerous affluents, including the Guadarrama and Alberche on the north and the Algodor, Torcon, Pusa and Sangera on the south. The Giguela waters the eastern districts. Gold, silver, lead, iron, quicksilver, copper, tin and other minerals have been discovered, but the mining industry does not prosper and there is little export trade in agricultural products. The number of sheep, goats, asses and mules is large; dairy-farming and the breeding of draught oxen and fighting bulls are also practised. Bees and silkworms are kept in considerable number. Manufactures once numerous, but now silk and woolen cloth, earthenware, soap, oil, chocolate, wine, rough spirit (aguardiente), guitar strings and arms are almost the only articles made. There is also a small trade in charcoal and timber. The province is traversed by three lines of railway—that of Madrid-Seville-Cadiz in the south, Madrid-Toledo-Ciudad Real in the centre, and Madrid-Cáceres-Lisbon in the north.

TOLEDO, the capital of the Spanish province of Toledo and formerly of the whole kingdom, 47 m. by rail S.S.W. of Madrid, on the river Tago, 2400 ft. above sea-level. Pop. (1900), 25,317. Toledo occupies a rugged promontory of granite, washed on all sides except the north by the Tagus, which here flows swiftly through a deep and precipitous gorge. Towards the north the city overlooks the desolate Castilian plateau; beyond the river it is confronted by an amphitheatre of bare mountains, the Montes de Toledo, and in the vast form of a curl of granite, defended by the river and by a double wall on the north, and dominated by the towers of its cathedral and alcázar. The absence of traffic in its maze of dark and winding alleys creates a silence uncommon in so large a city. There are few plazas, the principal open spaces being the arcaded Zocodover, described by Cervantes in the Novelas ejemplares; and some of the finest monuments of antiquity are hemmed in by meaner structures. The houses, tall, massive and sombre, are entered by huge iron-studded doors, and, owing to the extremes of heat and cold characteristic of the Castilian plateau, most of their windows open on an sheltered inner court (patio), the walls facing the street being often blank, though their monotony is sometimes relieved by carved Gothic or Moorish stonework. Nowhere, even in Spain, have the appearance and atmosphere of a Gothic city been

service made up of passages from heathen authors, in imitation of the Church of England liturgy. The title-page still embodies the mystery which the author threw round the question how far such societies of pantheists actually existed.

Mosheim's Vindiciae antiquae christianorum disciplinae (1722), containing the most exhaustive account of Toland's life and writings; A Life of Toland (1722), by "one of his most intimate friends"; Memoirs of the Life and Writings of Mr John Toland, by John Abernethi, published posthumously in London, 1747; John Leiden's View of the Principal Deistical Writers (last ed. 1837); G. V. Lechler's Geschichte des englischen Deismus (1841); Isaac Disraeli's Calomisites of Authors (new ed., 1881); article on "The English Freethinkers" in Theological Review, No. 5 (November, 1864); J. Hunt, in Contemporary Review, No. 6, June 1868, and his Religious Thought in England (1870-1875); Leiden's History of English Thought in the Eighteenth Century, vol. i. (1881), and article in Dictionary of National Biography; J. Cairns' Unbelief in the Eighteenth Century (1881). On Toland's relation to the subsequent Tübingen school, as presented in his Nazeremus, see D. Patrick in Theological Review, No. 59 (October, 1877); and on his relation to materialism, F. A. Lange's Geschichte der Materialismus (Eng. trans. by E. C. Thomas, 1877), and also G. Berthold, John Toland und der Materialismus der Gegenwart (1876).
preserved with so little change. Though the Moslems have left their imprint upon its architecture, and though many ancient buildings have been destroyed after the Christian reconquest to make room for churches, convents and seminaries, Toledo as a whole remains as distinctively Gothic and medieval as Granada is Moorish, Madrid Castilian or Barcelona modern. It has also been from the earliest times the centre of Spanish Christianity, and its archbishop is styled ex officio "primate of all the Spains."

Principal Buildings.—The Taqos is spanned by two fortified Moorish bridges, the Puente de Alcántara, on the north-east, which was built between the 11th and 17th centuries, and the Puente del Alcántar, on the north-west, founded in 1212 and rebuilt in 1390. The inner wall of the city is said to have been founded in the 7th century by the Visigothic King Wamba; much of the present Moslem wall dates from the 11th century.

The Puerta de la Calahorra, the outer wall in 1109. To the same period belongs the Mudéjar Puerta del Sol, the finest of several ancient gateways, among which the Puerta Visgra (1550, restored 1757), and the Puerta del Cambron (1102, restored 1576) are also interesting. The Puerta Visgra Antigua, a Moorish gateway of the 9th century, has been walled up, but its original form is preserved. The Alcázar, a huge square building with a tower at each corner, was transformed into a palace by Ferdinand and Isabella, a gateway by Alonso de Covarrubias and a staircase by Herrera and Francisco de Villalpando. The Ayuntamiento, or City Hall, is a 15th-century building with 17th-century alterations. Some fine Moorish work is preserved in the Salón de Mesa (c. 1450); in the Taller del Moro, which dates in part from the 14th century and was long the workshop (taller) of masons employed in repairing the cathedral; and in the palace of the counts of Fuen-

More important architecturally than any of these secular buildings are the churches of Toledo, and especially its magnificent Gothic cathedral (for illustration see Architecture). The cathedral occupies the site of a Visigothic church, which an inscription preserved in the cloister shows to have been dedicated to the Virgin by King Recared, on the 12th of April 586. If the event thus commemorated were a reconsecration, and it was in 586 that Recared was converted from Arianism to orthodoxy—the church may well have been the cathedral of Eugenius, Elidamo and Pistion, the bishops of which city, which coin in the name of the first of whom is said to have been a disciple of St Paul. From 712 until 1227 the Visigothic church was used by the Moors as their principal mosque. It was then razed by St Ferdinand, who founded the present cathedral. In August 1523, shortly after it was completed, the main fabric was delayed until 1493, while many of the churches and other subordinate buildings were added even later; thus Renaissance and baroque features have been introduced into a design originally Gothic of the 13th century. Though sacked by the Comuneros in 1521 and by the French in 1808, the cathedral is still one of the richest and most splendid foundations in the Peninsula. The exterior is marked by adjacent buildings, its most impressive part being the western façade, flanked by two towers, of which one is unfinished while the other rises to a height of 295 ft. The interior is somewhat dwarfish in appearance by its immense width. It is 295 ft. long by 172 ft. wide, and 84 ft. high. Five naves, with central lantern and choir, and a complete series of side chapels. Most of the chapels date from the 15th and 16th centuries, and are very magnificently adorned with stonework of the Flemish school. Much of the altar work, belong to the same period and number 750. The choir-stalls, placed in alabaster recesses divided by columns of red jasper and white marble, are among the finest extant examples of late medieval and Renaissance work, though rivalled by the retablo, which rises behind the high altar to the roof. The treasury, reliquaries and library, notwithstanding their repeated despoilings, contain many priceless MSS. and works of art. The cathedral also possesses a library of about 400,000 books, which is nearly 10 ft. high and is adorned with 260 silver-gilt statuettes. In it is a monstrance, said to have been wrought from the first gold brought home by Columbus, to which there are said to have been attached the spoils of the Moors ("monstrance of the Mozarab.") Within the precincts of the cathedral are interred the archbishops and cardinals Tenorio, Fonseca, Mendoza, Ximenez, the great constable Alvaro de Luna and a long array of kings and heroes. In the principal tower is hung the campana gorda, a bell weighing nearly two tons and said to be audible as far as Madrid. Among the treasures are said to be some original Goya, El Greco, Titian and Rubens. In the Mozarabic chapel mass and other offices are still performed daily according to the Mozarabic liturgy, which was also used in those days by the majority of the inhabitants ("Mozarab.")

History.—Toledo is of immemorial antiquity; Spanish legend variously ascribes its foundation to Hercules, to Tubic, the grand-son of Noah, to "Iberia, daughter of Hispans," and to Jews who, having been exiled by Nebuchadrezzar, settled here, naming their city Toledota, "the city of generation." It was a stronghold of the Carpetanias and may have been a Cathaginian trading-station. Livy (xxv. 7) mentions Toledo as a Roman municipium, and Livy (xvi. 41) says it was founded by Lucius Pompilius Nigidius, the Roman in 86 B.C. Under Roman rule it became a colony and the capital of Carolania. Various fragmentary remains have been preserved, including parts of an aqueduct, of a circus, which seems never to have been completed, and of a temple (the so-called Cave of Hercules). Toletum was never captured by the Vandals. Its ecclesiastical importance is coeval with the introduction of Christianity into Spain; numerous church councils (see below) were held here, notably in 396, 400 and 589, and here was the chief battle-ground in the long political and religious struggle which ended (586) in the triumph of Spanish Catholicism over Arianism. From the 8th to the 10th century the Moorish Caliph of Cordova, Abd al-Rahman III (756-96), occupied the city. In 1147 Alphonso VI. of Leon and Castile captured Toledo, aided by the Cid, and in 1087 made it his Capital.
a time the Castilians emulated the tolerance of the Moors, but the Jews were expelled in 1492 and the Arabic language was forbidden (except in church services) in 1580. Before this the archbishops of Toledo had become almost independent of any secular authority: they possessed enormous wealth and some of them, such as the Cardinal Jiménez de Cisneros, directed the policy and even led the armies of all Spain. In 1521 Toledo was the centre of the revolt of the Comuneros (see Spain: History); its commercial and political decline dates from 1560, when Philip II. chose Madrid as his capital. The city was the home of Lope de Vega (1562-1535) and forms the scene of several of his dramas. It suffered severely during the Peninsular War, being several times occupied by the French in 1808-1812.


TOLEDO, a city and port of entry, the county-seat of Lucas county, Ohio, U.S.A., on both banks of the Maumee river, about 4 m. from Maumee Bay, Lake Erie, and about 95 m. W. of Cleveland. Pop. (1900), 131,822, of whom 1710 were negroes, and 27,822 were foreign-born, including 12,373 Germans, 2449 English Canadians, and 1636 English; (1910 census) 168,407. Area, 28-57 sq. m. Toledo is served by the Ann Arbor, the Cincinnati, Hamilton & Dayton, the Cleveland, Cincinnati, Chicago & St. Louis, the Detroit, Toledo & Milwaukee, the Detroit, Toledo & Buffalo, the Philadelphia & Northern, the New York, Chicago & St. Louis, and the Michigan Southern. The Michigan Central, the Pennsylvania, the Pere Marquette, the Toledo, St. Louis & Western, the Wabash, and the Wheeling & Lake Erie railroads, by a "belt line" (30 m. long), the Toledo Railway & Terminal Company, by ten interurban electric railways (about 385 m.), and by the Wabash & Erie and the Miami & Erie canals. A channel 400 ft. wide and 21 ft. deep admits the largest vessels from Lake Erie to the city. Six passenger and freight steamship lines communicate with Cleveland, Buffalo, Sandusky, Detroit, Port Huron, Alpena, Mackinac, Georgian Bay and other points on the Great Lakes, and the city has 25 m. of docks. The city park system includes Ottawa Park (280 acres), Bay View Park (102 acres), Riverside Park (118 acres), Central Grove Park (100 acres), Collins Park (90 acres), Walbridge Park (67 acres), with a zoological collection, Navarre Park (53 acres), several smaller parks and triangles, and a boulevard, 18 m. long (incomplete in 1910), connecting the parks. Noteworthy public buildings are the County Court-house, the Public Library (about 65,000 volumes in 1910), the Soldiers' Memorial Building, the Toledo Club and the Toledo Museum of Art (1901). The city is the seat of the Catholic University, including Toledo Medical College (1880), which is affiliated, for clinical purposes, with the Toledo Hospital (1876).

There are numerous hospitals and charities.

Toledo is the port of entry for the Miami customs district and is an important shipping point for the iron and copper ores and lumber from the Lake Superior and Michigan regions, for petroleum, coal, fruit, and grain and clover-seed. In 1909 the imports of the port were valued at $642,286 and the exports at $600,794. The capital invested in manufacturing under the factory system in 1905 was $38,634,590 (62-4% more than that of 1900). The value of the factory products in 1905 was $44,925,004 (40-2% more than in 1900). Foundry and machine-shop products ($4,847,457) were the most valuable manufactures in 1905. In flour and gist mill products (value in 1905, $3,676,290) Toledo is the most important city of the state. Other important manufactures in 1905 were: iron, steel and other metal products ($2,066,484); lumber and planing mill products ($1,604,274); women's clothing ($1,477,648); children's carriages and sleds ($1,465,599); car-shop construction and repairs, by steam railway companies ($1,066,506); carriages and wagons ($1,245,397); structural iron work ($1,102,033); agricultural implements, bicycles, automobiles (a recent and growing industry), plate and cut-glass (made largely from a fine quality of sand found near the city), cobalt, manganese, and other ores. The building of boats, and large vessels is also an important industry. At Rossford (pop. about 400), a suburb, is the large factory of the Ford plate-glass works. The water supply is derived from the Maumee river and is filtered by a muddy suspension of filtered.

The administration of the city became famous after 1897 when Samuel Milton Jones (1846-1903), a manufacturer of oil machinery, was elected mayor by the Republican party; he was re-elected on a non-partisan ticket in 1899, 1901 and 1903, and introduced business methods into the city government. His honesty and sincerity in business and politics gained him the nickname "Golden Rule" man. When the independent movement was led by the Republican party, it was carried on under Brand Whitlock (b. 1869), a lawyer and writer who was mayor of Toledo in 1906-1911. The city council has 16 members, three elected at large and the others by wards, and there are boards of public service, public safety, public health and recreation.

The site of Toledo lies within an immense tract of land, constituting sixteen reservations, acquired by the United States government from several Indian tribes in 1795, and a stockade fort, called Fort Industry, was built here about 1800. In 1817 two companies bought from the government a portion of the tract, at the mouth of Swan Creek, including most of the land now occupied by Toledo. Upon the tract farthest up-stream the town of Port Lawrence was laid out (in 1817). In 1832 a rival company laid out the town of Vistula on the tract immediately below Port Lawrence, in the following year these towns were united and were named Toledo, and in 1837 the city was incorporated. The "Toledo War" was a dispute over the boundary between Ohio and Michigan. When Ohio Territory was organized in 1800 its northern boundary was described as a line drawn from the southern extremity of Lake Michigan due east to the Pennsylvania line, and the official map of the time placed the southern end of Lake Michigan at 43°20' N. lat. The state constitution adopted in 1802 followed the enabling act in accepting this line, but made the proviso that if it should be agreed that Lake Erie east of the mouth of the Miami river, then the northern boundary should be a line from the southern end of Lake Michigan to the most northerly cape of Maumee Bay and thence to the Territorial line, and to the Pennsylvania line. In 1805 the Territory of Michigan was organized with a southern boundary in accordance with the line extending due east from the southern end of Lake Michigan; and therefore there was in dispute a strip of land, about 5 m. wide at its western end and about 8 m. wide at its eastern end, a rich agricultural region, stretching across portions of four counties, and including all of what are now Ashtabula and Lake counties, and portions of Geauga and Cuyahoga counties, in Ohio. Within the belt lay what is now Toledo, and its great importance as a lake port was even then clearly recognized. On the 20th of January 1818 the Ohio legislature accepted the "Harris line" (surveyed in 1817 in accordance with the proviso of the state constitution) as the northern boundary of the state.

Acting on the recommendation of Governor Robert Lucas (1781-1853), on the 23rd of February 1835 the Ohio legislature passed a law creating the new county of Lucas. The new territory was then Wood, Henry and Williams counties (lying partly within the disputed strip) north to the Harris line, and providing for the organization of new townships within this added territory, and for the appointment of three commissioners to re-mark the line. Upon the appointment (March 9, 1835) by Governor Lucas of the three commissioners to re-mark the Harris line, Governor Stevens T. Mason of Michigan ordered a division of Michigan Militia, which near the end of March entered and took possession of Toledo. A division of Ohio Militia marched to Ferryburg, on the Maumee river, about 10 m. south of Toledo; but both Militias disband when Richard Rush, of Philadelphia, and Benjamin C. Howard, of Baltimore, appeared at Toledo as peace emissaries, appointed by President Jackson. In April several members of the party accompanying the Ohio commissioners were arrested by Michigan Militia. In June the Ohio legislature created Lucas county, mostly from the disputed territory, and made Toledo its county-seat. President Jackson now urged Michigan to discontinue interfering with the re-marking of the Harris line, and requested Ohio to postpone putting into effect the Act of Feb. 23, 1835; when throughout the summer an Ohio judge and court officers at Toledo were arrested in September, he peremptorily removed Governor Mason from office. In June 1836 Congress decided the dispute in favour of Ohio, and in 1837 Michigan was admitted to the Union as a state upon condition of relinquishing all claim to the disputed territory, but received what is now known as the Upper Peninsula (the land between Lakes Superior, Huron and Michigan).
TOLEDO, COUNCILS OF, OF TOLL, J. K.

TOLEDO, COUNCILS OF (Concilia toletana). From the 5th to the 16th century about thirty synods, variously counted, were held at Toledo in Spain. The earliest, directed against Priscillianism, assembled in 400. The "third" synod of 589 marked the epoch-making conversion of King Reccared from Arianism to Roman Catholicism. The "fourth," in 633, probably under the presidency of the noted Isidore of Seville, regulated many matters of discipline, decreed uniformity of liturgy throughout the kingdom and took stringent measures against baptized Jews who had relapsed into their former faith. The "twelfth" council in 681 assured to the archbishop of Toledo the primacy of Spain. As nearly one hundred early canons of Toledo found a place in the Decretum Gratiani, they exerted an important influence on the development of ecclesiastical law. The synod of 1565 and 1566 concerned itself with the execution of the decrees of Trent; and the last council of Toledo, that of 1582 and 1583, was so guided in detail by Philip II. that the pope ordered the name of the royal commissioner to be expunged from the acts.

See Canones epistolae et conciliorum saecularium, vi., vii., vii., viii., etc., by T. Bruns, pars prior (Berlin, 1839), critical text of seventeen councils of Toledo (Acta et Pelagiana, 1841-64); E. C. F. Tischendorf, Die Kirchenlteratur von Spanien (Regensburg, 1862-1879); E. H. Landon, A Manual of the Councils of the Holy Catholic Church, revised ed. (London, 1893), vol. i., 151-169. These two summarize the chief canons. See also W. W. R.*

TOLENTINO (anc. Tolentum Picenum), a town of the Marches, Italy, in the province of Macerata, 11 m. by rail W. by S. of that town. Pop. (1901), 5111 (town), 13,197 (commune). It is situated on the Chienti, 735 ft. above sea-level, and was once a fortified town of great strength. The cathedral has a fine portal by the Florentine Giovanni Rosso (1435), and contains the remains of S. Nicholas of Tolentino (d. 1309), whose Renaissance tomb and frescoes illustrating the life of the saint is preserved in a room adjoining the chapel north of the high altar. The church of San Caterino contains the early Christian sarcophagus of that saint, which is embellished with curious reliefs. The Museo Civico contains antiquities discovered during excavations near the town (in 1880-1884) in the Picene necropolis, dating from the 8th-4th centuries B.C. The town is the birthplace of the condottiere Niccolo Mauruzi, and of the learned Francis Philibus, one of the first disseminators of classical literature, who was born in 1598. At Tolentino the treaty was made between Bosnia and the pope in 1797, by which the pope succeeded Avignon; and here in 1815 a battle was fought in which the French under Murat were defeated by the Austrians.

TOLERATION (from Lat. tolerare, to endure), the allowance of freedom of action or judgment to other people, the patient and unprejudiced endurance of dissent from one's own or the generally received course or view.

TOLFA, a town of the province of Rome, Italy, 10 m. E.N.E. of Civitavecchia by road, 1558 ft. above sea-level. Pop. (1901), 3536. It is the chief place in the Tolfa Mountains, an extinct volcanic group between Civitavecchia and the Lake of Bracciano. Volcanic rocks, limestone and sandstone, which contain coal, are found, and some mining is carried on. The output of alum averages 4000 to 5000 tons a year, and is mostly exported from Civitavecchia.

TOLL, JOHAN KRISTOFFER. COUNT (1743-1817), Swedish statesman and soldier, was born at Mölleröd in Scania. Toll came of a very ancient family, of Dutch origin, which can be traced back to the 13th, but migrated to the Baltic provinces in the 16th century. Toll's father was one of Charles XII.'s warriors, his mother a descendant of the aristocratic Gylenstenjorns. In his youth Johan Kristoffer served in the Seven Years' War, and then, exchanging the military for the civil service, became head ranger of the county of Kristianstad. During the riksdag of 1771-1772 the dominant "Caps," deprived him of his post, and Toll, shrewdly guessing that the king was preparing a revolution, almost forced his services on the conspirators, Göran Magnus Sprengtporten (q.v.) declaring that a man who knew so much of their most secret plans must either "be killed or squared." To Toll was assigned by far the most difficult part of the enterprise. It was his business to secure the important southern fortress of Kristianstad. Two days after the coronation, on the 31st of May 1772, he set forth from Stockholm with twenty-two pounds wherewith to corrupt a garrison and revolt a province. He had no sort of credentials, and the little that was known about him locally from the official point of view was not to his credit. Finally, in the fortress itself there was but one man known to be a safe royalist, namely, Captain Abraham Hellichius. On the 21st of June Toll reached Kristianstad. By sheer bluff Toll first won over Hellichius, and, six weeks later (August 17), the whole garrison of Kristianstad, being few officers who proved recalcitrant; taking possession of the records and military chest, and closing the gates in the face of the "Cap" high commissioner who had been warned by the English minister, John Gooderich, that something was afoot in the south. Seven days later Gustavus III.'s coup d'état at Stockholm completed the revolution. Toll was liberally rewarded and more and more frequently employed as his genius as an administrator and his blameless integrity came to light. His reforms in the commissariat department were epoch-making, and the superior mobility of the Swedish forces under Gustavus is due entirely to his influence. But it was upon Toll's boundless audacity that Gustavus chiefly relied. Thus as Gustavus, under the pressure of circumstances, inclined more and more towards absolutism, it was upon Toll that he principally leant. In 1783 Toll was placed at the head of the secret "Commission of National Defence" which ruled Sweden during the king's absence abroad without the privity of the senate. It was he who persuaded the king to summon the riksdag of 1786, which, however, he failed to control, and in all Gustavus's plans for forcing on a war with Russia Toll was initiated from the first. In 1786 he had already risen to the rank of major-general and was Gustavus's principal adjutant. It was against Toll's advice, however, that the king finally decided to wage war. Toll had always insisted that, in such a contingency, Sweden should be militarily as well as diplomatically prepared, but this was far from being the case. Nevertheless, when the inevitable first disasters happened, Toll was, most unjustly, made a scapegoat, but the later successes of the war were largely due to his care and diligence as commissary-general. After the death of Gustavus III. Toll was for a short time war minister and commander-in-chief in Scania and, subsequently, was sent as ambassador to Warsaw. Unjustly involved in the so-called "Armfield conspiracy," he was again dismissed by his sovereign, but was reinstated when in 1796 Gustavus IV. attained his majority. At the riksdag of Norrköping, 1800, he was elected marshal of the Diet, and led the royalist party with consummate ability. On this occasion he forced the muttonish riddarhus to accept the detested "Act of Union and Security" by threatening to reveal the names of all the persons suspected of complicity in the murder of the late king. Subsequently he displayed great diplomatic adroitness in his negotiations with the powers concerning Sweden's participation in the war against Napoleon. In the Pomeranian campaign of 1807 Toll had taken an active part, and it was urged that he was entitled to surrender on the 20th of August by Marshal Brune, whereupon the Swedish army of 13,000 men, which had retired to Rügen, seemed irretrievably lost. It was saved by Toll, who cajoled the French marshal into a convention whereby the Swedish army, with all its munitions of war, was permitted to return un molested to Sweden (September 7). For this exploit Toll received his marshal's båton. It was in the camp of Toll, then acting commander-in-chief in Scania, that Gustavus IV. was about to take refuge when the western army rebelled against him, but he was arrested in the capital before he could do so. Toll retained his high position under Bernadotte, who, in 1814, created him a count. He died unmarried.

See R. Nisbet Bain, Gustavus III. and his Contemporaries (London, 1895); K. N. Liliekrone, Fältmarskalken Greffe J. K. Toll (Stockholm, 1849-1850).

(R. N. B.)
TOLL—TOLSTOY, L.

TOLL (etymologically, that which is numbered or counted; from a common Teutonic form, cf. "tale," "tell"); a sum of money, charge for the use and enjoyment of a privilege or advantage. In England it is now usually a sum of money; but formerly tolls in kind were frequent. Among the sins of the Miller in Chaucer's Prologue is that he could "tollen thryes," in that he was clever enough and rogue enough to subtract thrice the legal allowance from the corn he ground. In a note to the Heart of Midlothian, Scott asserts that the name of Lockman given in Old Scots to the hangman was because he was entitled to take a lock or fixed toll out of every boll of meal exposed in the market for sale. An act of 1796 for the regulation of mills, substituting a money for all kinds of tolls of corn in kind taken by millers, makes an exception for tolls to private individuals.

The Weights and Measures Act 1828 enacts that all tolls are to be charged and collected according to imperial weights and measures.

The word "toll" in early times had various meanings, thus it is defined by Glanville as the liberty of buying and selling in one's own land: "toll, quod nos vocamus thelonesum, scilicet libertatem emendi arpentis earundem a poenis quibus incolos impedit persuasit.

This right to take and the thing so taken. It formed the most obvious source of revenue in the early English boroughs; goods coming to market or passing through turnpikes, whether paid for in toll or not, still exists in various European countries under the name of octroi (q.v.). Private lords also levied tolls, but these in no case were levied as a common charge, nor were they taken in a real or feigned grant from the Crown. Imposes by the Crown are more properly taxes, though the name was frequently used, as in malefict, an arbitrary and vexatious impost levied till Edward III.'s time, or in the toll which passed for a tax, as in toll of other exclavations. We learn from Domesday Book that the men of Dover who paid the king's dues there were quit of toll throughout all England. Many subsequent charters granted the like, or even greater immunities from toll to favoured folk. In modern English law toll is either an incident of a franchise, as of a market or fair, or is independent of franchise. In the latter case it is claimed by payment of a set rate or is charged, as an adjunct of parliament, as in the case of turnpikes, railways, harbours, navigable rivers and canals. Toll traverse is paid for passing over a private way, bridge or ferry. No consideration need be proved. Toll threshold is paid for use of a highway. In this case, if charged by a private person, some consideration, such as repair of the highway, must be shown, as such a toll is against common right. At common law a toll must be reasonable. The same principle appears in various acts of parliament. The Statutes of Westminster the First inflicts a penalty for taking excessive toll. The Railway Clauses Act 1845 provides for the equality of tolls, that is, that all people shall be charged the same amount or rate, and fixes the prerogative, by grant or prescription, or by act of parliament. The king and queen consort pay no toll, and the Crown may grant to another exemption from toll. Turnpike tolls, bridge money and causeway mail were abolished in Scotland by the Roads and Bridges Act 1878 as from the 1st of June 1885. In England tolls on roads and bridges are now only payable in a few places.

In the United States tolls are a subject for state legislation, unless they affect the whole commonwealth, when they are dealt with by acts of congress. A city may levy reasonable tolls in a market established by itself. A shuntpike, or road constructed to facilitate passage of tolls on a turnpike road, may be established by a city.

The question of tolls was at one time an important one in international law. Tolls were exacted on certain straits and tidal rivers by virtue of the sovereignty of a particular state. Notable instances were the tolls imposed by the Sicilians on the Straits of Messina. These last were justified as a return for the lights maintained on the coast and the terror to pirates inspired by the castle of Elmina. In 1606, owing to the united efforts of England, France and Holland, an unwieldy rate was arranged.

See Pollock and Maitland, History of English Law (1895); Pease and Chitty, Markets and Fairs (1899); Cunningham, Growth of English Law (2 ed., 1888).

TOLLEMACHE (or TALMASH), THOMAS (c. 1561—1604), British soldier, was the second son of Sir Lionel Tollemache, Bart. (d. 1668), of Helmingham, Suffolk, although an idle report of the time made his mother, Elizabeth Murray (d. 1608), afterwards countess of Dysart and duchess of Lauderdale, the mistress of Oliver Cromwell. In 1678 he became captain in the Guards, with which he served in Tangier, and in 1685 he was made lieutenant-colonel of a regiment of fusiliers, but almost at once he gave up his commission because he disliked the proceedings of James II., and became colonel of an Anglo-Dutch regiment, usually stationed in Holland. At the head of his men he landed in England with William of Orange in 1688 and was made governor of Portsmouth and colonel of the Coldstream Guards, while in 1689 he was chosen an English member of parliament. With the Coldstreamers he served William III. at the battle of Ramillies, and then as a major-general in Ireland, where in 1691 he gained fame at the battle of Aughrim and at the sieges of Athlone, Galway and Limerick. He then went to the Netherlands and aided to his high reputation by his conduct at the battles of Steenkirk and Nieuwpoort in 1694. Tollemache, as he was generally called, proposed an expedition against Brest, the leadership of which was given to him. The fortifications, however, were too strong, and although he led on the English troops with great gallantry they were beaten off with heavy loss.

TALMASH himself was wounded, and returning to Plymouth he died there on the 12th of June 1694. He was buried in Helmingham church, where a long inscription summarizes his life.

TOLSTOY, LEO (1828—1910), Russian novelist and social reformer, was born on the 9th of September (August 28) 1828, in the family of Nicholas Petrovitch Tolstoy, at his country house (not the present one) built in a severely formal style, with Doric pillars and architraves, standing solitarily in a typical Russian landscape. The Tolstoy family, to whom it had belonged for several generations, was originally of German extraction, and had settled in Russia in the days of Peter the Great. The first ancestor of distinction was Petr Andreevich Tolstoy (q.v.). His descendant Nicholas (the father of the great author) was born in 1797. After serving for a short time in the army he retired in 1824, and led the life of a Russian boyar. By his marriage, in 1837, to Anna Leontievna von Korsakov, Count Nicholas in a great measure rebuilt the family fortunes, which had fallen into decay during the two previous decades. Count Leo Tolstoy was the youngest but one of the five children of this marriage, and lost his mother when he was barely three years old. Six years later his father died also, at the age of forty-one. As a child, Tolstoy, though observant and thoughtful, showed no marked talent. He was plain and very sensitive on the point, suffering keenly for want of notice and affection. This sensiveness led him as he grew older to hide himself away from his playmates and spend his leisure hours in books. His early life was a lonely one—he's always been alone, and deeply so. Then, one day, it dawned suddenly upon his mind that Death was ever lying in wait, and that to be happy one must enjoy the present, unconfined with the future. Whereupon the youthful Epicurean flung aside his books and pencils, and, stretched on his bed, fell to munching sweetmeats and reading romances. But Tolstoy's childhood was not without its share of wholesome pleasure. Hunting and shooting, the delight of the Russian noble, occupied much of his father's leisure, and from his earliest years the boy was wont to accompany his parent. At other times he was quite happy sitting beside his father's coachman on an expedition to one of the neighbouring towns, or with his brothers running in and out of the stables and coach-houses. The tedium of the schoolroom and the reproofs of his tutor made a reverse side to the picture, but did not prevent this fund of early memories from being, as he writes, "ever to be treasured, and fondled again and again, serving as a well-spring from which to draw my choicest treasures." After his father's death at Moscow, in 1837, Tolstoy and his brothers were placed under the guardianship of his aunt, the countess Osten-Sacken, and in the care of Mme Georgiakaya, Countess Pertsaevsky. The former died, Mme Jushkov, who lived in Kazan, Mme Jushkov was a typical Russian lady of her class. Keeping open house, fond of gaiety and society, her ideas on moral questions were liberal in the extreme. Tolstoy was eleven years old when he became subject to her influence—an influence which he subsequently regarded as having been the reverse of beneficial. A French tutor was engaged for him and his brothers, prior
to their entrance into the university of Kazan. Outside the hours of study Tolstoy spent his days either in solitary rambles, during which he reflected on the problems of life, or in violent exercise at the gymnasium (the only form of athletics enjoyed by boys of his position in Russia). Thus the physical and philosophical impulses of his nature were developed in equal measure, and these two conflicting forces began their lifelong duel. Only in later years has the philosopher sometimes seemed to outweigh the man of action in Tolstoy's vigorous personality.

In 1843, at the age of fifteen, he entered the university of Kazan, and gained with his college cap and uniform what he At College. prized most, his independence. The lax rule of the university—which was of no high scholastic repute, giving ready admittance to the sons of the rich and noble—enabled him at the same time to enter the world of society and study its complex problems at leisure. Kazan was in those days a real paradise for such as sought happiness in social excitement, dining and dancing. No city in Russia was so given up to the pursuit of pleasure. Among these scenes of luxury and licence the students played a prominent part. Amid such influences the boy soon crept shown in the poem. Tolstoy's evil genius and once more cast him in stony places and left him to work out his own salvation. History, religion and law now claimed his attention in his final efforts to gain the university diploma. 

In religion his opinions had undergone a great change. From the child's unthinking acquiescence in a hereditary faith had sprung absolute unbelief. History he held a useless form of knowledge. "Of what avail," he said, "to know what happened a thousand years ago?" Hence he neglected the lectures on these subjects, absented himself from the examinations, was confined in the university gaol for irregular attendance, and ended by coming out but moderately well in the yearly examination. The conviction that he was wasting his time forced itself upon him. An idle, dissipated life had told upon his health, and early in 1847 Tolstoy asked permission to go down, "on account of ill health and private reasons." Thus ended his college life, which from an educational point of view he had treated as a jest. Somewhat of an enigma as he was to his companions, with his alternate fits of feverish gaiety and melancholy abstraction, aristocratic hauteur and liberal views, there was yet found a little band of students to accompany him on the first stage of his journey. With the youthfulness of the monk admiring the original bent of his mind, they little dreamed their late comrade would one day be acclaimed as Russia's greatest thinker and novelist.

Tolstoy went back to his estates with fresh hope and energy, determined to ameliorate the condition of his peasants and fulfill the duties of a landlord. Rumours had reached him at Kazan from time to time of the recurring famines, revolts and miseries of the serfs. In 1847, as often before, the crops failed to suffice for the needs of the starving people, and whole districts set forth to petition the tsar for food. Here was a vital problem requiring prompt solution. In the course of desultory reading at the university he had studied the writings of Jean Jacques Rousseau, and the Frenchman's plea for Nature, honest work and simplicity of life, had impressed him greatly. Fired with enthusiasm, he now entered heart and soul on the task of realizing this ideal. Unfortunately, he was as yet without sufficient moral stamina to withstand recurring disappointments and to combat the temptations of the world. The painful task of the young author was to find the patience necessary to deal with the deep-rooted mistrust engendered by years of oppression and neglect. After six months of struggle with this discouraging state of things he temporarily gave up the attempt, and we find him in St Petersburg taking up for a time the broken threads of his education. But with the restlessness of transition strong upon him he soon returned to country life, and in company with his brother Sergius gave himself up to hunting, gambling, carousing with Zigan dancers, and throwing all serious thoughts to the winds. The Landlord's Morning may be taken as a picture of this stage of Tolstoy's life. The inevitable complacency of youth, Enlist the Army. pressed by debts and difficulties, in the spring of 1851 he betook himself to the Caucasus, where his eldest brother Nicholas was stationed with his regiment. At Pyatigorsk, at the foot of the mountains, he rented a cottage for about twelve shillings a month, and lived there with the utmost frugality.

Finally his brother's persuasions, aided by the influence of relations in high places, led him to enter the army. He passed the necessary examination at Tiflis, and joined the artillery in the autumn of the year. At that time Russia was much disturbed by the lawlessness of the Caucasian races. Bands of Circassians were constantly on the move, plundering and looting. The punitive expeditions in which Tolstoy took part were his first taste of warfare. Neither his military duties nor his love of sport entirely absorbed him, however. The great power which had hitherto lain dormant now awoke. He began to write, and within the next few years produced some of his finest works. Nekrassov, the editor of the Russian Contemporary, accepted Childhood, the young author's maiden effort. In accordance with the common practice, he added nothing for the MS. Publication of a first attempt was considered ample payment in those days. Tolstoy was now twenty-four years of age. Childhood was followed by The Landlord's Morning, Boyhood and Youth, in quick succession. His early aspirations were revived in these pages, which reflect the doctrines of Rousseau. "You neither know what happiness is nor what life is," he writes to expostulating friends. "Once taste life in all its natural beauty, happiness will consist in being with Nature, seeing her, communing with her." His philosophy notwithstanding, Tolstoy felt a pardonable desire for promotion, which was slow in coming to him. Some verses ascribed to him (an authorship never denied) making fun of the general during the siege of Sebastopol, which appeared in print, may possibly have had something to answer for. Be that as it may, the spirit of unrest and dissatisfaction was moving Tolstoy to return home, when rumours of hostilities arose, and the Crimean War burst into flame. He promptly volunteered for active service, and asked to be allowed to join the army on the Danube, under the command of Prince Gortchakov.

In the early part of 1854 we find him encamped before the walls of Silistria, a town of Bulgaria, which Gortchakov had invested. At the very height of the bombardment, however, Austrian intervention prevailed, and the siege was raised. The din of battle was hushed and revelry took its place. At the ball which promptly celebrated the event Tolstoy felt ill at ease. The joyous music and babel of tongues jarred on his sensitive ear, fresh from the moans of the wounded and dying. He went up to the prince and asked leave to start for Sebastopol. Permission being granted, he hastened from the ballroom, and left Silistria without delay.
He now exchanged the offensive for the defensive. Shot and shell fell like hailstones on the bastions of Sebastopol. Courage, fortitude, the presence of mind were at every moment demanded, while assault followed assault, until at last the overwhelming strength of the allies compelled the Russians to retreat. Throughout that trying time Tolstoy cheered his companions, whiling away many a weary hour with jest and story. Amid this "wrackful siege of battering days" he wrote those Tales from Sebastopol which earned him instant literary celebrity, and caused the emperor Nicholas to issue special orders that he should be removed from a post of danger. An official despatch recounting the events of the siege was next written by Tolstoy at the command of his superior officer, and with the charge of this duty cheerfully afforded, he was sent to St Petersburg. He was never again on the field of battle.

Tolstoy returned home with new impressions. Sad at heart and sick of the horrors of war, he came back with a feeling of brotherly love for the common soldiery, whom he had seen day by day doing quiet deeds of courage and devotion, fighting for their country without hope of reward, without fear of death. He contrasted them with the more self-seeking nobles, and felt their superiority. The stirring scenes through which he had passed, the scenes of constant toil and suffering, all helped to deepen his belief in God. Preceded by the fame of his descriptions of Sebastopol and the Caucasus, he arrived in St Petersburg to find himself the object of a general ovation. The Sovremennik (Contemporary), in which Tolstoy's first work, Childhood, had appeared, numbered among its contributors the foremost writers of the day. To be admitted to their ranks was considered by them an honour equivalent to the award of a fauteuil in the French Academy. They welcomed Tolstoy with open arms, the veteran novelist, Turgeniev, in particular hastening to greet him on his arrival, and beggin him to make his house his home. Society was equally eager to open its doors to the young soldier-author. His vivid and dramatic pictures of the war had been widely read and had created a profound sensation. The great official world of St Petersburg proceeded to offer him a brilliant series of entertainments in which he found himself the central figure. It is not surprising that this combined adulation from literary men and society overcame for a time the growing asceticism of his character. Yet it also in a measure hastened its development. Even while borne swiftly on the current of pleasure, his strenuous nature gradually reasserted itself. In the pages of My Confession Tolstoy describes the phases of this mental unrest. The narrowness of a literary life and the torrent-like existence of a man who had met with success and had been thrust into the front rank of the Russian intelligentsia at an early period, were bound to wear him out. In his study, in his room, he began to feel the oppression of his position. He began to escape from the noise and excitement of the world. During the few weeks that he passed at the fashionable watering-places, he became so engrossed in his thoughts that all conversation was impossible. His family and friends no longer sought him out, and the prospect of meeting one of them was to him a source of sorrow and disgust.

While Tolstoy was thus wakening to a sense of distaste for his environment, a great event was pending. With the accession of Alexander II. in 1855 a wave of progressive policy swept through Russia. The new tsar, Alexander II., removed the bureaucratic circles of Russia, and while fiercely resisted by some of the nobility, met generally with cordial encouragement. The emancipation of the serfs became the burning question. "The People!" and "Progress!" were the cries quickly caught up by the press of Russia and of Germany also. It was in Germany, indeed, that the novel of humble life sprang into being, Gotthelf leading the way with his tales, Ulri the Serf and Ulri the Tenant. Auerbach followed with his village stories, which opened a new world of thought; Stifter and a host of others brought up the rear. This new impulse in literature soon spread to Russia. Turgeniev in his Sportsman's Tales, Grigorovitch in The Village and the City, were among the foremost, and only to endure their sympathy with the moujik. But above all others, Tolstoy was most deeply and lastingly affected. Awakened by this echo from without of his own inmost yearnings, he realized at last the true bent of his mind. "The People!" became his watchword. One increasing purpose henceforth ruled his life, and gradually brought into harmony the inequalities and contradictions of his character. Roused from the inertia which had been caused by nerves and hypochondria, he wrote Polikoushka, a painful story dealing with the ills of serfdom. His active brain then turned to considering the meaning and scope of the catchword "Progress!," and fully to do this he determined to go abroad and study the educational and municipal systems of other countries. He finally started for Germany in January 1857.

Tolstoy only three times crossed the Russian frontier, and these journeys were all between 1857 and 1861. On his first trip, Germany and Italy were hurriedly visited. He also made a short stay in Paris, which had attractions for him in the society of several Russian friends, among whom were Nekrassov and Turgeniev. With the latter he met Mendelssohn, whom he met in Paris he went to Lucerne. An incident which occurred there, and is reproduced in his semi-autobiographical Lucerne, shows the workings of his spirit. He tells how a wandering musician stood one day in the hotel courtyard, and after his performance asked in vain for alms from the convivial crowd assembled. Tolstoy, in the person of the hero, then indignantly came to the rescue, brought the poor minstrel into the hotel, and, moved to wrath with the Churlish waiters who were unwilling to serve him, ordered a private room where he himself supplied his guest's wants, and sent him away happy within his pockets and full of music for the coming night. Outwards, the third alone was of long duration and of corresponding importance in its results. Prior to this last visit to foreign parts, his time was spent between Yasnaya Polyana and Moscow, often in the company of his friend Fet. On a bear-hunt together, Tolstoy narrowly escaped death, an incident which he graphically describes in his Fourth Reading-book for Children (20th ed., 1900, &c.). Fet also mentions it in his Reminiscences. His departure was finally hastened by the serious illness of his brother Nicholas, who had gone to France to recruit his failing health. Tolstoy, after halting in Berlin and Dresden, joined him, but only to witness of his death. Nicholas died on the 20th of September 1866, and Tolstoy's letters of that period show how deeply he was affected by the death of his brother. It gave a yet more serious turn to his thoughts. In a letter to Fet he reverted to his old trouble, the enigma of life. "In truth," he writes, "the position in which we stand is terrible." This mental gloom probably still hung over him during his wanderings through Italy. There is no record of his impressions of Rome, Naples, Florence. Turning his footsteps northwards, however, he began to take renewed interest in social conditions, elementary and secondary education, and the general subject of his quest. From Paris (where his friend spoke of him as "singular indeed, but subdued and kindly") he went to London in 1861, no noteworthy incident marking his brief visit.

The spring of 1861 found him once more at Yasnaya Polyana, where some little time before he had forestalled the Emancipation Act by freeing all the serfs on that estate. He Educational Act now began digesting the mass of information he Educational Act had acquired abroad, eager to put his ideas into practice. The feelings with which he reviewed his experiences were largely those of disappointment. Of the educational systems of Italy, France and Germany, that of the last-named country alone earned his partial approval. While there he visited the universities, prisons and working-men's clubs. He made the acquaintance of Auerbach, and was greatly influenced by his ideas on village schools. He was also much
impressed by the novel institution of the kindergarten, to which Fröbel, the great educationist, was devoting all his energies. Determined to follow these lines, he sought and obtained permission to open a school. In his zeal he also started an educational journal called Yasnaya Poliana. This journal now only exists as a literary curiosity, but the essays published in it have all been reprinted in his collected works. The time for opening the school was well chosen. The liberal spirits of Russia had gained the day and won a great victory. Just two months previously the decree of emancipation (February 1861) had been sent to the districts. The air was rife with schemes for the betterment of the peasantry. A new era seemed to have begun. Tolstoy’s school was essentially “free.” “Everything that savours of compulsion is harmful,” he said, “and proves either that the method is indifferent or the teaching bad.” So that not only were no fees paid, but the children came and went as they pleased, learned what they pleased, and were subjected to no sort of punishment. It was the duty of the teacher to fix the pupils’ attention, and his the blame if they failed to learn. “The student,” said Tolstoy, “must have the right to refuse to perform his duties which do not satisfy his instincts. Freedom is the only criterion. We of the older generation do not and cannot know what is necessary for the younger.” On these principles the Yasnaya Poliana school was started in a house near that of Tolstoy. He himself taught drawing, singing and Bible history. The Old Testament was his handbook; he held it as indispensable in any course of instruction, a model for all. Doubts and fears sometimes assailed him, still for a year all went well. Other schools were opened and the school in the district, and success seemed assured. But the eyes of the government inspectors had long been suspiciously fixed on them, and a correspondence on the subject presently ensued between the ministry of education and the home department. The verdict passed by the former was free from overt animus. “The activity of Count Tolstoy deserves respect and should win co-operation from the educational department, although it cannot agree with all his ideas; ideas which he will in all probability abandon on due consideration” (October 1862). Yet there was a subtle threat conveyed in these last words which was probably not without effect. Sighs of disappointment were heard. His masters desert him, his pupils fall away. The plague of inquisitive visitors annoys him. At the end of the second year the schools were closed, the journal discontinued, and Tolstoy, disheartened and sick, “more,” as he writes, “in mind than body,” betook himself to the healthful quiet of the steppes, to breathe fresh air, to drink koumiss and to vegetate. This was the end of his educational experiment, the aim of which was rather to develop the character than to educate in the ordinary sense of the term. When later he asked leave from the authorities to reopen the schools, it was peremptorily refused. His socialistic theories were now fully unfolded. In his view the people were everything, the higher classes nothing. The latter had misinterpreted the meaning of “progress,” imagining it to be synonymous with education; and hence compulsory teaching had been resorted to, with harmful results. Reading and writing played but a small part in forming a man’s mind and fitting him for life. They merely rendered him more articulate. These questions should be left to the people themselves. Their demands were very clearly expressed. They declared that they wanted, and were thoroughly convinced that “in the great question of their spiritual development they would neither take a wrong step nor accept that which was false.” Such was in substance Tolstoy’s doctrine. “The people,” he affirms, “are stronger, more independent, more just, more human, and, above all, more necessary than the upper class. It is not they who should come to our schools; we should learn of them.” This desire to subvert society is akin to the philosophy of Rousseau, as expressed in Emile (livre iv).:

“C’est le peuple qui compose le genre humain; ce qui n’est pas possibile n’est pas la peine de le concerter. L’homme est le meme dans tous les etats; si cela est, les etats les plus nombreux meritent le plus de respect.” Devant celui qui pense, toutes les distinctions civiles disparaissent: il voit les memes passions, les memes sentiments dans les autres que dans l’homme illustre; il n’y a differenc entre leur bonté ou leur恶情, qu’un coloris plus ou moins appele. … Etudiez les gens de cet ordre, vous verrez que, sous un autre langage, ils ont autant d’esprit et plus de bon sens que vous. Respectez donc votre homme; lorsque cette collection des peuples, que quand tous les rois et tous les philosophes en seraient dites, il n’y paratrait guere, et que les choses n’en iraient pas plus mal.”

While Tolstoy’s theories were thus in course of practical solution, his literary powers suffered eclipse. Turgenev, who lived near him in the country, writes in disgust that he “has grown a long beard, leaves his hair to fall in curls over his ears, reads newspapers in detestation, and has no soul for anything but his property.” Indeed, his time was fully taken up, for while still occupied in supporting the school, he had allowed himself to be nominated to the position of “Arbitrator,” which he held for a year and some months (1861–1862). Relations with the Peasantry.

This was an arduous post. The arbitrators were appointed under the Law of Emancipation to supervise the distribution of land, to adjust the terms, define the conditions of purchase, and decide all matters in this connexion. He could do none of this. Every day he had difficult points to deal with, deputations of peasants coming to see him, the new law and the rights it bestowed on them having to be explained. The hardest of all Tolstoy’s tasks was to remove the suspicion and mistrust felt by the serfs towards the landlord. On the other hand, he had to contend with the nobility of the district, who were well aware of the side on which his sympathies placed him. For a year and a half he tried energetically to do his duty, but his experience led him eventually to regard the Law as a not unmixed blessing. He had come too soon, and been granted too much. The condition of the peasantry was worse than before. A noble impulse, inspired by love of the people, impelled Tolstoy to become their champion and interpreter.

A tragic incident occurring about this period (1866) forcibly illustrates Tolstoy’s character as a defender of the helpless. A regiment had recently been stationed near Yasnaya Poliana, in consequence of some five hundred convicts being at work upon the railway. In this regiment was a certain Captain N., a strict disciplinarian, who led a solitary life and was much disliked by his brother officers and his men. For trifling faults he would condemn his soldiers to unheard-of punishments. One of his orders in particular, a young man of some education—who had voluntarily taken the place of a comrade to free him from military service—was constantly getting into trouble, until, for some slight clerical error in a report, Captain N. ordered him to be degraded and flogged. This was too much for the poor volunteer. He followed the officer as he was leaving the orderly-room, and struck him a blow on the face. He was immediately placed under arrest, and the details of the occurrence quickly spread through the neighbouring villages. Two officers of the regiment brought the story to Tolstoy and begged him to underwrite the accused’s defence. He consented readily, and no opposition being made by the military authorities, at once prepared for the court-martial. A few days afterwards the court assembled. Warned by the president of the severity of military law, Tolstoy made answer that he was come to defend not a criminal but a man compelled to crime by force of circumstances outside his will. The plea he set up was that the prisoner was not in full possession of his senses; but this defence was not allowed to stand. The soldier was condemned to be shot. In spite of the utmost intercession Tolstoy could make. The motion of the court was approved by his appeal, the mute acquiescence of the soldier (persuaded that death was better than the living agony of exile), the closing tragedy—all this, added to the many scenes of war and bloodshed which he had previously witnessed, made a lasting impression and caused him to raise his voice yet louder in the cause of universal love and peace. During the preceding period of ethical experiment he published only two books, but these stand high among his works. They were Three Deaths (1859) and The Cossacks (1863)—the latter written ten years before, its leading idea being that culture is the enemy
of happiness. At the conclusion of his arbitratorship, seeing his efforts partially nullified, and feeling himself overstrained and overworked, he determined to exile himself for a time to Samara, a south-eastern province. He halted on his way in Moscow, and here one night's high play cost him the MSS. of The Cossacks, which he sold to the editor of the Russian Messenger for £100 to pay his debts of honour. A pleasant feature of this visit to Moscow lay in the renewal of his intimacy with the Behrs family, Sophia, the younger daughter of the house, being his special attraction. He finally reached Samara in the spring of 1864 and wrote "knoutmaire," revelling in what he called "the life of a beast of the field."

By the month of July he felt completely restored to health, and returned to Yasnaya Polyana, where his sister Maria and his aunt, Mme Ergolskaya, were looking after the property. The house in which he now lived was comparatively new. The one in which he was born was sold to pay some earlier gambling debts, and had been removed bodily to the Dolgoe estate some 30 m. distant. He now felt a sense of something wanting in his home—a feeling of incompleteness took possession of him. He wanted to see Sophia Behrs, and accordingly left almost quietly for Moscow, where Sophia, a fashionable Russian doctor, born and bred in Moscow, and a graduate of that university. He had three daughters, of whom Sophia was the second. The friendship between the Behrs and the Tolstoy families was of old standing, Countess Maria Tolstoy having been a school companion of Mrs Behrs. It was now the height of summer, and every one of consequence was leaving the city for their country seats. The Behrs family were going on a visit to their grandfather, whose estate lay not more than 40 m. from Yasnaya Polyana. Here they accordingly broke their journey, and during the pleasant days that followed Tolstoy's attachment deepened. Not long after their departure his impulse took shape, and mounting his horse, he set out for Twycy, where they were staying. His errand was a definite one; and he lost no time in fulfilling it. At first

Marriage. Dr Behrs demurred, unwilling to allow his second daughter to marry before her elder sister, but his objections were presently overruled. On the 23rd of September 1862 the marriage took place, and Tolstoy installed his bride at Yasnaya Polyana with the conviction that calm and contentment were his at last. Two weeks later he wrote to his father almost saying that he was the happiest man he had felt quite a new man. In his Confession some years later he writes: "The new conditions of a happy family circle led me away from my researches into the meaning of life. My whole mind became concentrated on the family—on the mother, the children, and the anxiety to provide due means of subsistence. The effort after perfection resolved itself into the effort to ensure the happiness of my offspring." Tolstoy thereupon settled down to country life, and though to the young countess this exile from her town friends and relations must have been somewhat of a trial, they remained on their estates for the following eighteen years, with very short intervals of absence. They had thirteen children, of whom the eldest was born in June 1863. In the bringing up and instruction of his family Tolstoy conformed in essentials to the requirements of his position. No experiments were attempted. English and German governesses were engaged, and their educational methods followed the usual routine. Both father and mother devoted a considerable amount of time to their children. Punishment was rare. It consisted in a strict "boycott" of the offender, which was not relaxed until a frank confession of fault was made. The penalty to a sensitive child. The theory of free option in study was dropped by Tolstoy in the case of his children, but he was for ever joining in their games, taking them on his shooting expeditions and sharing in their gymnastic exercises. Manual labour was always congenial to the great writer, and formed a natural concomitant to his pastoral existence. It was a common thing for him to mow the lawns, hoe and rake the garden beds, or when out walking to take the scythe from a labourer and wield it lustily.
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restored by M. and Mme. Fet. The letters which subse-
sequently passed between them often served only to fan the
flame, so that even the amiable Fet was involved in the
dispute and for a short time estranged from Tolstoy. Finally, after a lengthy
and acrimonious correspondence, the threatened resort to arms
was averted through the intervention of friends; but fourteen
years were allowed to pass before a reconciliation took place.
In 1838 Tolstoy, believing himself to be in a dying state,
at length made overtures of peace to his brother-in-law; overtures
which Turgenev met cordially in the following terms:

"Dear Leo Nikolaevitch,—I received your letter to-day
which you sent to me poste restante. I was delighted and much
moved by it. With the greatest pleasure I am ready to renew our
former friendship and to press your proffered hand. You are quite
right in that you had no formality towards me. I am certain,
that they ever did exist have long since disappeared, and no remem-
brance of you now remains save that of a man to whom I am sincerely
devoted, and of a writer whose first step it was my great privilege
to be one of the earliest to welcome; whose every new work has
always aroused in me the greatest interest. I rejoice from my heart
that our misunderstanding has come to an end. I hope to be in
the province of Orel this summer, and then we shall meet. I send
you my best wishes, and once more grasp your hand in friendship."

Meanwhile Tolstoy had pursued literary labours with relent-
less ardour and with ever-increasing fame. Prince Andrei (the
hero of War and Peace) and Anna Karenina in turn occupied
all his thoughts. Several years were given to the perfecting
of these remarkable character-paintings. When the publica-
tion (1864-1869) of War and Peace had been succeeded by that
of Anna Karenina, he set himself to write yet another great
novel, dealing with the times of Peter the Great, but after
working at it for some months he suddenly abandoned the
scheme and took up the Moscow stories. One of the few excursions made during these years
of tranquillity was undertaken in 1866 to the battlefield
of Borodino, the scene of the famous fight in 1812. For two days
Tolstoy wandered over the plain, investigating and taking
notes, and there he drew a plan of the battle, which was after-
wards published as a frontispiece to War and Peace. But
the continued pressure of severe nervous and mental strain was
bound to affect a man of his calibre; health and spirits gradu-
ally sank, so that in 1870 Countess Tolstoy induced him once
more to seek the healthful air of Samara, and subject himself
in practice there to a strange feature of this "treatment"—lay in the avoidance
of meal and vegetables, the diet being strictly confined to
meat. Tolstoy pitched his tent in the village of Karakleev,
where the primitive life among the Bashkir nomads exactly
suited his habits and disposition. He had a faculty for
making himself at home with peasant folk, and was a great
favourite among them. In this district there was a large
community of Molochans, a sect whose tenets differ consider-
ably from those of the Orthodox religion of Russia. They
acknowledge no guide save the Bible, and reject all the rites
and ceremonies of the Greek Church. Their honesty, industry
and temperance made them an example to all the country
round, and caused Tolstoy to study them with special interest.
So delighted was the count with this visit to Samara, that he
shortly afterwards purchased an estate of over 2000 acres in the
district. But his pleasure was short-lived, for not long
afterwards (1872-1873) the crops failed and a serious famine
broke out. He thereupon opened a subscription fund for the
starving population, and went from village to village taking
a quantity of grain with him, and making what provision was
possible in the circumstances.

Tolstoy was now making up for lost time, learning what he
had failed to learn at the university. Greek was his great
attraction. "Without Greek," he exclaims, "there
Studied in
Philosophy
is no culture." He also became enamoured of the
writings of Schopenhauer, and for the greater part
of a year (1869) devoted himself to the study of that
philosopher. "Never," he says, "have I experienced such
spiritual joys." Enthusiastic in everything he takes up,
he assures his friends that Schopenhauer is the greatest genius
he has met with. He sets himself to translate his works,
and tries to enrol Fet as a co-translator. Philosophy at this
stage of his life went hand in hand with sport and agricultural
interests. He contemplated buying an estate in the province
of Penza, but on the 21st of October 1869 he writes:

"The purchase of the estate in Penza has not come to anything:
I have now finished the sixth volume (War and Peace), and I hope
it will be published on the 1st of November. There are a lot of
snipe. I have shot four brace, and to-day found two brace
and killed one bird."

After a period of comparative rest and ease, the shadows of
war and death once more encompassed Tolstoy. Two of his
children died in 1873, and their loss was followed by that of
his much-loved aunt, Mme. Ergolskaya. A mental restless-
ness and uneasiness came over Tolstoy, and also a desire for
the exercise of a wider philanthropy. The Russo-Turkish War
put the crowning touch to these feelings. God and death,
and the intricacies of life were now the constant subjects of
his letters. "You will not believe what joy your last letter
has given me," he writes in 1877 to his dear friend Fet. "When
you speak of the existence of the Deity, I agree with every-
thing you say, and I would wish to write much, but time fail-
s and it is difficult in a letter. For the first time you
write to me on the Divinity of God. I have been thinking about
it for a long time. Don’t say that we must not think about
it. Not only we must, but we ought. In all ages the best
people, the true people, have thought about it."

Tolstoy now resumed the study of the Bible, and took special delight
in the books of Ecclesiastes and Proverbs. He treats them as
a new discovery, and recommends them to his friends as having
much in common with the teaching of Schopenhauer! This
revived interest in religious questions was accompanied and
perhaps deepened by a state of extreme depression. It was
then he reconciled himself with Turgenev, and in December
1878 we find the latter staying with him on a visit of three
days’ duration. Turgenev writes that he finds him "very
silent, but much developed." The count on his side feels
the same want of mutual sympathy as of old, and confesses that
no real friendship seems possible between them.

Tolstoy now entered on the third phase of his life. He
himself thus describes the stages of his mental growth. In
the first phase he lived only for his own lusts and
pleasures. This came to an end at the age of
thirty-four. Then came the interest in the wel-
fare of humanity, which married life cooled and obscured
for a while. The striving for the welfare of mankind
was mingled with the striving for personal well-being. But
the third and highest phase was reached when the service of God
became the motive power of his existence. All other aims
grew subservient to this, and interest in the merely personal
life had begun to disappear. He had passed through every
imaginable grade of religious thought. As a child he had gone
to church and confession unquestioningly. As a student and
young man he had scorned and ridiculed religion. Later in life
he became a pious and devoutly orthodox Greek Churchman,
until one day during the Russo-Turkish War he was filled with
a spirit of revolt at hearing the prayers for the destruction
of the enemy, beseeching the Almighty to help them to kill
their hundreds and thousands. His whole being recoiled from
the un-Christianity of these prayers, and he then and there
renounced the orthodox faith. For three years he had exceeded
the priests themselves in the regularity of his attendance. Now
he felt there was something vitally amiss, and he flung it all to
the winds. The novelist was rapidly being hidden in the philo-
osophical cloak, to disappear in literature. So early as
1839 Turgenev had exclaimed, "If only Tolstoy would not
philosophize, all might yet be well." His brilliant contem-
poraries, Gogol, Dostoievski and others, had all in different ways
been seized in turn by what may be called the fever of religion.
Tolstoy was to suffer from it too. Like the flickering of a
dying lamp, his imagination again shone out in The Death of
Ivan Ilyitch and The Power of Darkness. Subsequently, with rare
exceptions, his writings were overloaded with ethical reasonings.
He was now fifty. While leading a life outwardly calm and

At Samara.
peaceful, he had passed through innumerable mental struggles and vicissitudes. Of these he speaks with simple candour in My Confession, an autobiographical sketch which appeared in print at intervals between the years 1880 and 1882. In the orthodoxy of the Greek Church, with fasting, prayers and rigid observances of her rites, he vainly sought an answer to his doubts; finally he broke away from a ceremonial which had become empty and lifeless to him, and built up a religion of his own. Impressed with the conviction that the peasant’s mental case was the result of his life of physical toil, Tolstoy tried to adopt the same habits, and for some ten years (dating from about 1880) he renounced the life of his own class as completely as it was possible for him to do. He rose early and went to work in the fields, and was feeding the sheep, and orphan, and helping them to gather in the crops. He also learnt boot and shoe making, and enjoyed being praised for his skill. Thus he laboured late and early, and in these simple physical acts found the best cure for his attacks of despondency. “Simplicity! Simplicity! Simplicity!” His food and drink, his pleasures and personal indulgences, were curtailed. Meat was given up and replaced by a vegetarian diet. Field sports—equivalents for cruelty and lust of blood—were abandoned, and his gun hidden away to rot and rust. Even tobacco was renounced, and smoking pipes and underclothing were given up.

But with all his straining towards simplicity, it was in the nature of things impossible for Tolstoy absolutely to lead the life of a peasant. Labour though he might throughout the day, there was his well-appointed house to return to. He could not cut himself off from his wife and children. Friends and acquaintance could not be wholly ignored by the would-be Diogenes. Circumstances in this respect were too strong for his views and wishes. The renunciation was still only a partial one. But as the strain of a great surrender is greatest while it is still incomplete, so Tolstoy felt more and more impelled to emancipate himself from all worldly concerns. The love of the simple, long spell of country life which presently occurred only served to deepen this desire. In 1881 his eldest son went to the university, and the two next in seniority soon followed him. It became necessary for the family to be in Moscow a great deal, for the sake of the children’s education. The eldest daughter had come out into society, and friends were continually calling, obliging Tolstoy to sit and talk with them. All the elements of town life were distasteful to him. Money was an evil thing in his sight, and he gave up carrying it about with him. Even when he was able to save, he abhorred the idea of having “a man good is having but few wants,” he said, and he accordingly set himself to limit his wishes rigidly, and to detach his heart from all treasured objects. The year 1880 was the census year in Russia. The government, as usual, called for volunteers to help to carry it out. Tolstoy became one of the enumerators, whose duties afforded an excellent opportunity for seeing the conditions under which the poor lived. The misery of it made him often wish to surrender all his property and have nothing more to do with lands and money, but the government and family circumstances prevented him. In the pamphlet, What are the Forms of the Future Life, he graphically narrates his census experiences. Again and again he attempted to carry his theories into effect. At last, calling his wife into his room, he explained to her that property and many possessions had become irksome to him. Wealth he now regarded as a sin. He wished to be rid of all personal ownership. In 1888 Tolstoy renounced all claim to his estates; everything was made over to his wife and children, the countess acting as trustee. True, this renunciation made little difference in his manner of life. He lived under the same roof as before, ate at the same table, wrote and read in the same study. The change was mental rather than material, and material care no longer for the growth or improvement of his estates, but gave himself up to ethical questions, and endeavoured day by day to bind himself more closely to the people. He now began to write specially for their benefit a number of simple tales which have been widely read, tales directed mostly against crying evils—the peasant’s love of vodka, and like themes. He

found willing fellow workers in the firm of Russian publishers known under the name of Posrednik (V. Tchertkov, and a group of friends). John the Fool, which was published in 1886 in the "Posrednik Series," is generally considered the best of these tales. The Penitent (1887) also appeared in this series, and was written with the same object in view. Unfortunately, the popularity of these stories aroused the attention of the government, and led to many of them being forbidden on account of their Socialist tendencies.

The terrible famine of 1891-1892 added fresh lustre to Tolstoy’s name. He and his family worked unceasingly in soup-kitchens and barns, distributing food and clothes. No true leader lacks a following. Every oppressed sect or individual turned instinctively to Tolstoy for sympathy and support, the most important case in point being that of the sect of the Malakhovs, who in 1891 rumours began to reach headquarters of social and religious excitement fermenting among the inhabitants of the Caucasus, and especially among the Doukhobors (q.v.). This people, numbering from fifteen to sixteen thousand, shared their goods and property in common, and made laws of conduct for themselves, based on a simple form of religion unobserved by ceremonies or ritual. In these matters, and especially in refusing to serve as soldiers, they defied the governors of the Caucasus provinces, so that, as their numbers increased, the growth of the sect alarmed the governor, and severe measures were put in practice for their suppression. Several of their leaders were exiled, and in 1895 some hundred of them were condemned to be enrolled for three years in the so-called “disciplinary regiment." It was in that year that Tolstoy came in contact with them personally, and became deeply interested in them. He promptly identified himself with the agitation in their favour, and by his endeavours aroused sympathy for them in other countries, especially in England. After many rebuffs from the government, and many unavailing efforts to reach the kindly ear of the Tsar, the persecution of the Doukhobors length ceased, and they were allowed to emigrate. It was in aid of these people that Tolstoy wrote and published Resurrection. The attack on the Orthodox Church in this novel was probably the chief cause which led to his formal excommunication by decree dated the 22nd of February 1901. In later years Tolstoy maintained all his interests, but old age gradually told on his strength. He died on the 20th of November 1910 at Astapovo, where he was stricken with pneumonia when carrying out a sudden election to leave Vsnataya Polyanaya and end his days in retirement.

No account of Tolstoy can pretend to any measure of completeness which does not refer to his views on religion. Tolstoy himself attributes so much importance to them that he has written several books on that subject, of which the world what he considers truth. In My Confession he describes the various stages of religious experience through which he has passed. He begins with a graphic picture of the religious state of the society in which he was brought up. There were people who were nominally orthodox, actually they believed in nothing. Indeed so inconsistent were the ideals of that society with any real belief in the Orthodox Church that at sixteen Tolstoy practically renounced Christianity and became a sceptic. During the whole of this period he felt unhappy and dissatisfied, for he had no theory which enabled him to solve the riddle of life. He found no solution to the question he often put to himself—Who am I? or to the other which depended on the first—How ought I to live?

It seemed to him that the men he met dealt with these questions in four ways. Some ignored them and treated life as if it were a meaningless jumble of vanity and evil. Others, recognizing the difficulty of satisfactorily solving these questions, simply shut their eyes and made the best of life as they understood it without thinking of the future. A third group answered these questions by regarding life as an evil and foolish thing and by putting an end to it. Fourthly, there were those who considered it a stupid and ridiculous farce and yet continued to live on, making the best of it. Tolstoy, when he first considered these questions, was himself in this fourth group, but it failed him to meet his spiritual needs. He felt that the millions who accepted the religious theory of life had somehow a better answer to the problem, notwithstanding that their solution was based on an absurd hypothesis. Although he had rejected as a lie and an illusion the idea of life, faith being understood as the theory which linked man’s finite life with the infinite. Having arrived at this conclusion Tolstoy

The Doukhobors.

Tolstoy’s Religion.
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society was founded upon principles disapproved of by Christ. His prison cells, factories and houses of infamy, its state church, its culture, science, art and civilization were all based on coercion and violence. People pretended that Christ did not abolish the law, but only changed it, and that he did not condemn men such as animals lived. Only man must labour, not as the animals, each for itself, but for all. The search after God was not an act of reason but of feeling. To live after God's word we must renounce all hope of life as we know it, and in that renunciation devote ourselves to all men. This belief he found in the churches, but mixed up with other things which he could not understand and which repelled him, viz. sacraments, prayers, doctrines, bowings, and sacrifices. All human beings, as commemorating miracles or alleged facts of Christ's life, were repugnant to him. Communion he explained to himself as an action done in remembrance of Christ, with the bread and wine, as a reminder of the presence of Christ's teaching. When asked by the priest to repeat before receiving the elements that he believed that what he was about to receive were the real Body and Blood, he repeated the formula but then that no wish he believed could make him where. The attitude of the various Christian churches towards one another also alienated his sympathy; it had no resemblance to a union of love. He thought that there should be but one church, but he had not so much in common, but was told that any compromise involved an admission that the clergy had altered the primitive faith and that it was their duty to hand on the faith inviolate. He was also very much shaken by the example of the church towards the poor. Suppressing the happiness of the poor as punishment. Tracing the happiness of the peasantry to their faith, he became convinced that there were certain elements of truth in Christianity. The Christian churches and the Greek Orthodox Church were in accordance with his view combined to obscure the basis of truth in Christ's teaching.

Tolstoy therefore set himself to endeavour to eliminate what he thought false doctrine and to seek the original elements which had grown up round Christianity, and to discover the varieties contained in it. Tolstoy started with the premise that Christ's teaching was communicated to unlettered persons and that it was written and written in such a manner that it may be assumed," he says, "that the Church in accepting the three synoptic gospels had accepted much that was inaccurate.

Tolstoy argues that it should be remembered that the gospels were written to answer the questions of many people, and that they were therefore at liberty to deal with them critically. He sees in Christianity not an exclusively divine revelation, nor a mere historical phenomenon, but a teaching which gives meaning to life. The commandments have not the same authority as any of the other teachings which Christianity has. Tolstoy's, but was a strainer and contorted version of what Jesus taught. The sectarianism of Christianity had its root in the idea that the gospels are to be understood only by taking them by themselves, but by interpreting them in such a manner as to make them agree not only with the other sacred writings but with the traditions of the Church, which were themselves obscure. Tolstoy maintained that the Church's teachings for a long time alienated the best minds from Christianity. Anyone taking Christ's teaching alone will see that it has no admixture of elements that contradict common sense. It has no sympathy with superstition, and has no "darkness," but is the strictest and fullest system of ethics.

The substance of Christianity seems to Tolstoy the inculcation of a life of love, fidelity, self-sacrifice, and self-renunciation. Evil is only an element of those essential attributes which attracted him throughout his life, even when he was a skeptic. The Greek Orthodox Church treated these principles rather as accessory to the teaching of Jesus than of its essence, and the Church considered dogma of more importance.

The rule of the Orthodox Church concerning dogmas, sacraments, fasts, prayers, seemed not only unnecessary but were not based on anything in Christ's teaching. The Sermon on the Mount as reported in Saint Matthew contains, according to Tolstoy, the essence of Christ's teaching which Christians should carry out entirely. The key to the sermon is contained in the words "Resist not evil," this injunction meaning that there is no reason to resist evil, but that they should not oppose it with physical force. Any physical resistance of evil is contrary to the law of love. This command he regards as the central point of all duties. It sums up in a short form all that Christ ever taught. He quotes Christ's statement, "My yoke is easy." The whole teaching of the churches was contrary to Christ's teaching when they gave their sanction and approval to armies and the enforcement of the commandments by human beings. Tolstoy denied that society not only ignored Christ's injunction not to resist evil but was actually based on a denial of its truth. The "Judge not that ye he not judged" Tolstoy treats as an expansion or rather a modification of Christ's teaching. The possibility of human justice, demonstrating in the case of the woman taken in adultery that man could not judge his fellow man, says Tolstoy. The same idea goes through the "thou shalt not kill," saying, "You believe that your laws reform criminals; as a matter of fact they only make more criminals. There is only one way to suppress evil, that is to return good for evil without respect of persons." The whole social fabric of modern so-called "Christian"
of the body this ceases to exist, but the divine spiritual life remains. It is not the death of the body but the transmigra-
tion of the spirit, its introduction to a new and unknown state of existence, to another form of manifestation of the divine spiritual essence. The more a man endeavours to live the life of the spirit after the death of the body, the less endures the somatic aspect of death. But it is impossible for the human intellect to conceive any form of existence outside space and time. So far therefore as it is necessary to imagine the body Tolstoy denies it; so far as it implies an individual condition of life, we cannot predicate nothing of it. There are two doctrines of life. One of these doctrines, the source of all error, consists in believing that the personal life exists outside space and time, and in an essential annihilation. The other doctrine, that taught by Jesus, is that the whole purpose of our personal life lies in the fulfillment of the will of God.

Before attempting to define the powers and position of an author, it would be well to have it clearly in mind that we are dealing with the development of the thoughts than of the life of a child, with a pale background of men and events. The distinct charm lies in the simplicity of early life. The book is a square of white paper, and the child introduced by the child, Nicholas Ilrtensky, to a number of characters one after the other—father, mother, grandmother, tutor, servants and sires; and are led by him from the father's study to the morning-room, from the dinner-table to the bedroom, from the game of ball at the church to the hall of the merchant's house, as in a magic crystal, the lifelike scenes on his waking—in the schoolroom—at his mother's side. But the apparently unconscious child of this early life, which is no waking but only a restless thought, hopes, fears—form the true drama of the story. The Cossacks (1865), written round the theory that culture is an enemy to happiness, was followed by War and Peace (1864-1869), which has been justly called Tolstoy's masterpiece. In it we glimpse life, as it has marshalled a panoramic array of kings, princes and nobles as they lived and moved during the times of the great Napoleonic wars. There are so many figures in the picture, so much kaleidoscope of colour and movement, that it is possible to follow the thread of the narrative. The leading characters principally belong to the highest Russian society, whose circle—with its inflexible code of laws and customs, and its vitiated moral atmosphere affecting each member of it in a greater or less degree—links them together. The interest centres not so much in any single person as in the groups formed by four leading families of the grand manner—the Bezouchnovs, the Volkonskys and the Kouragines—all bound together by common aims and interests. The men are eager to make a name and enjoy life; the women seek pleasure in gossip and romance. Peter Bezouchnov, who with his wife and children, but united by a love of truth, are the exceptions to this rule. Peter Bezouchnov is one of Tolstoy's finest characterizations, drawn with a hand that never discovered an outline in the body. And the only sinner in the novel is an abysm. On the one side there is the striving after an ideal and a capacity for self-sacrifice, on the other an absence of firmness and balance. Like Tolstoy himself, he is always in doubt as to what is right and what is wrong, as to the meaning of life and death, and, like Tolstoy at that time, can as yet find no answer to these riddles. While Peter Bezouchnov is a typical Russian, a very Tolstoy, Prince Andrei is a type striking, is a man of personality. Upright and noble-minded he is yet unable to cast off the chains of custom which have held him from childhood. He too is constantly seeking mental rest and finding none. The loves, the hates, the struggles of Andrei and Natasha in the novel are a story of passion. Natasha is a poem in itself. Natasha is almost the only heroine Tolstoy has given us who wins our affection; but even she, after many transitions, sinks to the level of the Hausfrau, with no aim beyond the propagation of her family name. The justification of the book is that in War and Peace Tolstoy winged his shafts not at men generally but at that particular section of society to which he himself by birth and association belonged.

So much for the preface followed the publication of this novel, during which the world heard little of it. At length in 1873 he issued the first parts of Anna Karenina. It is without doubt the most important, the most interesting, the most alive, the most complete in time and space in it, as in the preceding book, is large, but it has more continuity of action, and the principal characters are kept well in the foreground. It is a study of modern Russian life, and is in itself a masterpiece. Such a large circle of relationships is sharply contrasted with the transient omnipotence of passion and deep love. The hero and heroine are Count Wronsky, a young soldier in a crack regiment, and then Kitty. The heroine Anna Karenina, of an important official in the political world of St Petersburg. The parts of secondary heroine and hero are filled by Kitty Cherbatsky, a young and does not find the happy marriage of Levin, the central figure, is of course Anna herself, an elegant and fascinating person. She is honest, frank and well endowed by nature, and has an innate striving after truth and beauty in art and in life, but her early marriage to Karenin (the best known Russian character of the turn), while socially advantageous, has dulled and stunted her ideals. Ignorant of the meaning of love, she despises it, and it is not till she meets Wronsky that she realizes to the full the empti-
ness of her existence. Tolstoy is a master of his art. The recognition of no principle but his own desires, offers her the rich wine of life at a draught. She tastes it, after scant hesitation; and then, to crown it all, her husband, terrorizing her and child, drives them to the dregs, only to find that poison lies in the cup. Anna and Wronsky have no true ideal to cling to. He, as their passion cools, finds the tie irksome and a hindrance to his work and friends. The novel ends when Anna, after all that she sees that Wronsky's devotion is waning, recognizing too late that he loved her chiefly for vanity's sake, that they are slipping daily asunder, and growing displeasing to each other. Her past life is closed to her, the future opens like an abyss. The crisis has come, and swiftly obeying the impulse of her despair she seizes on death as her only weapon for avenging Wronsky and cutting the hopeless knot of her life. This pitiful end is led up to by step by step with microscopic truth and insight into the springs of human action. In the married life of Kitty and Levin, on the other hand, Tolstoy describes a state of happiness of a material nature—domestic contentment, the happiness of two good children, and the pleasures of the country. Levin is the Tolstoy of fiction. The improvement and development of his estates, the life of the countryside with its square of white paper, its vivid pictures, its own thoughts, hopes, fears—form the true drama of the story. War and Peace, the Kreutzer Sonata, published in 1890, created a profound impression. Many who were previously unacquainted with Tolstoy work read this story of love, jealousy and revenge, and were dumbfounded by its boldness. It is a startling advance upon Family Happiness, published thirty years before. This story of the Russian people in particular, is ruthlessly condemned for its views on marriage and its attitude towards the vexed question of the relations between man and woman. Marriage, Tolstoy says, can only be condoned if spiritual sympathy exists, and then only as the means to the continuance of the race; otherwise it is a breach of true morality. The "motif" of the Sonata is that the ideal we should strive after is a life where the spiritual penetrates and pervades everything, and where all that is carnal is eliminated. But in the "Sequel" to the Sonata Tolstoy adds that great ideals are always unattainable, and affirms that no man can know, whilst yet striving, how nearly he approaches them. The novel is a work of art only on condition that such subjects as sexual love, patriotism and religious devotion should be avoided. (C. H. W.)

TOLSTOY, PETR ANDREEVICH, Count (1645-1729), Russian statesman, was the son of the okoloniuchi Andrei Vasilevich Tolstoy. He served in 1682 as chamberlain at the court of Theodor III. Miscalculating the strength of the tsarsvena Sophia (g.v.) he became one of her most energetic supporters, but contrived to join the other, and winning, side just before the final catastrophe. For a long time Peter kept his latest recruit at arm's length; but when, in 1697, Tolstoy volunteered to go to Venice to learn Italian and ship-building, Peter could not restrain himself, and put him in charge of a division of Prince Shcherbatzky.

In November 1710 Tolstoy was appointed the first regularly accredited Russian ambassador to the Porte, and more than justified the confidence of the most exacting of masters; though his
peculiar expedients (e.g. the procuring of the strangulation of a grand vizier and the removal by poison of an inconvenient private secretary) savoured more of the Italian than of the Russian Renaissance. Even before Poltava, Tolstoy had the greatest difficulty in preventing the Turks from aiding the Swedes, and when Charles XII took refuge on Turkish soil he instantly demanded his extradition. This was a diplomatic blunder, as it only irritated the already alarmed Turks; and on the 10th of October 1710 Tolstoy was thrown into the Seven Towers, a proceeding tantamount to a declaration of war against Russia. On his release from "this Turkish hell," in 1714, he returned to Russia, was created a senator, and closely associated himself with the omnipotent favourite, Menshikov. In 1717 his position during Peter's reign was secured once for all by his successful mission to Naples to bring back the unfortunate tsarevich Alexis, whom he may be said to have literally hunted to death. For this he earned the undying hatred of the majority of the Russian people; but Peter naturally regarded it as an inestimable service and loaded Tolstoy with honours and riches, appointing him, moreover, the head of the secret chancellery, or official torture chamber—a post for which Tolstoy was by nature eminently fitted. He materially assisted Menshikov to raise the imperial consort to the throne on the decease of Peter (1725), and the new sovereign made him a count and one of the six members of the newly instituted supreme privy council. Tolstoy was well aware that the elevation of the grand duke Peter, son of the tsarevich Alexis, would put an end to his own career and endanger his whole family, so that when Menshikov, during the last days of Catherine I, declined in favour of Peter II, Tolstoy endeavoured to form a party of his own whose object it was to promote the accession of Catherine's second daughter, the tsarevna Elizabeth. But Menshikov was too strong and too quick for his ancient colleague. On the very day of the empress's death (May 11, 1727), Tolstoy, now in his eighty-second year, was banished to the Solovetsky monastery in the White Sea, where he died two years later. He is the author of a sketch of the impressions made upon him by western Europe during his tour in the years 1697-1698 and also of a detailed description of the Black Sea.

See N. A. Popov, "Count P. A. Tolstoy" (Russ.) in Old and New Russia (Petersburg, 1879); and "From the Life of P. A. Tolstoy" (Russ.) in Peter the Great (London, 1897); and The First Romanovs (London, 1905). (R. N. B.)

TOLTEC (Mexican Tolteca), or dwellers in Tollan (the place of reeds), the name of a people that if partly mythical is also partly historical. Traces of this people can unquestionably be detected in historic times; and many cities, particularly those which carried on traffic with the coast, claimed to be of Toltec origin. The conception of Toltecs, like that of Chichimecs, acquired in time so general and vague a significance that in vocabularies such a word as "toltecatl" is interpreted as meaning merely an expert. So that in some cases the name "Toltec" denotes no more than some race of Nahua affinities possessed of a certain degree of culture. In others, however, there is a substantial reason for believing in the existence of a specific tribe or people called Toltecs, though the genuine historical background has been obscured by the legends which the priests embroidered upon it to glorify their hero and god Quetzalcoatl.

Our ignorance as to the distribution and movements of the native peoples before the time of the Spanish invasion forbids any positive statement as to the original home of the Toltecs. It is certain, however, that they, as well as their god and their ancient city of Tollan, were known to those who lived in the Maya countries far beyond the confines of Mexico proper. Their migration-myths point to the eastern districts known as the "tierras calientes," famous for such valuable products as feathers and cacao, with which the Mexicans from the earliest times carried on a vigorous commerce. It is possible that the legendary wanderings of Quetzalcoatl (Feathered Serpent), who was said to have committed himself to the flames in Tiltlan-Tlapallan (the land of the black and red, i.e. the land of picture-writing), the region of Tabasco and Campeche, are really a mythological description of the moort's periodic course. But even in that case there can be no doubt that the nature-myth has been embellished with details derived from an actual race movement which took place in prehistoric times.

The Historia de Colhuacan y de Mexico is a most valuable manuscript written by an anonymous author in the Mexican language. In this work it is stated that Quetzalcoatl died in A.D. 865, and was followed by four Kings in succession, after which the wise Huitzilopochtli ascended the throne in A.D. 994 under the name of Atepecacatl. In the reign of this sovereign there broke out a great famine, which occasioned the institution of the custom of human sacrifice. From the same source we learn that it was in A.D. 1064 (a date which is assigned to the beginning of a half-mythical history by various other documents and MSS.) that the Toltecs left their homes and migrated eastward to Tabasco and Soconusco. At the same time Huemac killed himself in the cave of Cincaico. Tradition ascribes to him the authorship of an encyclopaedic picture-writing called 'te amatli' dealing with the history of his people, with astronomy, the calendar system, and the Aztec gods. According to the Ancient History of Tula and Mexico, which is confirmed in spite of some slight variations of detail by Itzilxochitl, the duration of the "Toltec Empire" was not more than 318 years.

Archaeologists are justified in claiming as indubitable monuments of the Toltecs the serpent-pillars which have been found in situ at Tula, close to the City of Mexico. The historian Sahagun states that Tula was an old centre of the Toltecs and explicitly mentions these pillars as their work. It is interesting therefore to note that the only other place where such pillars occur is Chichenitz in Yucatan (see Central America: Archaeology), a site which exhibits most strikingly Mexican features, so that archaeology fully confirms the assertion of the historians that Chichenitz, though in Mayan territory, was subject to the domination of some Nahua people. Chichenitz and Mayapan are the only sites in Mayan territory at which are found those round temples, which are attributable exclusively to Quetzalcoatl, the principal god and national hero of the Toltecs.

W.L.*

TOLUCA, or TOLOCANN, a city of Mexico and capital of the state of Mexico, on the S.W. border of the Anahuac plateau, at 8.09 of the Cercue de la Hija de Colhuacan ab 8,850 ft. above sea-level. Pop. (1900), 25,940. Toluca is on the Mexican National railway, 36 m. W.S.W. of the national capital. Its situation near the high cordillera gives it a cold, changeable climate. The government has a meteorological station here and a national college. Industries include the manufacture of cotton fabric, flour and wax candles. Swine-breeding is a profitable occupation in the vicinity. The Nevado de Toluca, an extinct volcano, rises to a height of 14,950 ft. on the south-west side of the town. Its summit is frequently draped with snow, and its broken-down crater contains a lake. Traditionally Toluca was one of the earliest Toltec settlements on the Anahuac tableland, but no remains of this occupation have been preserved.

TOLUENE, or Methylenebenzene, C₆H₄CH₃, an aromatic hydrocarbon; the first homologue of benzene. Discovered by Pelletier (Ann. chim. phys., 1838, 67, p. 269) in the oil obtained in the manufacture of gas from the resin of Pinus maritima, and named retinampe, it was prepared from the same gas by Couerbe (ibid., 69, p. 184) and named heptacarbarbue quadrirhydrique, C₆H₄ (C = 6); Sainte-Claire Deville (ibid. 1841 [3] 5, p. 168) obtained it by distilling Tolu balsam, naming it benzene. Générard and Bouldaut obtained a substance by the dry distillation of dragon's blood which they called dracyle. The complete identity of these substances was established by A. W. Hofmann and Muspratt, and they adopted the name toluen (anglicized to toluene), which was proposed by Berzelius. Its derivatives and its relation to benzene had been previously studied by the above and other experimenters, its relation to benzene being first proved experimentally by Cannizzaro and its constitution
settled by Fittig and Tollens's synthesis from sodium and a mixture of methyl iodide and bromobenzene.

The hydrocarbon occurs in wood-tar and in petroleum, and is prepared commercially by fractional distillation of the light oil fraction of the coal-tar distillate (see COAL TAR). It may be obtained by Fittig's method, or by Tollens's process, devised by Friedel and Craft's process, devised in 1877, of acting with aluminum chloride on a mixture of benzene and methyl chloride; this reaction leads to benzyl chloride, which may be hydrolyzed, or broken down under the continued action of the aluminum chloride; or by heating the toluene carboxylic acids obtained by oxidizing the higher homologues of benzene. It forms a colourless mobile liquid and burns with a blue flame, and has a specific gravity of 0.868 (13:1°F). It is insoluble in water, but dissolves readily in alcohol and ether. On reduction it yields hexahydrodoleulene; oxidation with dilute nitric acid or chromic acid gives benzoic acid; whilst chromic acid, and the sodium or potassium gives benzoic acid. On nitration it gives ortho- and para-nitrotoluene—which on reduction yield the valuable toluidines, C₆H₄(CH₃)NH₂—and on sulphonation the para-sulphonic acid is formed with a little of the ortho-acid. Chlorination in the cold gives ortho- and para-chlorotoluene, but at the boiling point the side chain is substituted (see BENZALDEHYDE).

TOMAHAWK, Tompkinsville

TOMAHAWK (a native American word, probably from the Algonquian verb olo'mahuk, to knock down), the war-hatchet of the North American Indians. The earliest tomahawks were of chipped stone, usually sharpened to a point at each end something like a pickaxe, and passed through a hole bored in a stout wooden cudgel. In the more primitive types the stone head was simply tied to the handle by animal sinews, or a withe was doubled over the head and fastened below to form a handgrip. Sometimes deer antlers were used instead of stones. After the arrival of the Mohawk, and especially of the Iroquois, the stone head was sharpened only at one end the blunt end was sometimes cut out into a pipe-bowl, the handle, hollowed, serving as the stem. The weapon was at once symbolic of war and peace, and was ceremoniously buried at the termination of hostilities, to be as formally exhumed when the feuds revived. Hence the colloquialism "to bury the hatchet."  

TOMASZÓW, or Tomaszhów Fabryczny, an industrial town of Russian Poland, in the government of Piotrków, 41 m. N.E. of the town of Piotrkv. Pop. (1897), 21,041. It has woolen mills, steam flour-mills and ironworks.

TOMATO, Lycopersicon esculentum (Nat. Ord. Solanaceae), a tender annual, native of South America, probably Peru. The fruit is much esteemed in salads and as a vegetable. Efforts have been made to popularize it for dessert, with varying success. Plants intended to fruit out of doors during the summer should be raised from seed sown at the end of February or early in March, under glass, in a temperature of about 60°. Pots pans or shallow boxes are the usual vessels. The soil should be composed of a mixture from, preferably of loam, sand and leaf mould in equal proportions. As soon as the young plants appear they should be fully exposed to sunlight, as near the glass as practicable. When the second pair of leaves is formed they should be pinched off, and then the pots should be 3 in. diameter, using slightly richer compost and less sand. This operation should take place with great care to be accomplished. The first flowers will appear towards the end of April or early in May. The pollen should be gathered and applied to the stigmas of the flowers by hand. The plants should be fit for planting out early in June, and should bear at least two clusters of rapidly growing fruits. They should be planted in the sunniest and warmest position available. It is customary to confine the plants to one shoot, pinching off all lateral shoots as they appear. Owing to the fickleness of the European climate it is of the utmost importance that the setting of fruit should be secured early. Manure should be applied sparingly to tomatoes until the crops become heavy. Under glass, without artificial heat, tomatoes succeed well. In cold, sunny seasons, however, the crops are seldom remunerative. The culture is substantially as advised for out of doors. In heated structures tomatoes should be raised all the year round, as they are a small and precarious crop during winter, however. During summer the crops are usually heavier and of better flavour, even in favourable seasons, than from out of doors. It is necessary to have at least two shoots trained to each fruiting shoot, those that are being worn out by heavy cropping. Periodical sowings are therefore necessary. Some prefer to raise the plants intended for winter fruiting by cuttings inserted in August. Planting out is usually effected on sheltered ground enriched with compost. The fruit is of various varieties riches and sizes. Some are kept for the production of green and dried tomatoes. The shoots trained on wires near the glass. As more nourishment is required, new soil is added. In this way excessive luxuriance, to which the tomato is so addicted, is avoided. The plants should never be allowed to become dry—they are large consumers of water. The following varieties comprise some of the best in cultivation:

TOMPAH, Yellow Frutted.—Chiswick Peach, Golden Jubilee, Carter's Green.

Early Varieties for Outdoor Culture.—Chemin, Fromgrove Selected.

TOMB (Gr. τύμβος, τύβος, properly allied to Lat. tumulus, literally a swelling, tume, to swell), a general term for a place of burial for the dead, including the excavation or cavity in which the body is Iqid and the superstructure which marks the place. (See BURIAL and FUNERAL RITES.)

The various forms which the tomb has taken throughout the ages are treated under such heads as BARROW; CAIRN; TUMULUS; CARACAS, and TOMBSTONE.

TOMPA, MIHALY [Michael] (1817-1868), Hungarian lyric poet, was born in 1817 at Rima-Szombat, in the county of Gómér, his father being village bookmaker. He studied law and theology in Sárós-Patak, and subsequently at Budapest; and, after many vicissitudes, at the age of thirty he accepted the post of Protestant minister in Beje, a small village in his native county, whence, in two years, he removed to Kelemér, and four years later to Hanva, in the county of Borsod, where he remained till his death in 1868.

At the age of four-and-twenty Tompa published his first poems in the review, Zsíros, which subsequently became known as the Zsíros-Szó. His first volume, Néprépek és Népmondák ("Folk-Legends and Folk-Tales"), in 1846, met with great success, and the same may be said of the first volume of Poésies populaires, where he took part in the War of Independence, acting as field chaplain to the volunteers of his county and seeing several battles; but the unfortunate close of that heroic struggle silenced his poetic vein for a considerable time, and when in 1852 and 1853 he gave up to his patriotic grief in some masterly allegories on the state of oppressed Hungary, he was twice arrested by the Austrian authorities. After being released he published his Virággék ("Legends of Flowers," a collection of poems showing great imagination and love of nature. Soon after this he became oppressed with melancholy and abandoned this branch of poetry. He published three volumes of sermons, "which," says his biographer, Charles Szécs, Protestant bishop of Budapest, "are among the best in Hungarian literature, and will favourably compare with those of Robertson, Monod or Parker." His collected poetical works were published at Budapest in 1870, and again in 1885.

TOMPKINS, DANIEL D. (1774-1825), American politician, was born in Cheshire, Westchester county, New York, on the 21st of June 1774. He graduated at Columbia College in 1795, and was admitted to the bar in 1797. In 1801 he was elected to the state constitutional convention, in 1803 was a member of the state assembly, and in 1804 was elected to the national House of Representatives, but became a judge of the state supreme court, and served as such until 1807. He was governor of New York in 1807-1817; and in 1817-1825, during both terms of President James Monroe, was vice-president of the United States. In March 1812, under the authority of art. xviii. of the New York constitution of 1777, he prorogued the legislature without any reference to the exercise of this power. During the War of 1812 he was active in equipping and arming the New York militia. For this purpose he borrowed much money on his personal security, and sometimes neglected to secure proper vouchers. Later the state comptroller announced a shortage of $120,000 in the military accounts, but Tompkins claimed that the state owed him $150,000. Later investigations disclosed that the state actually owed him more than $90,000. In 1821 he was president of the state constitutional convention. He died on Staten Island, N.Y., on the 11th of June 1825.

TOMPKINS, R. (1807-1817) (3 vols., 1808-1902) were published by the state. See D. S. Alexander, Political History of New York, vol. i. (New York, 1906).

TOMPKINSVILLE, a former village of Richmond county, New York, U.S.A., since 1808 a part of the borough of Richmond, New York City. It is on the N.E. shore of Staten Island in New York Bay, about 4½ m. S. by W. of the southern extremity of Manhattan Island, and is a residential district of New York City. Tompkinsville was laid out in 1814-1815 upon a tract of about 700 acres, most of which was owned by Daniel D.
Tomsk. It was chartered as a village in 1823, but because of legal flaws the charter was revoked soon after Tompkins's death (in 1825), and thereafter the village was gradually absorbed by New Brighton and Edgewater (both incorporated in 1866), though the principality continued to be called Tompkinsville.

**TOMSK.** a government of western Siberia, extending from the Chinese frontier northwards to 6° N., and bounded by the government of Tobolsk on the N.W., by Yeniseisk on the N.E. and E., by north-western Mongolia on the S.E. and by the province of Semipalatinsk on the S. and W. Its area, 327,284 sq. m., is more than one and a half times that of France. The surface includes in the south-east the high alpine tracts of the Altai Mountains, and in the north-west and west the lowlands of the Irtysh and the marshy tracts of the Ob. The Altai Mountains or Sallughem system, which at their northern extremity join with the Sayan Mountains, run from north-east to south-west along the Russo-Chinese frontier, and are cleat by a deep gorge through which flows the Yenisei (see **Altai**). A zone, some 200 m. in width, of alpine tracts fringes the outer margin of these mountains, which have a very steep slope towards the north-west, although their south-eastern foot-hills rest on the plateau of Kobdo (4500 to 5000 ft.). A chain having a north-western direction—the Salair Mountains—shoots off from the main range of the Altai, between the Tom and the Chumysh; it is about 170 m. in length, with a width of nearly 60 m., and it contains the most productive silver-mines of the region, as also several gold-washings. Its upheaval belongs to a more recent epoch than that of the Sallughem range, and (like the mountains of Turkestan, having a north-west direction) it is composed of dioritic rocks. In the Kuznetsk depression it is deprived of the Lower and Upper Carboniferous, containing beds of coal. The Kuznetskiy Ala-tau, one of A. von Humboldt's meridional upheavals, consists of a series of ridges running south-west to north-east.

Tomsk is drained principally by the Ob and its tributaries, but the south-east corner drains into the Abakan, a tributary of the Yenisei. The Ob, formed by the union of the Biya and Katun, has within the government a course of more than 800 m., and is navigated as far as Barnaul and Biysk. Its tributaries, the Tom (450 m.), Vasyugan (550 m.), Ket (230 m.) and Tym (200 m.), are all navigable. The Chulym and the Chumysh are also large rivers. The Buhkarma, Om, Uba and Tara, tributaries of the Irtysh, are worthy of notice.

The climate is severe, and is, moreover, very wet in the north-west. The average yearly temperatures at Tomsk, Kainsk and Barnaul are 30°-2°, 31° and 32°-7° (Jan., 4°, 6°-2° and 3°-7°; July, 65°-5°, 68°-5° and 62°-2°) respectively. The Altai steppes enjoy a much drier climate than the lowlands, and are clothed with beautiful vegetation; in the sheltered valleys corn is grown up to altitudes of 3400 and 4250 ft.

The population was estimated in 1906 as 2,412,700. The bulk (90%) is Russian, the remainder being Ostyaks, Mordvinians, Tatars (mostly in the Altai), Teleuts and Teleungts (Mongol tribes, chiefly in the Altai), and nomad Samoyedes, representing a mixture between the Samoyedes and the Ostyaks, and dwelling along the Ob river and its tributaries. The prevailing religion is Greek-Orthodox, but there are also some Non-conformists, Roman Catholics, Jews, Mahomedans and pagans.

Agriculture is the predominant occupation, and excellent crops are obtained in the southern portion of the government, especially in the Altai. Livestock breeding is very important, and butter-making in model dairies, partly co-operative, has developed greatly, butter being exported from Tomsk to western Europe. Trade is actively carried on at Tomsk and Barnaul, the chief centres for the trade of Siberia with Russia. The Biysk merchants carry on a barter trade with Mongolia and China.

The government is divided into six districts, the chief towns of which are Tomsk, Barnaul, Biysk, Kainsk, Kuznetsk and Marlinsk.

**TOMSK**, a town of Western Siberia, capital of the government of the same name, on the Tom, 27 m. above its confluence with the Ob. Pop. (1900), 63,533. Tomsk is an episcopal see and the largest city of Siberia, exceeding even Irkutsk in population and commercial importance. The great Siberian highway from Tyumen to Irkutsk passes within 54 m. (by branch railway to Taiga) of Tomsk, which is the terminus of the navigation by steamer from the Urals to Siberia. It has, moreover, communication by steamer with Barnaul and Biysk in the Altai. The town is not an administrative centre, like so many Russian cities, but an entrepot of wares. Before 1824 it was a mere village; but after the discovery of gold in the district it grew rapidly. It is built on two terraces on the right bank of the Tom, and is divided into two parts by the Usshaika. The best building is the university. The industries are almost entirely confined to tanning and the manufacture of carriages. Tomsk has a university (founded in 1888, with 690 students), and archaeological, ethnological, zoological, botanical and mineralogical museums, a technological institute, a cathedral (finished in 1900), public libraries and scientific societies (naturalist, geographical, medical, musical, &c.). The city was founded in 1604.

**TOM-TOM, or TAM-TAM,** a native Indian and Asiatic word, reduplicated and onomatopoeic in form, for a drum, hence often loosely applied to the various types of primitive drum used for purposes of religious excitement, war, signalling, &c., by savage tribes throughout the world. The term is applied strictly to the metal gongs of the Far East, which are flat disks with a shallow rim.